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Introduction

I began as a flatwater kayaker back in 1968 and raced the 1969 season. Then I discovered whitewater and have done that in various capacities for about 20 years. In 1984, one of my former whitewater slalom paddlers, Norm Bellingham, took up flatwater, or sprint as it is called today, and asked me to be his coach. For the next four years I did that as best I could, along with coaching the U.S. Whitewater Slalom Team.

During that time, through Norm, I came to know Greg Barton. In the time since our first meeting Barton would become a three-time world champion and an Olympic champion in both the K-1 and K-2 1,000 in 1988, along with Norm.

I realized that Barton was a good story; he was probably the best singles paddler of the late 80's and he was not from Eastern Europe. How did he do it? I was curious. Also, I'd never seen a book on sprint which contained the level of detail I thought necessary to show what it takes to win today, especially considering how the sport has changed with the advent of the wing paddle.

Then, there was "symmetry." I already had written books on slalom and wildwater; why not make it a hat-trick and do one on sprint, too? Finally, there was the obsessive thought that this may be the best way to learn more about canoeing and kayaking in general and worth a year of my spare time to find out.

I have targeted several groups of people I believe might be interested in the book. The first, as with my earlier books, is actively training athletes. For them, the book goes into great detail about technique and general sports training principles. Another section of the book, the biographical portion, goes into detail about Barton's career. In the past, I've found athletes like to have this kind of data.

The second target is coaches and other students of the sport. A third target is the media. While I know they won't be interested in all the details, they often appreciate background material that explains the sport so they can write their stories more accurately.

I would like to thank several people for helping me with this project. First, there's Norm Bellingham, because without him I never would have come close enough to sprint at the highest levels. Then there's my old Australian friend, Reg Hatch, coach of several world and Olympic medalists, who gave me a number of ideas on how to do such a book.

Obviously, the greatest debt goes to Greg Barton, for this project would not have been possible without his complete cooperation. He gave a great deal of time, submitting to interviews and reading drafts. I can only hope that he is satisfied with the outcome.

I would like to thank David Hearn and Brian Brown for making a number of valuable comments. My wife, Abbie, and Melissa Andrews edited the book, and I would especially like to thank them, also. Finally, my thanks to Steve Kelly, United States Canoe and Kayak Team Associate Director for Programs; Erika Austin, USCKT Communications Intern, and the rest of the USCKT staff who helped prepare the book for publication.

WILLIAM T. ENDICOTT
Bethesda, Maryland
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Chapter 1

Biography

Everything On The Line

It is nine o'clock on the morning of October 1, 1988. On the Han River Olympic Race Course located outside Seoul, Korea, nine men position themselves at the starting line for the men's kayak 1,000m Olympic final. Facing a headwind, they are hardened veterans of international competition doing their best to remain calm, trying not to think about the years of training and sacrifice now on the line. Among them are Grant Davies of Australia in Lane 1; defending Olympic champion Alan Thompson of New Zealand in Lane 4; East Germany's Andre Wohllebe in Lane 5; Hungary's Ferenc Csipes in Lane 9; and Greg Barton of the United States, the event's reigning world champion, in Lane 8.

Barton is one of the pre-race favorites. A year earlier, in Duisburg, Germany, he won the World Championship by three seconds, enough of a margin to be able to raise his paddle over his head in triumph as he crossed the finish line. This time out, though, it is the Olympic Games; he knows he faces tough competition. Csipes, the old rival who has beaten him in past world championships, worries him. However, Barton believes the lane assignments have worked to an advantage. "At least I've got a good lane," he thought before the race, "I can keep an eye on him." Barton's plan is simply to maintain contact with Csipes and the other leaders, then come on strong at the finish when everyone else usually fades.

The gun explodes and Csipes jumps to the lead. Despite a reasonably good start, Barton finds himself in the middle of the pack. By the 500m mark, though, he has used his steady, rhythmic stroke to move into third place. A quick glance across the lanes shows him another boat abreast of him, but he can't identify who it is —Australia's Davies, who has been a steady performer all season but who was not a favorite for the gold.

With 200m remaining, Csipes fades and Barton, according to his game plan, takes the lead. Wohllebe is second, but Davies begins his final surge, narrowing the gap. The crowd roars.

They hit the finish line in a photo finish. The result is so close that the officials take longer than usual to sort out the first two places. Finally the scoreboard flashes:

Place	Lane	Team	Time
1	1	AUS	3:55.00
2	8	USA	3:55.37
3	5	GDR	3:55.64

Barton appears to have lost in a close finish. Although he entered the race as the reigning world champion, the Olympic gods seem to have denied him. What went wrong? Didn't work hard enough? Wasn't smart enough? Wasn't lucky enough?

Confusion ensues as race officials hurry to review the tapes and double check the finish line judges. Everyone waits anxiously for the decision. The final determination will take ten whole minutes, but it seems an eternity.

Flashback on Barton's Life

Farm Boy

Greg Barton was born December 2, 1959, in Jackson, Michigan. At the time, his family lived in Horton, a small town with a population of about 500. When he was 16, the Bartons moved to Homer, a town of 2,000 located 15 miles from Horton. He remained there until he left for college some years later.

Barton's parents, Mike and Kathy, are commercial hog farmers. They began farming before they had children, beginning with a few hundred pigs on a small piece of inexpensive land. The venture grew until it included, in addition to the family members who still work the farm, a dozen full-time employees overseeing a pig population of between five and ten thousand. Looking back years later, Barton said,

> *I think growing up on a farm helped me. When I was young I always had to get up and do chores. My father made me responsible for what I did. I can't even remember how old I was when I started doing chores on the farm. I was probably five or six. There was a barn I used to clean out. My father would pay me a quarter. This was just on weekends. When I was 13 or 14, I started doing some chores after school as well.*

Growing up in Horton and Homer, Barton didn't have a lot of friends because there simply were not many houses around. In Horton, the next house was about a quarter of a mile down the dirt and gravel road. In Homer, the next house was a similar distance, though this time on a paved road.

"The only kid at all was Mark Rimer, my brother's friend, who was about five years older than me;" recalled Barton. Rimer eventually became a paddling buddy.

Although other children to play with were scarce, there was plenty of water around. The Bartons had to travel only two to six miles to get to a number of lakes and rivers, such as the Kalamazoo and the Saint Joseph.

A Paddling Family

Barton had a brother, Bruce, two and a half years his senior, and a sister, Connie, a year and a half younger. Undoubtedly an important part of his background is the fact that every member of the family paddled, not just recreationally, but actually trained and raced.

Barton's father grew up in Maumee, Ohio, where he played high school football and did some canoeing in an aluminum Grumman canoe. Every year he and one of his high school friends would enter a local canoe race, although they didn't really train for it.

In the summer of 1968, the Hanover-Horton Lions Club staged a canoe race. Mike Barton called an old paddling partner and decided to enter the event. They used an open canoe which Bruce had purchased two years before. Eight-year-old Greg and Bruce, too young to race, were spectators.

> *One guy had a racing canoe. He was about 60, but he ended up winning. My father started talking to him after the race and heard about some other races and said he wanted to check some of them out.*

That summer Barton's father went to watch a few other marathon races in Michigan. He saw that they had a mixed couple's class "and he decided it would be neat for him and my mother to enter the mixed class," Barton said.

The following year, the family acquired a Sawyer fiberglass canoe built to racing specifications. That spring, both parents began race training. They had little knowledge about formal training, but every day after work they spent an hour paddling. They entered their first race that spring... and won.

> *They won this race and then got bit by the bug and started going to more of them. They would race one about every weekend during the summer. We'd travel around Michigan, Ohio, and Indiana.*

The races covered distances from five to 20 miles, but generally lasted between one and two hours. The mixed couple's class averaged about 10 boats per race. The races culminated in the U.S. Canoe Association National Championships, which usually featured a field of about 30 entries.

"They would win a lot of races going into the Nationals," Barton remembered, "but they never won the Nationals." They did, however, place third three years in a row (1969-71) and Kathy Barton won the women's tandem competition in 1970 and '71.

While the parents raced, the Barton children accompanied them, providing moral support from the riverbank. Bruce was the most interested, since he had actually been the first family member to buy a canoe. He and his friend, Rimer, decided to start racing in the junior class. A year or so later, at the age of 10, Greg joined in the fun as well.

Early Sports Involvement

All the Barton children were introduced to canoeing quite young — and all three of them wound up on a U.S. National Team. Bruce competed in the Olympic Games and Connie in the Junior World Championships. Bruce ran cross-country in school, while Connie played girls' basketball and ran the two-mile event in

track. "But canoeing was the main sport," Barton recalled.

Barton participated in a number of sports before focusing on canoeing. He played pickup football and basketball. Like the majority of Midwestern youngsters, his first organized sport was Little League baseball, playing in the nine- and 10-year-old brackets. In high school, he ran cross-country for two years and wrestled at 132 pounds his junior and senior years, earning varsity letters in each sport.

> *As a sophomore at Concord High School, our cross country team won the state championships. I was one of the slower runners and didn't qualify for the varsity team in the state meet. The next year we moved to Homer, where I was one of the best runners on a weak team. In my first year of wrestling, I probably lost more than I won, but in my last year I did much better.*

Foot Problems

Barton was born with club feet. "That's really just a general term people use to describe problems with your feet," he explained. His feet tended to turn inwards and he walked on the outside of them when he was young. When he was only a few months old, doctors put casts on his feet to turn them back out, but the effort was unsuccessful. When he was one year old, the doctors tried surgery on both heel cords to try to lengthen them. It was the beginning of a series of unfortunate mistakes which had the effect of actually worsening the problem.

> *I was not really conscious of having foot problems when I was growing up except that my parents would take me in to see the doctor every year and take me to the store to buy special shoes. One day my father questioned the way they put in the heels. We went to the doctor and reviewed it and found out they put the heels on exactly the wrong way. It had probably been that way for a year or two.*

But Barton does not believe this mistake really mattered very much. He also had to wear "night shoes," which probably counteracted it. These were two old shoes with a bar attached to them which he wore while sleeping and which turned his feet outward. His brother, Bruce, underwent the same treatment. 'Nowadays if you see him in a picture, his feet are always turned out," Barton noted. "He'd probably have been better off if they'd done nothing and just let nature take its course."

In January of 1970, Barton had surgery on his left foot.

> *They'd do an operation and I'd spend about a week in the hospital. I'd get out of the hospital, spend six weeks in a cast with crutches, then an additional six weeks in a walking cast, and then the walking cast would come off, and I'd spend a couple of weeks with just crutches. The next year, the following January, they did the right foot. After that, they noticed that the right foot seemed to turn out reasonably well, but with the left foot I could no longer touch my heel to the ground unless I hyper-extended my knee. There wasn't enough motion in the ankle after the surgery, so my heel would not come down to the ground. It was worse than before.*

Two years later, Barton underwent further surgery to try to correct this

problem. Instead, the condition was aggravated, further limiting his range of motion and stunting the growth of his leg. He began to wear a lift in his left shoe to correct the shortening of the leg.

Nowadays, in our litigious society, such a situation probably would have resulted in a malpractice suit. However, Barton is surprisingly forgiving about it.

"I think people are always looking for excuses when things go wrong," he said. "My definition of an accident is that nobody intended it to happen. No one intended this to happen. The medical procedure was just developing." Looking back on it, with the knowledge he had gained, Barton admitted he never would have permitted doctors to operate on his feet.

> *But when you're ten years old and somebody's told you all your life you're going to need this surgery, you just go along with it. Now I say it was the stupidest thing I ever did because now medical practices are so much better. If I had waited, I would have had basically normal feet, I think. The other problem with having it done at a young age is that when they fused some of the bones, it killed the growth centers, which increased my leg discrepancy as I got older.*

So did Barton become a canoeist because he couldn't excel at other sports involving the use of his legs? It is a tempting speculation, but he denies it, pointing out that he already was concentrating on canoeing at the time he underwent the operations. However, the experience may have had a bearing on his career in another way:

> *I think having the surgery and the problems I'd gone through made me tougher mentally. I realized there were hard times and that you just had to pull through them. When you experience pain after surgery, there is no way to make it go away. You just have to grit your teeth and bear it, no matter how intense. It makes you realize that you can endure much more pain and inconvenience than you thought possible. This perspective gives you the confidence to push on when times are tough.*

Though left with a relatively severe disability, Barton still could run, which always had been a part of his training. He was 13 at the time of the last surgery. He was 14 or 15 before he started running again.

"I'd already been involved in canoeing for four or five years and I could see that other people were doing some running for cross-training," he said. He had a two-mile course that he worked on, running out a mile and coming back. He would run until the pain in his legs forced him to stop. After massaging his feet and walking to work through the pain, he began again. Finally, he got to the point where he could complete the two-mile circuit.

"I started running more and it seemed that my feet sort of adapted to it," he recalled.

Early Canoeing

Barton started canoeing during family summer vacations when he was 9 or 10.

"We'd go on a week-long canoe trip up in the Boundary Waters of Canada, or upper Michigan, or some place up north," he said. They would pack sleeping

bags, tents, and food in the aluminum and the racing canoes. Barton usually would paddle with his father and Bruce paired off with his mother while his sister would ride in the middle. There would be portages between lakes and around rapids.

> *I remember one time we went to the Boundary Waters for about a week. We paddled for about two or three days to get to this lake where we heard the fishing was good. We were relatively fast paddlers so we could go quite a distance on only a one week trip. The fishing was fantastic, so we just stayed a couple of days and fished and paddled around a little on the lake.*

Vacations were not the only time he paddled. When his parents first started training, occasionally they would paddle with Barton sitting in the middle between his mother in the bow and his father in the stern.

"Sometimes my mother would sit in the middle, and I would get up front and paddle with my father," he said. These sessions started in the spring and went through the summer and fall. This was not actual training, of course, because it was spontaneous. If his parents were going out to train, sometimes he would go with them and paddle, too. This went on for about a year.

When he was 10, he participated in his first canoe race, about an hour and 20 minutes long:

> *We were at this race and my brother was racing in the junior class with his friend. There were trophies for three places and they said,' there are only two or three boats entered. You should get in it because you can win a trophy.' So Phillip Kruger, who was 15 at the time, and I did it. There turned out to be four boats in the race, but one of them was an aluminum canoe and we beat it. The other two racing boats beat us. But I came home with a tiny little trophy and I was happy about that.*

This was the U.S. Canoe Association marathon-type of paddling, in which the paddlers switched sides every six to ten strokes on the command "hut!" Barton competed in a few other similar races that summer, following the same formula of meeting someone at the site, teaming up spontaneously and racing. In the first couple of races he was in, Barton and his partners usually would finish last among the racing canoes but ahead of the aluminum canoes. He already was demonstrating his talent as a successful ten-year-old in a classification for 15-year-olds.

Influence of Marathon Racing

In the beginning, Barton's marathon "training" was random. His parents figured out a yearly plan, and Barton simply followed that.

"They knew the first race was in May, so they knew that in mid-March they needed to get on the water and start paddling," he said. They would go out almost every evening after work and paddle for an hour or two and he occasionally would accompany them. "A lot of times I would get to go along and sit in the middle of the boat and trade off."

During this time, he learned general paddling aspects, putting the blade in the water and "knowing what it feels like to pull on a paddle." However, he also was laying the foundation of his endurance base, which grew to tremendous proportions as the years went by:

When we went on canoe trips we'd paddle for six hours during the day. We'd paddle for an hour and a half, and then we'd stop and have a snack. Then we'd paddle for an hour and a half and stop and eat lunch. After that, we'd get back in and paddle for another couple of hours that afternoon. You had to be able to withstand the entire day, so you didn't go out and kill yourself in the first 500 meters.

Sometimes, though, they would pick up the pace:

My father and I would be together and Bruce and my mother would be together and we'd kind of race each other to the end of the lake or something. Looking back, I see that it was endurance based, because everything I did was longer in duration. And the first races I did were marathon races —an hour or longer.

There were several people who had an early influence on Barton's canoeing. Initially, of course, it was his parents. There were some "big names" for him to watch, too: Andy Toro, an immigrant from Hungary who had won an Olympic bronze medal in double canoe; Marcia Smoke, the bronze medalist in women's single kayak at the 1964 Olympics; and Roland Muhlen, who was later fifth in the World Championships in double canoe. Additionally, there were paddlers on the "professional" marathon canoeing circuit. At some of the races the Bartons attended, there was an amateur marathon race, an amateur mixed doubles race, and a professional marathon race. The Bartons would enter the amateur races and watch the pros.

Barton tells an interesting story about one of them: John Baker— or was it John Glare?

There was this big guy, John Baker, who was doing well in the pro races. 'Big John' they called him because he was 6'6 ", probably 200 pounds, and real muscular. He competed in the 1968 Olympics as John Glare. In professional racing, he was John Baker because supposedly he had raced a few of these Michigan pro canoe races before going to the '68 Olympics. Back at that time there were very strict amateur rules. I can remember they used to have the 'contamination rule'. I remember one day I was at an amateur race where someone who had raced in a pro race wanted to enter. Marcia Smoke was saying, 'Don't race against him! He raced in a pro race and anybody who races against him here is professional and won't be able to go the Olympics!' It was absurd, when you think about it now, but it was a big concern then. Maybe these people would win $100 and split it with a partner— it wasn't like they were earning a living by any means. But that's the way it was perceived at the time.

Barton didn't learn any particular techniques from these people — "it was more just endurance canoeing and sort of learning how to paddle." He went through the usual process of learning and then having to relearn. For example, he remembers that his father thought it was important to bend way over to paddle so he could use his back more. Later, when he and his parents went to a sprint racing training camp in Florida, they were told to sit more erect and use more body rotation. "It was later, when I got more involved, that I started hearing more about the technique points."

School

Barton did extremely well in school, thus attesting to the fact that he brought great intelligence to bear on the problems of sprint racing and how to train for it. At first, he did well in all subjects, but when he got to high school, he concentrated more on science and mathematics. He claims that he was not a "bookworm," however.

> *I'd do the work at school and occasionally I'd bring a book home. The schools I went to were small, and 1 didn't have to do much to keep up with what was going on. It was a big shock to me when 1 went off to the University of Michigan, because all of a sudden I had to start studying and putting in a lot of time outside the classroom.*

With this meager background, however, Barton scored a perfect 800 in mathematics on the Scholastic Aptitude Test (SAT).

> *The math on the SAT is not that hard. There isn't any calculus. A lot of it seemed to meal most easy. When 1 took the SAT, I thought it was something I had done in the sixth grade. In the English section, I ended up guessing at many of the answers I didn't know. I thought their system was way off, and that they had made the English portion much more difficult than the math portion.*

How does he account for his doing so well, the top percentile in the entire country? He says that he had a few good math teachers. He also says his mother discovered him one time when he was young, sitting in a big cardboard box "spouting off the multiplication tables that I had figured out." In other words, he was just plain smart.

First Kayaking

Up to this point, all of Barton's paddling had been in two-man open canoes. But in 1970, the family bought a sprint kayak. In the winter of 1969-70, the Barton parents heard about a training camp in Florida for flatwater kayak racing, run by Bill and Marcia Smoke and Marcia's sister, Sperry Rademacher, from Florida, and they went to it. Smoke was an Olympic bronze medalist in K-1W and still was training seriously for international competition. Her husband also was a U.S. Olympian. Besides sprint racing, Marcia also competed in a few marathon races, which is how the Bartons met her.

Barton's parents and his brother Bruce attended the camp, while he and his sister stayed at his grandparents' home in Florida. The parents and Bruce saw people in flatwater sprint boats and decided to order a less tippy one, called the "Slender."

> *We had a couple of racing canoes and the Slender. Sometimes I would paddle it. In the spring of 1970, Mark Rimer, my brothers racing partner, who was 15 and therefore bigger and stronger, went with us to one of these races organized by Marcia Smoke which had sprint and marathon classes. My parents raced the marathon class and Mark Rimer raced our Slender. He did pretty well. That summer, Marcia, who was coaching a lot of juniors for the Niles Kayak Club, asked my father whether Mark would like to come down*

and train for the Nationals. He did. Later on that fall, we were at another race and Mark was racing. By that time, Bruce was racing a kayak there, too. Bill Smoke had an extra Slender that I could use. We had only two kayak paddles, though, and Bruce and Mark used them. I had to borrow a left control paddle! That was my first kayak race.

In the winter of 1970-71, the Barton family again went to the Smokes' training camp in Florida. This time Greg attended, too. There was a distance event at the start of the camp, and he borrowed a Slender and raced it. That was his second kayak race. Following that, there was a week-long camp.

"I don't remember getting much personalized instruction," Barton said. "I'd go out and dip around while other people were training." At the end of the camp, there were some sprint races, Barton's first: "I think they had a 500 or a 1,000 that required you to go out, turn around a buoy and come back."

In June of 1971, Barton bought a racing kayak, a Hunter. From that point on, he started training more in the kayak than in the marathon boats "just because it was more convenient." He did not have a regular marathon partner, so he paddled the kayak more in practice. But he still did a lot of marathon "simply because there were more marathon races available." His parents would go to a marathon race practically every weekend, and there would be a junior class or other age group classification that he could enter. He would meet other people his age and recruit them for partners. There were not many sprint races, however.

"Marcia Smoke would organize one or two a year," he said. "Then there used to be divisional championships that you had to go to in order to qualify for the Nationals. And then there was the Nationals."

Influence of the Smokes

Although Barton's brother also was paddling a kayak, he was so much better than Greg that they seldom paddled side by side in workouts. "We'd train at the same time, but not with each other."

In 1971, Marcia Smoke invited the Barton brothers and Rimer to her house in Buchanan, Michigan, about 100 miles from Homer. They stayed for two weeks and trained with Marcia and Bill Smoke and other children. "That's where I started to learn a lot more about training and techniques. They were talking about rotating the torso, reaching out with your arms, and having straight arms at the catch."

Torso twist, the ability to twist from low down in the back which would become a hallmark of Barton's technique, first started here:

Initially, I remember hearing all the comments about needing to rotate as much as you can, so I was thinking about rotating out. Later on, I think I started to really exaggerate it, using low body rotation, like twisting from the hips and lower back instead of just the shoulders. I really concentrated on that. But initially, it was just realizing that you needed to rotate when you paddled.

Barton also learned about interval training from the Smokes. Before he attended the 1971 training camp in Buchanan, his workouts consisted of simply paddling for an hour or two at a constant speed. On occasion, two boats would be

going side by side "kind of racing each other." But in Buchanan, he saw his first interval workouts. One of the Smokes would go out in a motor boat with a stopwatch and call out various times and intervals.

"I remember posted down in our basement was a list of Marcia's workouts," Barton recalled. "I think there were 10 or 12 of them she had gotten from Sweden." Smoke had gone to Sweden one summer and compiled a list that she called "Swedish workouts." Some examples: 20 x 70 seconds on, 20 off; and 6 x 6 minutes.

And then there was "X times one":

> *That meant you'd go for one minute as hard as you could — basically like doing a 250-meter piece all-out — and then you'd rest five minutes. Then, you'd do another one. And you'd do that until you started dropping off, which usually meant you'd do about five of them. Usually, after you dropped off on one, you could tell you were slowing down or really tiring, and you'd do one more. Then, you'd stop.*

Barton also learned one technical point. When he was in Florida for the first training camp, Lee Abbott commented that he wasn't dipping his paddle all the way into the water. "After that, I felt I really needed to work on that" In the late 1970s, though, he realized he had overcompensated: "I realized that I was always dipping my paddle in too deep, and that I had overcorrected at that young age. It was a problem, and I needed to think about not going too deep."

The other thing Barton remembers from being with the Smokes in Buchanan during that period was being exposed to all the different types of boats:

> *Marcia still had some of these older boats in her basement and we ended up paddling them all. It was a mini boathouse. She lived right on the St. Joe River. I think she had a K-4, two K-2 Gliders, and the model before that, called the Ribelle. She had her wood Hunter. She may have had one or two other wood K-1s. And then, she had some fiberglass K-1s, like a couple of glass Hunters, a couple of Tracers, a couple of Slenders, and a couple of other boats. So I got to see the evolution of the boats.*

Barton continued to work with the Smokes, particularly Marcia, regularly through 1974. They were his first real coaches. He would see them at least one week every winter during the Florida training camp, then at the races that Marcia attended, and finally, several times in Buchanan during the summer. In 1974, Marcia stopped taking on new pupils, and shortly thereafter, the ones she did have started to drift off to college, and the group dwindled in size. Barton was the youngest one in the group, "probably by three or four years at first. I was one of the slowest ones, too, because I was 80 pounds, 4'10", and a lot of the others were 150 pounds."

At this point one would do well to stop and consider something: the United States at this time—the early 1970s—was not very good at flatwater sprint racing. It was difficult to obtain information about the sport and Americans, with one or two exceptions, had not been very competitive internationally. But at a very young age, Barton was exposed to the best the country had on a recurring basis. As he put it, "At that point Marcia Smoke WAS American canoe and kayak, as far as flatwater went. She had won a medal in the 1964 Olympics, made the finals in two events in 1968, and was consistently making the finals in international

competition."

Another point worth making is that Barton had an excellent training environment starting at a very early age. Thus, in a way, he was able to overcome the handicaps that tended to plague Americans at that time: lack of information, lack of coaching, and lack of training partners.

> *I think I had a handicap compared to other countries, like East Germany or Hungary, where they had a lot of year-round coaching and professional coaches. But compared to the rest of the U.S., I was much better off. Also, there were some other people in the Michigan, Ohio, and Indiana area. There was Andy Toro in Ann Arbor. Roland Muhlen was down in Ohio.*

"Learning the dedication" was a big part of what Barton learned from the Smokes. They would do two-a-day workouts when he was with them. 'We'd get up in the morning and I remember we'd always go for a mile and a half run or something, come back and stretch, and then go out and do a practice in the morning, and then another one in the afternoon."

Initially, Barton's motivation for doing all this was the fun of it and "thinking about going to the National Championships and getting to race these different events and team boats, and that sort of thing." But fairly early, he could see that the Olympics was a possibility for him, "because Marcia was going to the Olympics."

Barton's first U.S. Nationals was in 1971, where he raced K-2 Juvenile 500m, K-4 Juvenile 5,000m, and C-8 Junior 500m. In 1972, he tried to qualify for the K-1 Juvenile event at the Nationals, but came in fourth in the regional qualifying event and didn't make it. He did, however, race Nationals in K-2 and K4.

Bruce's Influence

Throughout his early career, Barton's brother Bruce was going through more or less the same experiences he was. It was natural that the two of them would compare notes. Initially, Barton did not learn much directly from Bruce, but by 1973, when Bruce qualified for the European Junior Championships and started going to Europe each year, he learned a lot more. One of the things that made an impression was the fact that at age 17, Bruce and some other paddlers paid their own way to Europe just to train.

> *I learned a lot from those experiences. In the United States I think we were exposed to many of the same things. But going over to Europe, I think he saw how the Europeans were training and what they were doing. He also made me realize that the Europeans were a lot better than we were, which I knew already. But I learned more about why they were better and that we had to improve. In this country people think as soon as they qualify for the Worlds or the Olympic team, they're hot stuff. They go over to Europe and think they're going to be right in there, fighting for the medals. They don't realize that it's a whole other world out there, and they get blown off in the repechages (last chance heat for advancing to the semi finals), and they wonder what happened. Whereas, I knew when I was 13 or 14 how fast these guys were over in Europe, and that when you get to the top in the US, it's just one small step to becoming competitive internationally.*

Bruce brought a mixture of practical information and stories: "I remember hearing all these names, you know, Sledjewski, Lars Anderson, and Csapo." For example, he learned that during most of their workouts, the Swedes would do long intervals at less than maximum pace. 'Bruce said they weren't really that quick, that he could hang with them on the first few pieces or the first part of a piece, but they would maintain a steady pace throughout the workout." But the favorite Swedish workout, Barton learned, was "X times one," where they would do pieces at maximum intensity with long rest.

> *A lot of it was just the concept that there are different types of interval training. You've got long pieces. You've got intermediate pieces. Then, there's speed, practicing starts, and that sort of thing.*

Any technique tips? "Nothing really sticks out in my mind other than just the basics: using your rotation, straight arms and wrist, and so on." But he does remember one time when Bruce was paddling in front of him demonstrating how different racers paddled. "Sledjewski paddles like this, he'd just sit up really straight" or "Csapo from Hungary paddles like that."

Quantity of Training, 1971-73

During this period —remember, he was only about 12 years old at the time — Barton was training every day in the spring and fall, and often twice a day during the summer. He'd start paddling a little in March, and by April was up to a daily routine. As soon as school was out for the year, he would do occasional two-a-days. By the middle or end of October, he'd be back down to one workout a day. Thereafter, he would paddle occasionally, until the river froze in December. Sometimes, he would paddle in the winter, too.

> *There was the Kalamazoo River close to where we lived and it would stay open. Parts of it would freeze, but other parts would stay open year round, so we'd go out and paddle marathon canoes. That may be where I learned a little bit of marathon canoe racing strategy. As soon as you got to the river, there was a race right away: whoever could hop out of the car, untie their boat, and throw it in the water the fastest would have a head start on the next crew. It would be kind of a race going upstream. We were always going in and out of the current. Somebody would get ahead. It was a real twisty river with a lot of current — that's why it would stay open. It was always hard to pass somebody who got ahead of you. You'd have to sneak by him, and you'd end up crashing and banging boats and swearing at each other. Then there was this pipe that went across the river. Depending on the water level, you had to go in different places to get around it. There would be a great mess racing around that thing.*

Barton's partners in these sessions were other family members or friends who stopped by the house. During the winters, because of the cold, he did steady distance paddling. When it was wane enough to do interval training, he would start with long intervals. As the date of the Nationals drew near, he would do more start practice and more speed work.

Istvan Granek's Book "Paddling Canoes and Kayaks"

The earliest literature on sprint racing that the Barton family had access to was a book by a Hungarian coach, Istvan Granek, called *Paddling Canoes and Kayaks*. It was a 288-page double-spaced, typed English translation made available by the U.S. Olympic Committee in 1969, which covered almost all aspects of canoeing and kayaking in considerable detail. The book had an indirect influence on Barton because his father bought a copy at a training camp and referred to it frequently. It contained a lot of the same things he was learning from Marcia Smoke: "My father was always talking about 'you've got to reach out, and get a good rotation, and don't bob the boat.' "

> *I remember after my father read the book he built this paddling weight machine. It was two pulleys on the wall. He had one about waist level when he was sitting on the floor. And then there were a couple of them on the ceiling, and a string hanging down. He'd stack a bunch of barbell weights on the rope, and sit there with one hand and grab the handle on this thing. There were a number of exercises he got from the book. You'd get pulling and the weights would start swinging around. You didn't want to have any nice lamps too close to it!*

This machine was used for winter training. Since his father never did any barbell lifting but focused his weight training solely on his homemade machine, Barton did only the machine, also. "There was a belief that you shouldn't start weight lifting too young because it might harm your growth and that sort of thing," he recalled. He did some push-ups and pull-ups, but it wasn't until age 16 that he began real weight training.

Although the Granek book had an influence on Barton through his father, he didn't get around to actually reading it himself until 1980.

Evolution of Technique

We have seen how Barton spent a great deal of time in his earliest years in marathon canoes. The question naturally arises, what effect did that have on forming his kayak technique? He believes the techniques in both were probably more similar back in the 1970s than they are now: "I think a lot of the marathon techniques were quite similar to flatwater kayak techniques, as far as trying to use your rotation, reaching out, getting a full extension, and not pulling back too far behind you."

Probably a lot of the similarity had to do with the fact that many of the best marathoners were sprint racers who were just "much better athletes and in much better condition." But now, Barton believes marathoners have specialized and their techniques have changed considerably. Contributing to the difference is the evolution of the bent shaft paddle.

> *Back when I started, you had the straight paddles in marathon, which meant it was really important to reach out in front of you. Now that the paddle is bent, you can paddle more behind you, and you don't need to rotate out as far forward. As a result nowadays, my marathon stroke is much different than anyone else's because the two techniques have sort of diverged. Today, marathon has emphasized pushing DOWN with the top arm and pulling*

back farther, and not so much rotating out in front of you, which I found allowed me to develop more power in the middle distance kayak races. In some of the eight-hour races, just the act of moving your body that much can fatigue you, and it's actually putting more power on the stroke than the body can handle for eight hours, so what I always thought was the most efficient for any type of paddling may not be the most efficient for an eight-hour race. The marathon stroke has changed. Also, nowadays, the flatwater stroke has gotten even more involved with rotating with the wing paddle and everything. You've been able to really involve your back and shoulder rotation, and I've really concentrated on that in the last several years, put a major effort into thinking about using this body rotation. Now when I get into a marathon boat, the guys say I'm using half a kayak stroke. Sometimes it's hard to match up with partners. But I still think mine is an effective stroke, especially in the shorter races.

Barton has gone through several different phases in his kayak stroke. In the early 1970s, he was using techniques Marcia Smoke taught him, which emphasized the top arm pushing out at eye level, "or even a little higher than that."

Then, when I went over to Europe for the '75 and '77 Junior World Championships and the '79 Senior Worlds, I saw a lot of the Soviets and East Germans paddling with much lower top arms, more shoulder level, and it seemed more powerful. In 1980 I tried to use a little more of that, pushing out a little lower and trying to use a little more body. Then, for a couple of years, my technique was kind of strange. I went through this phase where I was trying to use everything. I would rotate out and I'd have my top arm bent a lot with the fist close to my cheek, then I would rotate and pull with my arm at the same time and really try to combine the rotating, pushing, and pulling. It really didn't work that well, especially in the shorter events. I was almost slapping the water at the catch because the paddle angle was too low. My top arm was bent greater than 90 degrees, and the fist was close to my head. I wasn't getting a clean, powerful catch. Later on, I realized it was better to just stick with the rotation and use the arms as little as possible, so in 1983 I started changing some more.

1975 Junior Worlds

In 1975, Barton was 15 years old and weighed about 110 pounds. In order to make his first U.S. Team, he had to get past the U.S. Junior Trials on the St. Joseph River in Buchanan, Michigan. He made it by the narrowest of margins:

In those early Junior Worlds, they had only 500 meter events. It had been decided beforehand that we were going to take four or five men kayakers to the Junior Worlds. I raced K-1 500 and finished sixth and my brother, Bruce, won. Another guy from Michigan, Dan Hintz, beat me out by just a couple of feet in fifth. But Bruce and I won the K-2 event, so they were trying to decide whether to take me, who was sixth, or this other guy, who was fifth. They decided to have another K-1 race. This time, we finished in the same positions, only it was even closer, about one foot. I was ahead of him all the way, then he passed me at the very end. So they said, okay, we'll have

another K-2 race. We switched partners around. Again, I won the K-2, with another partner, so they finally decided to take me on the team. I made it by the skin of my teeth.

He went to Castel Gandolfo, Italy, for the Junior World Championships, where he raced only the K-4 500. His team was eliminated in the repechages. Bruce had better luck, though, taking sixth in the K-1 and K-2.

"I was impressed," he recalled, "and got the idea that it was possible for an American to make the finals and do well." The other impression he had was that the athletes from the other countries were a lot bigger than he was. "I could also **see** they had much better developed programs in Europe than we did in the U.S."

Toro Becomes His Coach

Barton first met Andy Toro when he started paddling at about nine or 10 years old. Toro had been a bronze medalist in C-2 at the 1960 Olympics, racing for Hungary. He first met Toro after he had immigrated to the United States from Hungary and was studying naval architecture at the University of Michigan. Toro and Barton would see each other at races. "But he never coached me until 1975, when he was the coach for the first Junior Worlds Team I was on," Barton recalled. With Marcia Smoke phasing out of coaching — she was now a mother and had other responsibilities — Toro became Barton's coach, a relationship which would last through the early 1980s.

In 1975 he'd tell me to reach more, twist more, don't pull back before you bury the blade. He had us do basic interval workouts. He felt I needed more size and strength.

To achieve that, Barton started barbell weight training in 1976.

I used pretty much the standard upper body lifts. At first, I remember, the bench press was a big one. I guess that's one everybody does. I still did pull-ups and maybe some overhead presses, and some curls — just a few exercises at first. I did some bent-over rowing as well. That's not always the best thing for your back. At that time, we didn't realize there was such a thing as bench rowing.

1977 Junior Worlds

In 1977, Barton went to the Junior Worlds in Vichy, France. By then he was up to 135-140 pounds and was the fastest Junior in the U.S.

I went over to race K-1 and K-2 500 meters. I thought I had a good shot at making the finals in the K-1, at least. I ended up fourth in the semifinals. It was a photo finish, less than a tenth of a second, between Grayson Bourne of Great Britain and me. But that was just an honest reflection of how good I was at the time. I would get behind at the start and middle of the race and then come on at the end, but I could tell I had made a lot of improvement in the past two years. I went from being one little guy in a K-4 that was being eliminated in the reps, up to being in contention with the big guys. At least I wasn't totally out-classed the way it had been in the past.

1978 Season

Due to the weight lifting and a growth spurt, by 1978 Barton was now up to 5'10" and about 150 pounds. He had a "decent year" in 1978 when he made the U.S. Senior Team, and by the end of the summer was the second fastest K-1 on the team, behind two-time Olympian Steve Kelly. He and Bruce raced K-2 1,000 in the 1978 Senior World Championships in Belgrade, Yugoslavia, but were eliminated in the repechages. He also raced K-4 500 — "It was a joke, we trained it only once before the race and got totally blown off in the reps."

But his first senior worlds made some impressions on him:

> *I remember seeing a lot of techniques there and thinking that as long as you did a few things properly, like getting good rotation, and having good steady strokes, perhaps some of the minor details weren't so important, like having full extension, or worrying about the height of your hand on the push-through.*

He also remembers seeing East Germany's Rudiger Helm for the first time:

> *Before the races, at the start, it seemed like you could just see the confidence in the way he looked warming up, stretching out, and kind of shaking his arms around. It looked like he really had it under control and knew what he was doing. I picked him to win the K-1 1,000 and sure enough, he did. He won three golds that year.*

Beating Bruce

That year also was marked the first time Barton was able to beat his brother in a race. At the Memorial Day Regatta in Lake Sebago, New York, he won the K-1 1,000, "pretty much surprising everybody, including myself." At the end of the season, he also beat Bruce at the Nationals. "I was excited because I knew I had just made a big jump."

Disappointment in 1979

In 1979, Barton's improvement came to a halt because he hurt his back — an upper middle back muscle tear — in the Lake Sebago race in May. He stopped paddling completely for two weeks, and then took almost two months "babying it along, where I never had a hard workout." So he views the 1979 season "as almost a waste." He competed in the World Championships in the K-1 1,000m, "and I felt I was continuing to learn just by seeing the top people. But physically, I didn't use what I learned, because I wasn't strong enough. By the end of the season though, my back was fine."

Counter-Rotate

There was one important technique element that Barton picked up in these two seasons, the idea of "counter-rotating," a term which came from Toro.

> *Back in the mid '70s I'd see Canadians in Florida working on snapping the blade out of the water, and I started to copy them. Then in '78, Toro noticed that I was coming back to a certain point in my pull-through and just stopping everything, jerking the paddle out of the water. When you stop like*

that, you put the brakes on. Toro said I needed to continue my rotation while I was pulling the blade out of the water. The Soviets, particularly Parfenovich, Chukhrai, and Tinakov, did that really well. They were just beautiful. The prevailing philosophy was that you had to get the power on up front, and get the blade out of the water before the blade got to your knees, but these guys were pulling back quite far. The boat would really run smoothly, and it was because they were continuing to keep the power on as the blade came out of the water.

1980 Olympics

In good health and with the prospects of competing in the Olympic Games, Barton faced the 1980 season with renewed energy, and credits this year with a big jump in performance. One of the reasons for this was his association with Toro, who was named the Olympic Team coach.

Toro's influence didn't reach its peak until the 1980 season. Barton was in college then, but took off the spring semester to spend two months in Florida working with Toro and the rest of the U.S. Team. "I think I put in the highest volume during that time that I've ever done," Barton recalled. Toro had him and the others regularly spend two hours at a time on the water. These workouts consisted of very long intervals, such as 10 times six minutes with two minutes rest. The athletes would train twice a day like this for two or three days, and on either the third or fourth day, they would have a time trial in the morning and the afternoon off. Initially, the time trial was two times 10 kilometers: do a 10 kilometer time trial, rest an hour, and do another one. They did that for two weeks, and then went to two kilometer time trials — three of them at a session. At the end of the two months, they were doing 1,250 and 1,000 meter time trials, and a 500 or two right at the end.

Most of these long workouts were competitive with boaters paddling side by side. The time trials, however, were not. In these, the athletes started one after the other and raced against the clock. This, Barton guesses, was "perhaps because Toro wanted you to get more of a feel for your own pacing, rather than racing somebody else."

I've seen this happen a lot. Often when people train together, they learn how to play mental games with each other. For example, they know that if they go hard to a certain point in a workout, they can break the other person and then they can back off. But if you're out there on your own, it's just a matter of going at your own pace and you know that there's nobody beside you who is going to back off when you break them. So you just have to go and do your fastest time, and then at the end of the time trial you can compare times.

During this preparation for the 1980 Olympics, Barton changed his technique a bit. He concentrated more on rotation, "using a low body rotation," and he lowered his top arm on the push-through. Toro always was in the motor boat giving him feedback about his technique.

Initially, he didn't like my top arm push. He thought I was keeping it bent too long, instead of pushing straight out. However, after some work, Toro decided he liked the new technique.

Barton has some interesting comments about stretching in order to improve his torso rotation.

> *Initially, I did some stretching with putting a bar across my back, sitting on the ground as though I was in the kayaking position, and just twisting as far as I could. When a lot of people do this exercise, they just go back and forth. But I would twist and try to hold it in the stretched position for a second, because you actually need to do that when you are paddling. You rotate out, and then you need to maintain that position while you are putting the paddle in the water. A lot of people rotate out, but then they come back before they get the paddle in the water. A little later on, probably around 1984 or so, I occasionally did some stretching where I would be sitting down and bend one leg up and twist to the side to stretch my back. Other times after weightlifting, I would just sit down, put my feet against the wall as though it were a kayak footbrace, and just twist, put my left elbow on the outside of my right knee, and rotate as far as I could, and do a couple of air strokes, just trying to use that rotation.*

Another thing he thought he learned during 1980 was "just concentrating during the workouts and really putting out a good, consistent effort."

> *I would think about what I was doing the whole practice and really force myself to do it. For example, if I felt unstable extending forward, I'd force myself to extend anyway. And if I was in the middle of a long workout and it felt hard, rather than slacking off, I'd force myself to put in that extra effort.*

Throughout the period in Florida, Barton could see himself improving relative to the other athletes there, his brother Bruce, Steve Kelly, and Brent Turner among them. "I'd usually have the fastest time trials," he said, "but Terry White was coming on at that time and was pushing me sometimes."

The Carter Boycott

Even before the U.S. Olympic Trials, the athletes training in Florida knew that they probably would not get to go to Moscow. Rumors of a boycott came during the Winter Olympics, during the TV coverage. In talking about the Winter Olympics, newscasters mentioned that the Soviets had invaded Afghanistan, and Barton recalled "somebody said we shouldn't go to their Olympics."

> *After that, a lot of people started calling the White House saying 'Let's boycott the Olympics.' 1980 was an election year, and the athletes became Carter's pawns to play with to try to drum up votes. So we didn't go. I was opposed to the boycott. My view is the whole point of the Olympics is that they're not supposed to be political. Back in the Greek days, they used to stop wars to hold the Olympics, and I don't see what's wrong about that! I just wanted to go to the Olympics and race against the best people in the world. I didn't think it was right to not allow us to compete. I felt it was more of election politics rather than really hard international politics. We didn't go to the Olympics, but we still sold them grain. Which had the greater impact?*

But Barton did not let the boycott disturb his enthusiasm for training.

I think the reason it didn't devastate me was because I was feeling good. You know, it's always easier to take when you're feeling good. And I realized that I was only 20 years old; I was not at my peak anyway. I felt a lot sorrier for the people who were at their peak, or for whom it was the last chance to go to the Olympics.

After the announcement of the boycott, the U.S. Team competed in a few major international events. At Nottingham, England, where almost all the top boaters competed, Barton raced in the K-1 1,000 and got seventh. He might have placed fifth had he not been mistaken about the finish line and stopped paddling too soon. At Duisburg, Germany, with the Soviets and East Germans absent, he took second in the 1,000 with a 3:57 into a head wind. At the end of the season, he competed in the Sella, a Spanish marathon race lasting about 80 minutes, in K-1. He placed third, largely because there was a portage in the race "and two other guys outran me."

In summing up the 1980 season, a pivotal one for him, Barton said:

I think the main thing was that even though I didn't go to the Olympics, I realized that now I could compete with the best in the world. I saw the results from the Olympics and figured I could have been between sixth and eighth.

Viral Illness

Barton was excited after the 1980 season: "I should be in the finals in the 1981 Worlds, and if I improve a bit more, I could get a medal." He knew how hard he had trained in 1980 and he resolved to do it again this year. However, this time he was taking a full load of classes at the University of Michigan. He also joined a fraternity and spent a lot of time there. "I just wasn't resting enough," he recalled. "That spring I came down with a viral illness. Everything just caught up with me." It took him a year and a half to get over it.

I just started getting real tired. I'd go out for a workout and half way through I'd wonder why I couldn't do more. Then I started having headaches when I got up in the morning. A lot of times, I felt nauseous. I could go to classes and function, but I felt terrible. After school got out in May, I saw a doctor who took some tests. He said I had some type of viral illness, but he couldn't say more than that.

Barton raced in the U.S. Team Trials that spring, but he wasn't fast enough to qualify for the K-1 or K-2 events. Toro had scheduled him for the K-4, but he decided not to go to the World Championships.

I just wasn't feeling well. I knew I wouldn't perform well if I didn't feel strong. It's one thing when you're coming up and you get smacked over the head; it's a learning experience. But after you've gone through that phase and you've made it to the top, or are at least in contention for a medal, it's hard to go back to getting smacked over the head again —going out in the reps —and I knew that's probably what would happen if I went over to the Worlds.

So he stayed home. He actually continued training some through the year, but by the end of the year he had stopped completely. He tried to return to college in

the fall, but wasn't feeling well and wasn't happy, so he dropped out in December. He saw more doctors, but while their tests showed something was wrong, they couldn't tell what it was or what to do about it. They never figured out what to do about it.

Barton had stopped training completely for a few months, but then started again because stopping only made him feel worse. He didn't train hard, though. "I'd just go out for an easy paddle or an easy run." In the spring he felt normal and started to resume a more normal schedule. He went to the U.S. Team Trials, but didn't do very well — ninth in the K-1 500; sixth in the 1,000. The Team wanted him to do team boats, but he knew he wasn't back to full potential, so once again he skipped the World Championships.

But he did a lot of races back home and continued to improve. He won a B-Team race in Canada. He won all three K-1 events at the U.S. Nationals, although the fastest person, Terry White, wasn't allowed to compete because he had sent in his entry late. "I figured I was back on track."

1983 Season

Barton continued to improve during the winter of 1982-83 and won the team trials in the K-1 1,000. He was seventh in the 500. But he stopped improving after the trials and stagnated through the rest of the summer. Terry White, on the other hand, continued to improve all summer, and by the time of the World Championships in Tampere, Finland, was faster, so he was picked to race the K-1 1,000. Barton had been training only in K-1, so the only other event for him was the K-1 10,000.

He came in eighth in that race, which at the time was a good finish for the United States. That year, there was a large front pack of 10-12 people and Barton led for much of the race. At that time, there was a rule in the 10,000 that on the last 1,000 meters, paddlers had to go into their own lanes and weren't allowed to come closer than five meters to another boat, but the top seven boats all went into three or four lanes, a technical violation of the rule which hurt Barton's chances.

> *There were lots of protests, and several sets of results were released and they ended up not disqualifying anybody. I felt that if people had stayed in their lanes, I might have been able to grind a couple of them down. I still wasn't fast enough for a medal. I might have been fifth or sixth. They changed the rule after that; they allowed wake riding right up to the finish after 1983.*

Influence of Paul Podgorski

During the 1983 season, Barton realized that he needed more work on his technique. In 1982, he was using a lot of rotation, but he also was trying to use every body part to the maximum. This meant that he cocked his upper fist back close to his cheek and pushed out from there at the same time that he pulled with his lower arm. "It was really stiff and mechanical," he recalled.

> *I realized that I was using my arms too much, even though I was trying to use all my body parts. Part of the reason I wasn't doing well in the 500 — worse than usual — was because of another problem: I had such a low, horizontal paddle angle that I couldn't get a good catch. I would just slap the*

water, rather than really catching hard in a more vertical position where you can really apply effective power.

Barton figured this out with the help of Paul Podgorski, a native of Poland who immigrated to the United States in 1980 and became the first full-time paid coach for the U.S. Canoe and Kayak Team in 1983. He emphasized that the arms shouldn't bend past 90 degrees in the stroke, and the push shouldn't begin too close to the face. With this in mind, Barton started watching the New Zealanders. "I knew they had had a lot of success, and Chris Spelius, an American who trained in New Zealand, was always saying how they were trying to keep their lower arms straighter, and they would actually lean away from the stroke at the end, so they could keep their arms straighter." He figured maybe he needed to start doing more of that, so he worked on two things: not bending his arms so much and having his top arms more forward at the catch so he could catch the water more vertically at the front of the stroke.

Paul was always telling me that I looked too stiff. I was really trying to put as much power and emphasis into the stroke as possible, and I ended up being very stiff. I also had a problem with bending my right wrist on the push, which had gotten a little better since I started to work on it. Paul also thought that while my speed was pretty good, I was revving the stroke rate too much to get it. As a result, I figured out that I should move my hands closer together.

Barton came up with this approach more or less without the help of video.

"One of our weaknesses as a team at that time was that we didn't use the video more," he said. "I would have used it every week. When the team gets together for a couple of months during the summer, I think it's important to use the video as much as possible."

By working on his technique like this throughout the 1983 season, he was able to improve his speed by the World Championships. That improvement grew even more by the winter of 1983-84.

Summa Cum Laude

In the meantime, Barton graduated from the University of Michigan in December of 1983. "This was perfect," he said, because he could spend the spring concentrating solely on preparing for the Olympics. It should be noted that he graduated with the highest honors the university had to bestow, summa cum laude, despite the demands of training at a world-class level and battling a year and a half of illness.

I didn't study much in high school, and it was a big shock for me when I went to college. In the engineering school, courses were tough, and I was spending a lot of time studying. I remember thinking, 'I don't know whether I can take this.' Because I had done well on the aptitude test, I was placed in advanced classes. Many students from larger schools had already studied these subjects. I went into this calculus class where most of them had already had a year or two. Same thing in chemistry. But things got better after the first semester.

At Michigan, 4.0 was a perfect grade point average. To graduate summa cum laude required a four-year average of 3.6 or 3.7. Barton got a 3.8. By his own admission, for four years he spent his time studying, paddling, eating, and sleeping.

1984 Olympic Year

After graduating, and spending a month at home, Barton went to Florida for a winter-long training camp under Paul Podgorski.

"I didn't do anywhere near as much volume as in 1980," he recalled. "I followed the Podgorski program, which had me doing more quality training. I think this worked well for me because my endurance base was already high."

During the fall of 1983, besides working on his technique, Barton incorporated one or two speed workouts into his weekly schedule, even though this was traditionally not the time for this, because he wanted to improve his basic speed, especially in the 500m. "I would do one or two workouts at maximum speed: short pieces, all-out, with full rest in between." He continued it every fall thereafter.

> *I figure that if I am doing endurance four or five times a week, if I take one or two days to do speed work, I'm still getting in enough endurance. I feel I needed to work on my weak points, even though the general training philosophy is that during the early part of the training year, you train your endurance and then work on speed later on. But I think if you have a weakness, then you should work on it during the off-season, too. I'm not saying that you place the main emphasis on improving your weaknesses; I think you need to spend the most time building up your strengths. You need to strike a balance.*

After winning the Olympic Trials in the 1,000, Barton and the rest of the U.S. Team went to Europe to race. He began to win medals in major international races. "It felt really great to be back, finally. It had taken me four years to get back to where I thought I belonged," he said.

Performance in the '84 Olympics

Barton believes he performed in the boycott-depleted 1984 Olympics at about the level he thought he was capable of, winning the bronze medal in the K-1 1,000. With the Communist countries out, *Sports Illustrated* picked him to win, although he thought that unrealistic. He had won at Duisburg, but Alan Thompson, the eventual '84 Olympic winner, was ill then. Barton figured he "had a chance at a medal, but only a long shot at winning the gold."

Where did Thompson and Milan Janic, the Yugoslavian silver medalist, gain on him? What needed work in the future? "Just speed over the whole course." That, in turn, broke down to a combination of two things: more physical ability and more technical ability. In the technical realm, he believes he was "just paddling too stiff; really tight and not relaxing enough."

> *When you're stiff, it's almost like you're losing a little bit of efficiency. It's like you're forcing the boat all the time. Just the tension of flexing muscles uses energy, and I think it's a mind-set, in a way, when you're paddling more relaxed, and when you get down towards the end of the course, and you*

feel you've been paddling relaxed this race, you should have a lot left for a good kick. Whereas if you are really tight about the whole thing, and you get that into your mind, I think you start fatiguing before you really need to; both physically, because of the act of tightening muscles that don't need to be tightened, and then psychologically, because you're sort of stressed out by the whole thing.

Where does the tightness come from?

I think I was just trying so hard all year. Actually, I don't think I really started relaxing much until I switched over to the wing paddle in '86. I think the wing gave me a chance to improve. Sometimes when you're stuck on a problem, I think it's better to leave it completely and start something different. That's what happened to me with the wing. It was a new technique, and I didn't need to keep my bad habits.

Nevertheless, Barton ended the 1984 season a happy man. "I was excited to come home with a bronze medal. It wasn't a gold medal, but I was happy. Up to that point, it was 20 years since an American had won a medal in a flatwater Worlds or Olympics, and I was just happy to have one."

Paddle Business

After the '84 Games, Barton went home and started making marathon canoe paddles for a living. He was to do this for two years before moving to California. He had been repairing his equipment since he started paddling. This evolved into building some of his own equipment, and in 1981 he had made an all-composite canoe paddle. At that point, most marathon paddles had wooden shafts and composite blades. People saw his paddle and expressed interest, but since he had spent 30-40 hours on this particular one, he realized he couldn't charge enough to make a profit and still interest customers. So he researched how to make molds and speed up the process. The result was the "Barton Paddle Company." But then, he needed a workshop.

At first, I was building them in the basement of the house, then my father closed in and insulated one of the stalls in an old garage we had, put in a heater and some benches, and said "Here's your shop; build paddles!"

Soon Barton hired two other people and was selling 500-600 paddles a year, all mail-order. "I had a little brochure, people would send in their orders, and I'd ship them out, UPS."

The paddles were called "Blackbucks," after Barton's nickname, "Buck."

It's funny, I had a hard time thinking of a name for them, but that's what people started calling them because they were black, because they were carbon. They'd say, 'Hey I want a Blackbuck!'

Barton ran the business for two years, after which he sold it to his father and brother. They, in turn, hired some of the farm workers to build paddles for a couple of years before they sold the business to Jim Hagen in Minnesota. It is still called the Barton Paddle Company.

Barton gave it up because it consumed a great deal of time and he wasn't making as much money as he thought he could through other work. "I saw the

Olympic Job Opportunities Program (OJOP), and I thought about the chance of using my engineering degree, getting a job out in California, and being able to train through the winter. It seemed like a good move for me." At the end of 1986, that's what he did.

1985 Season — First World Championship Finals

Barton's main goal in the 1985 season was to at least maintain the world ranking that he had achieved in 1984. He remembered four years earlier after the 1980 Olympics, when, as he puts it, "the bottom dropped out for me." He was determined not to let that happen again.

> *That's about what happened in 1985. I didn't really improve. I held even as far as my speed, and I had a few bright spots here and there. The 1,000 at the Worlds didn't go really well. I was sixth, which was a decent performance. I'd hoped to do a little better than that, though. But then I won the 10,000, which I was really happy about.*

There was one other highlight in the '85 season. There was no European tour for the American team prior to the World Championships, as was customary later on, but the team did race in Montreal. There, Barton did a 3:41 for the 1,000 (admittedly with a good tail wind), which at the time was almost unheard of. "But later on that year, Csipes of Hungary did 3:40 at the Worlds — with much less of a tail wind. So you could see that times overall were starting to drop." This trend was accelerated in subsequent years by the development of the revolutionary wing paddle.

Four Year Peak

Does it make sense to take every year as seriously as the Olympic year? Are some World Championship years more important than others? For example, it might be difficult to reach maximum intensity every single year, year after year. It seems to this author that for some people, the Worlds the year before the Olympics is the most important one, because it lays the groundwork for the Olympic year. Similarly, the Worlds the year after the Olympics would be less important, because it is farthest away from the next Olympics. What does Barton think about this hypothesis, and did he follow it?

> *I think it is more of an individual thing. There are probably a few people who, as you say, slack off a little and try to build up to the next Olympics. But I don't think many people do that. One thing that does support your theory is that people tend to retire in four-year cycles, right after the Olympics. Therefore, the next Worlds can be slightly weaker. But I think the people at the Worlds take each one as seriously as the other. Then there are some people — like myself — who take a year off, and generally that would be the year after the Olympics. And that person gets more and more serious the closer he gets to the next OIympics. The year he comes back he's not going to be at full strength.*

1986 — Switching to the Wing

The most significant factor in Barton's 1986 season was switching to the wing

paddle. He believes that the K-1 1,000m event was the main beneficiary of the new paddle.

> *Initially, you didn't see that much benefit. In '85, Kalle Sundquist, from Sweden, was really the only one who had it in the K-1 1,000. In '86, there were various people: I started using it, Jeremy West (the '86 World Champion in both the K-1 500 and the 1,000 from England) used it. There were more people creeping in there, too. And, I think by '87 and '88, the majority of people had the wing, and as people learned how to use it, it was probably about two to three seconds better.*

One might think that the difference would be even more pronounced in the K-1 10,000: if the paddle is more efficient, it should show up more the longer the event.

> *The 10,000 is really hard to compare because it often turns into a tactical pack race. I've been in some 10,000s — like '87 — which are relatively fast. I broke away from the pack about halfway through the race, and the last half was a time trial to the finish. If there's someone pushing you all the way, the wing is much faster. But in other 10,000s I've been in, people are hanging back, nobody is willing to take the lead, so it's tough to compare. But if you had a 10,000 meter time trial, there'd definitely be a huge difference because of the wing.*

The first time Barton used the wing was in Florida in the winter of 1985-86. He borrowed one from a Swede who was training there, using it for only about 15 minutes. At first, he thought that if he didn't use it correctly, "it would want to suck under the boat at the end of the pull-through." He soon discovered, however, this occurred only when you tried to pull it straight back. If you let it drift out to the side a little, the way it was designed to be used, there was no problem.

Nevertheless, Barton's initial reaction was that it "felt terrible." He went back to his old paddle again — and it felt even worse!

> *In that 15 minutes I had adapted to the feeling. It's a different feeling in that if you pull straight back, it does some weird things. But if you let it follow its natural path, it's really solid in the water. It wants to follow a path out from the boat, and if you let the paddle do that, you can almost use it like a brace. You can put a lot of force on it and it really holds solidly in the water, so that when you go back to a standard paddle and pull a stroke like that, the old paddle feels unstable. After you've paddled with the wing, it's more difficult to go back to a standard paddle than switching to the wing in the first place.*

So Barton had to change his technique to suit the wing. Since the wing stroke comes out to the side rather than straight back, he found that he did not have to bend his lower arm as much "because you don't have to worry about going too deep." Going out to the side also helped him get a better push through with the upper arm. "Because the wing stroke goes out to the side, your lower hand finishes farther from your hip than with the standard pull-through. That means that you start your push-through for the next stroke farther away, too. In '82 and '83, I was starting the push almost next to my face." Also, beginning in '86 and even more

so in '87, he began to go more vertical with his stroke.

> *That makes the wing work more effectively because the cross sections of the wing are better lined up with the way the paddle is moving through the water. The farther you get it away from the design angle, the less efficient it is.*

And finally, he noticed a big change in the feel of where the power comes on with the wing.

> *With the old standard stroke, the catch is much harder and it seems like the last part kind of falls off. There's not as much power in the stroke with the traditional paddle. With the first wings, the Swedish ones, the catch was not nearly as strong, but the middle and later parts were more efficient and it was possible to generate much more force later on in the stroke. The newer Norwegian wings have more force at the front of the stroke, compared to the original wings. So first, they improved the middle and later part of the stroke, and now they've improved the front to be closer to what it was with the old standard paddle. So the entire stroke phase has improved.*

Evaluation by Subjective Feel

How does one make a big change in equipment and technique? How sophisticated are the methods you use for this? Is video used? Do you talk to other people? Do you seek to quantify differences in speed in measurable ways like doing time trials? How long do you use a radical piece of equipment before you decide to accept or reject it?

Essentially, Barton made up his mind about the wing just by feel. He had heard bits and pieces about the wing from the Swedes and finally borrowed one, as we have seen, and tried it out.

> *Then I decided that I should try it for a whole workout. So during one of the team workouts, when Paul Podgorski was out there in a motor boat, I just went out with a wing paddle and used it for the entire workout. It felt kind of weird, but I did it. The next workout I went out with a standard paddle, and I did this for about three days in a row, alternating workouts. I felt terrible the entire time because I could never get used to either of them. I thought, 'Well, I can't paddle any more; I better quit this sport! Everything I've learned during the last 15 years seems weird now.' Finally, I decided that there may be some benefits in using the wing and that I shouldn't keep switching back and forth. In mid-April, I decided to give it a month. But even after one week I started to see how it could be an improvement, and that I'd probably go with it. I don't know whether I was actually going faster. I knew my starts were slower initially, but after a week I felt that on long pieces it was definitely a benefit to use the wing. I didn't do any time trials; I just went on how it felt. I did use the video a little, just to see what it all looked like. By the time I started racing that summer, I could tell my times were better, so I felt that my earlier assumptions going on feel were correct and that I was moving faster because of the wing.*

In the European tour earlier in the summer prior to the World Championships, Barton did 3:39 in the K-1 1,000m two weekends in a row (Nottingham and Paris),

and was beaten both times! "Csipes beat me in one of them and he was using a standard paddle!" he recalls.

He took fifth in the K-1 1,000m at the World Championships in Montreal, a bit of a disappointment to him, but at least he was still improving. Summarizing the 1986 season, he said:

> *I just got more experience. I'd had a lot of consecutive training at a high level, '84-'86. I was feeling better, and I started improving again. My technique improved when I switched to the wing. I used the same sort of training that I had been doing in other years.*

Moving to California

At the end of the 1986 season, Barton moved to Newport Beach, California, where he had gotten a job with Fluor Daniel through the U.S. Olympic Committee's Job Opportunities program. The firm builds installations for companies that need refineries, power plants, food processing plants or chemical plants. He worked as a mechanical engineer. He was involved with the equipment installed in the plants. Initially, he worked at analyzing heat transfer processes and later at making calculations for pressure vessels.

Barton worked six-hour days, starting at 9 a.m., having 45 minutes for lunch, then ending the day at 3:45 p.m., leaving his mornings and evenings open for training. He did this for the two years leading up to the 1988 Olympics.

World Champion in the K-1 1,000m and K-1 10,000m

The pre-Olympic year of 1987 was a terrific one for Barton. As a result, we will look at his training (and the next year as well) in great detail. But first, what were the big differences between those years and what he had done before?

> *Going out to California definitely helped. I was able to train on the water year round. I had a good employment opportunity; it was better than the paddle business, because when I left work for the day, that was it, I didn't have to think about it any more. With the paddle business, people were always calling me up and asking me for paddles. I also figured out the wing a little more. I started really thinking about putting the rotation into the stroke, and changing some things around. Initially I used a long wing paddle, but then I shortened it up a bit.*

Group Training

Another difference in Barton's training was that he had others to train with in California.

> *In Michigan after 1980, when Bruce quit doing flatwater, I was pretty much by myself most of the time. Sometimes I would put on a resistor (a rope around the hull which slows down the boat) and go out with the marathon canoes. Once a week, they'd do some kind of intervals and I'd train with them. But there were no flatwater kayakers to train with. In southern California there were. Terry White moved out there with me in the first year. Philippe Boccara (from France) was there, and there were a bunch of other people out there as well.*

Analysis of the Training

Because he kept extensive training logs, it is possible to reconstruct in great detail how Barton trained for both the 1987 World Championships and the 1988 Olympics. These details are in the Appendices of this book, but we will look at an overview here.

His training year ran from early November to the World Championships in August, a total of 42 weeks. He averaged 689 minutes of training per week, a little less than 70 percent of that in the boat. The vast bulk of this was done as two workouts a day, but there were some three-a-days, particularly in the spring.

Other noteworthy items are:

- He paddled on the water all year round.
- He did weights consistently all year, right up to three weeks before the World Championships
- He ran consistently all year, right up to the Worlds.
- After April 19, he cut back on the amount of time on the weights, and almost entirely eliminated the other forms of endurance training — biking and swimming, for example — that he had been doing up to that time.

Norm Bellingham

In 1987, Norm Bellingham became Barton's K-2 1,000m partner. Since he was to share the next two years closely with Barton, it is worthwhile to know something about his career.

Bellingham was born on December 23, 1964. At the 1987 World Championships and 1988 Olympic Games, he was 6 feet, 4 inches tall and weighed 198 pounds. He used a 223.5 cm paddle, right controlled.

Bellingham started out as a K-1 whitewater slalom paddler. He began his career under the tutelage of Tom McEwan at the Valley Mill Camp, in Germantown, Maryland, at the age of 12. There is a story which reveals much about his character and desire to succeed. About to embark on a difficult whitewater river trip, there was much discussion about whether Norm should try it or not. Finally, he reportedly asked Tom, "Well, is there a 50-50 chance I'll survive?" Tom replied that, yes, there was probably at least a 50 percent chance. Bellingham then said, "All right, I'll go."

In 1979, McEwan introduced Bellingham to Bill Endicott, coach of the U.S. Whitewater Team, who had trained many world champion medalists. Bellingham spent the next four years at slalom, becoming the U.S. Junior Champion and finally representing the U.S. national senior team in the Europa Cup in 1982. Inspired by reading Endicott's history of the whitewater world championships, *The River Masters*, his dream in those days was to become world champion in slalom. The East Germans, particularly Olympic champion Siegbert Horn, had set all the records and Bellingham tried to learn everything he could about their methods. Then, in 1983, he was forced to deal with a pair of crushing setbacks: he failed to make the world championship whitewater team and, after a lackluster performance in high school, his plans to attend college were temporarily shelved.

Bellingham left home, rented an apartment with several other athletes and got a construction job. He tried to continue to train slalom, but found it impossible. By the fall of 1983, he realized that he would have to train full-time if he were to become a world champion. He knew he could not afford to do that in slalom, which was a non-Olympic event and received no U.S. federation financial support.

That is when he elected to try sprint racing. Friends told him he had the right size and build for it. Since it was an Olympic event, he would be eligible for United States Olympic Committee financial support.

So Bellingham got a sprint boat and started training. But by the early spring of 1984 — an Olympic year — he had a falling out with the U.S. Team staff, was dismissed from training camp in Florida, and returned to his old slalom coach, Endicott. He asked Endicott to train him in sprint for the Olympics. Endicott had begun his paddling career as a sprint racer, but had spent only one year in the discipline before switching to whitewater.

Endicott, by chance, had attended the 1981 Sprint World Championships, which were held in Britain one week after the whitewater world championships. He took a lot of video, particularly of the East Germans, and most particularly, of Rudiger Helm, the many times world and Olympic champion. Endicott and Bellingham studied the videos assiduously and learned sprint technique. In short order, Helm replaced Siegbert Horn as Bellingham's idol.

Endicott philosophy was that the best way to practice canoeing or kayaking was in the boat all year round. It had worked well in slalom, so the two resolved to try it for sprint. Bellingham scrapped the weight and running workouts that others were doing, substituting more paddling workouts instead. In an upset chronicled by *The New York Times* and *The Washington Post,* Norm won a spot on the 1984 Olympic Team. A few days later, he asked Endicott to go with him to the Games as his personal coach.

Before the Olympics that summer, there was a European racing tour, which conveniently started just after Endicott finished with the slalom Europa Cup. He stayed in Europe and accompanied Bellingham throughout that summer, learning more about sprint and making sure his pupil did, too. Bellingham ultimately stroked the U.S. K-4 in the Los Angeles Olympics, but was eliminated in the repechage.

Nevertheless, he had proven his talent in sprint and hoped he would now be accepted into the U.S. sprint establishment. He began to train with the sprint team in the fall of 1984.

Once again it didn't work out. By the end of the spring, Bellingham returned, asking Endicott to coach him.

New Zealand

As luck would have it, in the winter of 1983-84, Endicott had been invited to coach the slalom national team athletes in Australia and New Zealand. However, he had also heard about the successes of New Zealand sprint athletes, particularly Alan Thompson, and made a point to stop in at Gisborne to see what he could learn about their methods. There he met Benny Hutchings, the coach, saw the athletes train and thought to himself that their approach was similar to the one he and

Bellingham had used in slalom: be in the boat all year round and paddle competitively in group workouts.

He also saw that the New Zealand sprint racers' training was based on the principles of the famous track coach, Arthur Lydiard: very long, hard, distance paddles. Endicott read some of Lydiard's books in a New Zealand library and then went to see Lydiard in person. Endicott emerged from all of this with the notion that if anyone wanted to improve fast in sprint racing, New Zealand was the best place to do it. The country was beautiful, the athletes had the right approach and a good coach and all of them were friendly people. There weren't a lot of distractions in New Zealand, and, most importantly, it was summer there when it was winter in the northern hemisphere.

After the 1984 Olympics, Endicott advised Bellingham to go to New Zealand, but Bellingham wanted to try again with training in the U.S. After the 1985 season, however, in which he qualified only as the alternate on the U.S. Team at the World Championships, Bellingham's father, who provided by far the greatest amount of financial support he received during his athletic career, gave him the money to go.

He was to spend the next three winters in New Zealand, learning from Olympic champions Ian Ferguson and Paul McDonald, their coach Ben Hutchings and others. After the winter of 1985-86, Bellingham emerged from "down under" with an Arnold Schwarzenegger haircut (and build), a slight New Zealand accent and the same old fanatical determination to win.

All or Nothing

He decided that he would race the K-1 500m event at the 1986 World Championships in Montreal or nothing at all. Thus, at the trials, he entered only one event, which meant that the only way he could make the team was to win, that is, beat Barton.

Barton had not lost a singles race to an American at 500m or 1,000m since 1984. Bellingham already had lost to him once this year, in the trials for the European tour earlier in the summer. Still, he held to his strategy and raced only the one event. It was the last one of the trials. Tension mounted as knowledgeable spectators waited to see how this desperate challenge to Barton would turn out. The training in New Zealand paid off — Bellingham won.

The next step was obtaining training money from the U.S. federation. Up to this point he had received none. He asked what he would have to do to qualify for funding. The answer: get sixth or better at Montreal. Bellingham got sixth.

The next year, 1987, he went to New Zealand again, came back in the spring and won the 500m trials again. That year at the Duisburg World Championships, he took fourth in both the K-1 500m and K-2 1,000m, which he raced with Barton.

Bellingham, who had gone from being an outsider, had had to survive a period of direct confrontation with Barton in order to become an insider. By 1987, he was fast friends with his former rival.

New Boats

Besides acquiring a new K-2 partner in Bellingham, Barton also acquired some other new "equipment," a newly-designed K-1 called the Eagle and a K-2 called the Falcon. These boats were the product of a program financed by the U.S.

Olympic Committee and were designed by Eric Haught and MIT engineer Ted Van Dusen, owner of Composite Engineering, a Massachusetts-based firm that made high-tech rowing shells and equipment.

Haught and Van Dusen studied all the components that contributed to drag on a kayak moving through water and looked for an overall reduction of those factors. In their new design no one parameter reached its optimum state, but the overall mix was better. Haught and Van Dusen realized at the project's outset that very little research had been done on the "slender body theory," the type of naval architecture that has to do with rowing shells and kayaks. What little which had been done was not supported by testing. Thus, a primary component of their work was to test actual hull designs by dragging them in tow tanks.

Their work resulted in a number of technical improvements in the boats, among which was a change in the "prismatic coefficient" of the boats, which is the relationship of the volume of the ends to the water line width. The new boats had slightly more voluminous ends and narrower mid-sections. These improvements resulted in a K-1 that Barton thought was faster over 1,000m than the previous design, the Cleaver, and a K-2 that was a similar improvement over the Regina.

> *I feel that the Eagle handles much better in rough water than the Cleaver because it tends to run a little bit smoother due to the buoyancy of the ends. Overall, the balance is about the same as the Cleaver, but it's a different kind of balance. You have initial stability and final stability. The initial stability of the Cleaver is better because it has almost a flat spot on the bottom, so when you put it in the water, it wants to stay on that spot. But the sides of the boat go up straighter, so when you lean it over, the Cleaver is very unstable, has low final stability. The Eagle is very round on the bottom, almost like a half circle. As soon as I saw it, I said 'This is designed by someone who makes rowing shells.' Since it's round, it's easy for the boat to roll from side to side. And it's narrower in the middle of the boat. But this means its sides flare out at more of an angle than the Cleaver. So when you tip the Eagle, it makes the water line wider, and gives you more stability than the Cleaver.*

1987 World Championships

At the 1987 World Championships, Barton won gold medals in the K-1 1,000m and 10,000m and was fourth with Bellingham in the K-2 1,000m. He won the 1,000m by more than three seconds with a time of 3:53.46. This is what he wrote about the race in his training log later.

> *Felt really good. Stiff head wind. Two to four feet behind Csipes and Staehle at 100 meters. Moved into lead by 250 and then did solid hard strokes in windy section and pulled way ahead. Looking around last 250 meters. Felt like I could have gone faster if challenged. 80% speed.*

In the K-2 1,000m, tired from having raced the K-1 1,000 just 90 minutes before, he and Bellingham placed fourth:

> *Very hard race. Went out hard and tried to keep the rate up all the way. Harder than usual 200-600 meters. Dying last 200 meters. Focused on finish line for last 300 meters and tried to go for it — good effort. East Germans went past us in last 100 meters. Felt like timing was off a little.*

Made us struggle and be inefficient. Cost us in the end. 80% speed.

Racing back-to-back 1,000s was a problem that would require considerable thought before the Olympics.

The next day Barton won the K-1 10,000m by 53.53 seconds, one of the largest margins in the history of the event. Here is what his log says about the race:

> *Felt tired at start of race, perhaps from yesterday's races. Missed jump on the start. No pause. Everybody went on "Ready?" (The start command was "ready?" followed by a gunshot; boaters are supposed to wait for the gunshot.] Started to feel O.K. at 4,000m and then the pace slowed. Rode wake until just before (200m) 5,000 turn. Fast people kept moving to the inside so I was at end of the pack on the outside. Moved straight up to the lead and then cut the buoys close. Szabo had to go behind me and I had him off wakes by end of the turn. Kept going and cut in front of him so he couldn't go up the side. 50% speed. Straight wind, head at start (tail at finish).*

Besides moving to California, paddling with other boaters, having a job that facilitated training, and more time with the wing paddle, Barton believes the other reason he did so well in 1987 was peaking.

"I think I peaked better in 1987 than I did in 1988," he said. "In the singles, I felt like I was moving faster at the 1987 Worlds." Does he know why?

> *I think a lot of it was just the way things occurred. Part of it was that '87 was exciting. In '88 there was more pressure; I felt in '88 I was supposed to win, and therefore may have overtrained. I thought 'I better train my butt off for this.' Looking back to '87, there's something else. At the time, I thought it was terrible, but maybe it was a blessing in disguise. In '87 I improved quite a bit between the first European tour and the Worlds. After the tour, I came back and started doing some more endurance work. Then one day I was out mountain biking and ran into a log. I fell over sideways onto a small stump. BOOOM! It went right into my ribs. I just lay there for a while. It really bothered me. For a couple of days I couldn't do anything. I think now it kept me from overtraining. I could do steady endurance, but no high intensity work. It was probably five or six weeks before I had no pain at all, then only a couple of weeks before the World Championships.*

Barton kept meticulous records for both 1987 and 1988 and the reader is invited to study summary charts of the data which are included in the Appendices of this book, beginning on page 106.

1988 Season

Barton continued his job with Fluor Daniel through the winter of 1987-88 and continued to train in California under the same circumstances he had for 1987. Appendix V is a chart showing the minutes per week he trained in 1988. The reader can see that in 1988, not only did the preparation period go on longer, but his average minutes per week was up by three percent. Furthermore, 1988 average minutes per week of water training was up six percent and athletic training was down by five percent, with reductions coming in the categories Swim, Bike, and Other. Running and Weights were virtually the same both years.

Appendix VI shows how many workouts he did in 1988. Compared to 1987, it is immediately apparent that in 1987 he had almost twice as many days off. There were other differences. In 1988, from November to March, he generally did more workouts per month than in 1987. Then, from March to June, he did fewer workouts than in 1987. But from July to the end, he did more than in 1987. Also, he seemed to do more of the work as two-a-days in 1988, and less as three-a-days.

Appendix VII shows the water training broken down by percent speed. If the reader cares to study it carefully, he will see that compared to 1987, he did a larger proportion of his water training at higher percent speeds than in 1987.

Taking all these charts together and comparing them to the ones for 1987, it appears that in 1988 Barton did more total work, the work was generally of higher intensity, and he took less days off. This corresponds with his subjective statements about the year ("I felt I had to train my butt off") and could indicate that he was overtrained for the Olympics, again as he subjectively felt he was.

1988 Olympic Games

We have seen what Barton did all the way through his canoeing career to get to this point. We know exactly the training he did in the few years before the '88 Games. What were his feelings going into the race?

> *In '88 I felt at the Olympics that I was forcing it, like I had to hold on, I had to win. But maybe if I had trained a little bit differently and was a little more relaxed, maybe I could have performed better at the Olympics. Sometimes I've had my best races like this, the pressure's off a little and I feel like I could go harder if I wanted to. Maybe you can't actually go harder, but just thinking you can makes you have a better performance. Things are more relaxed and just happening, rather than you forcing it. At the Olympics I was forcing it, but it still worked.*

Let's return to those anxious moments following the K-1 1,000m event at Seoul.

> *I remember crossing the finish line and Paul Podgorski telling me I'd won. Andy Toro came running down the bank, jumping up and down, saying, "You won, you won!" because he was watching the big video screen which showed I'd won by six inches or more. But the line on that screen was wrong; it was not the true finish line. But anyway, I thought I had it. Then, the scoreboard showed USA second. At first I thought it must be wrong, because even if I had lost, it definitely was by much less than .37 second. But then when they told me to sign papers for receiving the silver medal and I saw that Grant Davies had already signed for the gold, I started to think maybe Paul and Andy were wrong. I heard later that when the officials were looking at the photo finish, the Australians were saying, "Call it a tie, give them each a gold." They blew the photo up really big and it's kind of fuzzy. There are a couple of grains of my kayak hitting the line; there are a couple of air spaces in front of Grant's. Our officials were saying to the Australians, "No, look, we won. You guys take the silver!"*

And that's the way judges finally saw it. They reversed themselves and flashed these results on the board:

Place	Lane	Team	Time
1	8	USA	3:55.27
2	1	AUS	3:55.28
3	5	GDR	3:55.58

My first reaction was to jump up and down and yell "Yeah! Yeah! I've got it!" But I was talking to Grant at the time and I could see how disappointed he was. I reached out and shook his hand. Grant was a real good sport about it and said he was glad to be Olympic champion, even if it was only for 10 minutes!

Double Gold

Ninety minutes later, Barton began the final leg of his quest for a second gold medal and a place in Olympic history. Bellingham picks up the story:

I remember right after Greg's race I got the doubles boat and had it right near the boat dock so that as soon as Greg finished the race, he could see me, paddle over and get out of the singles and into the doubles so he could warm down properly. The singles race was over and I wanted him to start concentrating on our K-2.

Barton and Bellingham were not expected to win the doubles event. They had been fourth at the World Championships a year before and many of the top boats, including Bellingham's mentors, Paul McDonald and Ian Ferguson of New Zealand, were back again.

The Americans were fourth at the 250m mark, third at 500m and 750m, and won in 3:32.42 to New Zealand's 3:32.71. In his training log after the race, Barton wrote, "Was afraid I would die if I went too hard in first part, so paced conservative and kicked last 200 meters. Good kick and falling apart last few strokes. Left head wind. 80% effort."

Aftermath

Life for Barton and Bellingham changed remarkably after winning Olympic gold. Bellingham was able to parlay it into an advertising deal which featured a life-size billboard poster of himself, shirtless, hanging onto a kayak paddle with a "GAP" T-shirt draped over his shoulder. The poster appeared in bus stops all over America and full-page versions were included in national magazines. He studied hard and achieved admission to Harvard College.

Barton's life changed, too:

When I was doing all this training, I didn't think about what was going to happen after the Olympics. Even that day, I didn't think about what was going to happen the night after the races. I kind of felt, my life ends at the finish line, and whatever happens after that, I don't care. But as soon as I came out of doping control, I had 50 people pulling at me: "you gotta do this, you gotta do that."

Once he got back home, he got so many requests and demands on his time, he had to change jobs.

Fluor was willing to work with me, but there was a problem when an appearance would come up at the last minute and I'd have to take three days off. I could see that was causing a bit of friction. They finally said, "you need to decide what you really want to do here." I decided I wanted to go back into training and I had an offer from Ocean Kayak which was more flexible, so I took it.

Barton worked on his public speaking and eventually polished his presentation so much that he was able to land some paid speaking engagements. He learned from Olympic gymnast Peter Vidmar that right after someone wins the Olympics, he can count on a few offers. People don't really care what he says, they just want to see an Olympic champion. As time goes on, though, they want more, they want to hear an impressive speech. Vidmar was able to do this through hard work, and he told Barton about it.

Does he mind spending less time as an engineer and more time as a public speaker?

It doesn't bother me so much now because I realize there are a lot of other opportunities out there and my future may or may not be in the engineering area, although I am still working primarily in engineering. It's true that the more I am involved in doing appearances, the slower I advance in my engineering career, but I think it's all given me the confidence to realize that I'll always keep busy and that I don't think I will ever wonder what to do with my time. I feel that as long as there is a desire to keep learning and doing new things, I'll always have new opportunities opening up for me.

Looking Back

When asked whether he would change anything if he had his life to do it over, Barton gives an interesting answer:

One thing I regret is that I've missed out on a lot of fun times that I've seen my friends have. I think my social life suffered because of the time and energy I put into both my training and schoolwork. I had to go to bed early so I could get up and train while my friends were out doing fun things. Even now that I'm out of school I miss out on a lot of things because of commitments. A lot of times it hasn't been fun; working so hard with so little time to rest or relax, I often feel like I am physically ill. However, if I hadn't been as dedicated, I wouldn't have gotten to where I am. Many of my friends now haven't had the experiences of traveling the world or pushing themselves to the limit. For me, the ultimate thrill is performing at my very best in the Olympics. Overall, I'm happy because of the successes I've had, so I wouldn't change what I've done.

He recognizes that he paid a price for his success. Would he recommend that his own children do what he did?

I've been lucky to keep a career going and win two gold medals. I could very easily have put in all this time and energy and had nothing to show for it if I hadn't won the Olympics. Of course, I would still have all of my experiences and things that I've learned along the way.

I wouldn't advise my children to follow my path, but they'd have the opportunity if they wanted. I wouldn't wish all of my struggles on anyone who didn't truly want to push himself. Few people have the abilities and the dedication to reach the highest level. It takes sacrifice. If my child wanted to compete, I'd be behind him all the way. If he chose another path, that would be okay, too. The key is balance in your life and enjoying what you do.

Does this mean that the idea of winning was more important to Barton than it was to most other people and that is why he was willing to make sacrifices for it, or was the day-to-day training just a little bit more pleasurable for him than it was for the others, or both?

Both. Growing up with the sport helped. I feel I was almost brainwashed at the young, impressionable age of 9-10, when I met Marcia Smoke and saw all these other people who had been in the Olympics and won medals in the Olympics. It made a big impact on me and I thought how wonderful it would be to do that myself. And 10 years later, when I was in college, I still had all those impressions. I also had goals that were in front of me to keep me going, whereas somebody who takes the sport up at 18 already has a lot of other things established in his life. Perhaps the sport is less important to him. I think the goal has to be meaningful to you, in order to truly dedicate yourself to it. I also think you have to have some fun along the way to make up for the times when it's not enjoyable, the times when you've had only five hours' sleep and it's five in the morning and you wake up with a headache and it's cold and rainy out and you have to go out anyway and just push through. You have to get enjoyment out of being in shape, of competing at your best level of performance, and in the training itself. Some days you know you're having a great workout, your paddle is flowing through the water just right and your technique feels like it's right on, and the boat is moving fast. It's like being on top of the world.

Chapter 2

Physiological Principles

This section will acquaint the reader with the concepts and terms that have traditionally been used to describe sports training and how it relates to kayaking. A subsequent section, "How Barton Trains," explains what Barton actually does and contrasts it to the traditional view. This way, the reader will have both a theoretical understanding of the matter as well as one concrete example.

Paddling a sprint boat is a mixture of aerobic (with oxygen) and anaerobic (without oxygen) work, with the proportion of each determined by the length of the event. The aerobic aspect is the most important for the 10,000m event and the anaerobic most important for the 500m. However, having a good aerobic base is useful for creating a good anaerobic one; consequently, the largest proportion of a sprint racer's training is aerobic.

Three Energy Systems

The body produces energy from three different systems (two of which are anaerobic and one aerobic) with the preponderance at any given time being on one of the systems. The maximum potential of each of these systems in an individual is determined at birth, and the percent of that potential reached is determined by hard training. Exactly when each system comes into play is determined by a combination of the intensity, duration of the exercise, and the duration of the rest period. Furthermore, the employment of the systems is not purely sequential; they operate to some extent at the same time. For purposes of clarity, they will be treated separately here.

The three systems are: the ATP-CP system (anaerobic), in which you operate at maximum intensity for a short period (less than about 15 seconds); the lactic acid system (anaerobic), in which you operate at very high intensity for up to about 180 seconds and thus produce lactic acid; and the O_2 system (aerobic), in which you operate at less intensity and thus can do so for much longer periods.

The graph below represents the three systems and the variables of duration and intensity of exercise. To represent intensity, *assume you are going at an all-out*

sprint the entire time. This might occur, for example, if you attempted an all-out 1,000m sprint in a kayak. It should be borne in mind, of course, that a sprint race is not exactly like this, because you have to pace yourself in order to be able to produce a big kick at the end. Nonetheless, this graph gives an idea of what we are talking about:

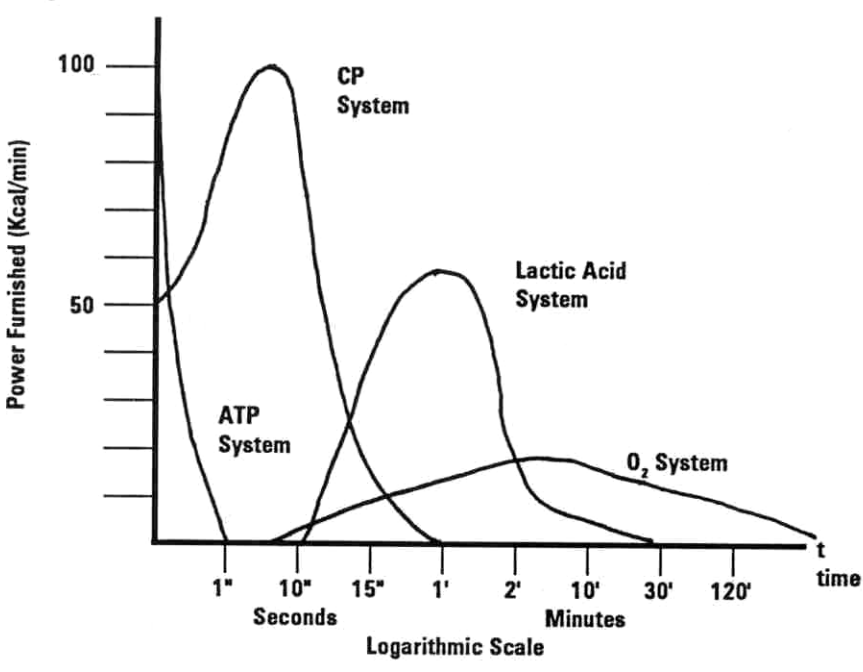


Figure 1

ATP-CP SYSTEM: This system has several names, each descriptive of some of its characteristics. It sometimes is called the anaerobic alactic system because while using it, you do not supply your oxygen needs from air taken in during exercise, so it is anaerobic. In fact, you may be holding your breath during the duration of this system (like a 50m sprint in a kayak). Yet the exercise does not go on long enough to produce perceptible amounts of lactic acid in the bloodstream (thus it is alactic). Sometimes the system simply is called the fast energy system because it is the fastest source of energy. Barton calls work on this system "speed work."

Adenosine triphosphate (ATP), is a compound necessary for muscular contraction to occur. Limited amounts of ATP are stored in the muscles and a very quick contraction, lasting a fraction of a second, uses it all. For any exercise lasting longer than this, another compound, creatine phosphate (CP), must be used. CP quickly breaks down to provide more energy, allowing a somewhat more prolonged muscular activity. However, the combined ATP-CP system is depleted after about 15 seconds. The 100-yard dash is the classic example of an event relying exclusively on the ATP-CP system. Any acceleration in a sprint boat would use it, too, such as the start or the final kick, or tactics in a 10,000m race like jumping on

a wake or going around a turn. Anything requiring short bursts of energy at maximum intensity to re-accelerate the boat relies heavily on this system.

However, there are some important points to remember about how the ATP-CP system works. Since it is quickly exhausted, its use for sharp bursts of energy is limited. After using it, the athlete would have to drop back into less intense work and allow his ATP-CP system to recover. He could not expect to complete even a 200m race relying totally on this system.

Figure 2 demonstrates that the more intense the work effort, the greater the energy per unit of time with the anaerobic systems (the ATP-CP and Lactic Acid systems).

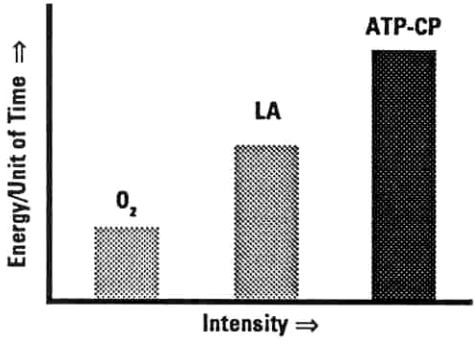


Figure 2

In an untrained person, ATP-CP is exhausted in about eight seconds. Through proper training, it can be made to last a few seconds longer. Specific training causes a larger storage of ATP-CP in the muscles. It takes about three minutes of complete rest to get a fairly complete restoration of ATP.

Proper training for maximizing the ATP-CP system would be short efforts of 15 seconds or less done at maximum intensity. For sprint training these are typically done as short sprints, or "buckets," (dragging a small bucket behind the boat) while making a maximum effort.

It doesn't take long to build up the ATP-CP system — two to three weeks at most. While ATP-CP is built up relatively quickly, it also is lost quickly through disuse. Since it doesn't take long to develop the ATP-CP system, it is usually the last of the three energy systems to be developed, with emphasis on it coming only in the few weeks before the major race. Since the other two systems take longer to develop, work on them is typically begun earlier in the yearly training. During the period of emphasis, the ATP-CP system may be worked daily, but more likely would be combined with other work (LA system) and targeted exclusively only every other day. Barton calls this "speed training".

LACTIC ACID SYSTEM: Sometimes this system is called the anaerobic lactic system because when using it, you are operating anaerobically and do it long enough to produce lactic acid. Barton calls work on this system "speed endurance" work, the term used by his coach, Paul Podgorski. Once ATP is depleted through the ATP-CP system described above, the body supplies ATP through another energy system, the Lactic Acid (LA) system. In this, the intensity of the work is very high (but not maximal) and oxygen debt is incurred while breaking down glycogen to supply ATP. However, the breaking down of glycogen in the absence of oxygen produces a waste substance called lactic acid, which inhibits muscular contraction as it accumulates in the exercising muscles. Lactic acid is the cause of the burning sensation in muscles during exercise and later muscle stiffness. Five hundred and 1,000m races make heavy demands upon the LA

system. The ability to function with a high lactic add build-up and to dissipate it quickly in rest periods following exertion also is trainable. Intense efforts of between 30-120 seconds are one method of doing this. Having a good aerobic system also helps to re-oxygenate the muscles quickly and thus gets rid of the lactic add (also called lactate).

It takes about six to eight weeks of concentrated effort to build up the LA system, thus this system is the next to last one that the athlete should concentrate on, beginning as close as 8-12 weeks before the big race. During this period, the LA system should be worked about three to four times a week. Working the LA system one to two times a week is enough for maintenance, but not improvement.

It was noted earlier that the LA system is used in breaking down glycogen in the absence of oxygen. It is worth pointing out that carbohydrates are the prime source of glycogen. During normal physical activity, glycogen is formed by, and largely stored in, the liver and, to a lesser extent, muscles, being converted into glucose and released as needed. The best source of carbohydrates are complex carbohydrates such as vegetables and fruits, pasta and breads. Sprint athletes should incorporate a lot of complex carbohydrate in their diets.

The higher the glucose levels in an athlete's body, the longer he can exercise. The initial supply of glycogen lasts about 80 minutes. After that, additional glycogen has to be stored or added. A highly-trained athlete has a large capacity to store glycogen intramuscularly. It takes up to 48 hours to replenish liver glycogen, but only a few hours to replenish muscle glycogen. Thus, in a sprint workout lasting about an hour it would not be likely that the athlete would suffer significant liver glycogen depletion, although he would suffer depletion of muscle glycogen. Therefore, he would be able to have a second workout later in the day without adverse consequences. But if the workouts were long ones, say two hours, there could well be a significant depletion of liver glycogen and the athlete would need about 48 hours to replenish his stores. This is why some athletes follow the hard day, easy day cycle in training.

O_2 SYSTEM: This is sometimes called the aerobic system, for unlike the other two systems, it is not anaerobic and in using it, you supply your oxygen needs from the outside air during exertion. Barton and Podgorski call work on this system "endurance" work. In the O_2 system, glycogen is broken down into ATP in the presence of oxygen. With oxygen present, this system does not cause the build-up of lactic acid. However, lactic acid may well have been built up in previous work bouts because the LA system may have been used first. But in this case, transferring from the LA system to the O_2 system will allow lactic acid to dissipate somewhat. Furthermore, the O_2 system can actually use lactic acid as a small source of fuel. In a process known as the Cori cycle, which takes place in the liver, lactic acid is transformed into liver glycogen.

The O_2 system takes longer than the ATP-CP or LA systems to produce energy, but it is by far the most efficient of the three once it starts. In a process known as the Krebs cycle, the O_2 system can use both carbohydrates and fats (for very long duration exercise) to produce energy.

A 10,000m race makes maximum demands upon the O_2 system. Since the race is so long, most of it has to be done aerobically. The 1,000m also places great emphasis on the O_2 system.

Having a good O_2 system also will help an athlete get through a long workout comprised largely of anaerobic segments. The sheer duration of the workout taxes his aerobic powers. Thus, his ability to do a lot of anaerobic work might be lessened because of a poor aerobic capacity. This is one reason it is thought best to begin a year-long cycle of training with emphasis on the O_2 system. A good O_2 system is necessary to support the high levels of intense training to come. This situation is depicted in Figure 3, which shows that the longer the work continues, the more total energy supplied comes from the O_2 system.

The real reason it is thought best to begin the yearly training cycle with emphasis on the O_2 system is because it takes longer to develop than the other three — at least three or four months. Top paddlers typically spend six months out of the year working on their aerobic systems. During this period, the O_2 system should be worked four to six times a week. It takes only two to three times a week to maintain it, though.

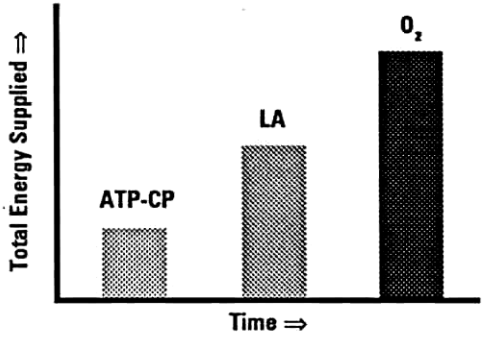


Figure 3

Traditional literature says maintenance can be done through general training, such as running, swimming, cross-country skiing, and biking, as well as boating. This procedure is followed by many top sprint boaters, including Barton. There is another school of thought, though, which says O_2 training only should be done in the boat. This school is represented by the phrase "runners don't kayak, so why should kayakers run?"

In this author's opinion, the answer as to who is right centers on whether the key link is the heart and lungs (cardio-respiratory system) or the specific muscles used in kayaking (peripheral musculature). If cardio-respiratory system development is the key, anything that works the heart and lungs is satisfactory, but if the peripheral musculature is the key, working those muscles— through paddling — would be the key. This author believes the latter is key and that is one reason why year-round paddling is best. He believes that the heart and lungs bring enough oxygen into a paddler's system, and it is the ability of the muscles used in kayaking to extract the oxygen and use it that is the crucial factor in kayaking.

There is a common belief that the O_2 system should be developed first, then the LA system and finally the ATP-CP system, as though they had to be done in that order. But there is some evidence that it is necessary to do some ATP-CP work all through the year in order to keep the stroke rate up. Thus, during the six months of basically aerobic training that Barton does, he will do some ATP-CP work twice a week as well.

Measurements of Aerobic and Anaerobic Power

VO_2 MAX. VO_2 MAX means the volume of maximum oxygen consumption. It has been determined in many sports that maximal aerobic power, i.e., O_2 system

capability, is highly important to success. The same thing is true of sprint racing. Barton, for example, has a VO_2 MAX of between 65 and 70 milliliters per kilogram of body weight per minute (Ml/Kg/Min) which is very high, an upper body-produced value that is comparable to values produced by runners with their legs.

VO_2 MAX is the largest amount of oxygen per unit of time that can be transported by the heart and lungs and used in active muscle tissue. There are two ways of looking at VO_2 MAX. It can be expressed in liters of air per minute (I/ min), in which case it is proportional to body size and muscularity: the greater the size, the greater the VO_2 MAX. (Barton's would be about 5.2 liters per minute.) Or VO_2 MAX can be related to body weight and expressed as milliliters per kilogram of body weight per minute (ml/kg/min). The latter method is normally used with sprint athletes.

Anaerobic Threshold

At a certain point, a paddler approaching his VO_2 MAX starts to lapse into an anaerobic state. The point at which this occurs is called the anaerobic threshold. It starts to occur at about 70 percent of VO_2 MAX in the average untrained individual but at a higher percentage (85 percent or more) in the well-trained person.

Figure 4 depicts the situation: One paddler, "A," reaches his anaerobic threshold at point A. He can continue to do work but from here on, it will be in an anaerobic state (and therefore less efficient). The paddler reaching his anaerobic threshold at point B can do more work than A in an aerobic state, which means that B can do the extra work more easily than A. It could be true that A may be able to function better than B anaerobically and may even be able to beat B, but he must work harder than B to do so and thus it is less likely that A will be able to beat B.

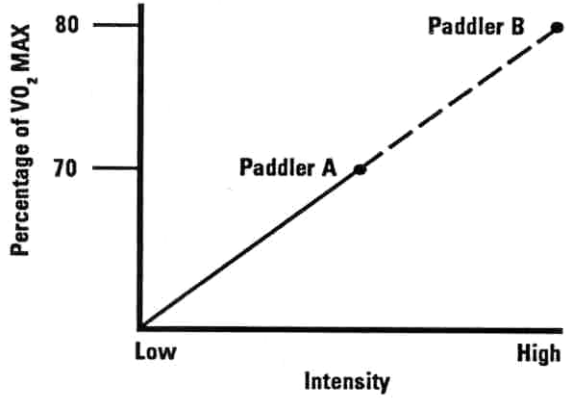


Figure 4

Once a paddler is in an anaerobic state, it is important to know how long he can stay there, and how anaerobically he can function. The current method of measuring this is to measure the amount of lactic acid, or lactate, present in the blood. It is typically reported in milligrams percent, which is simply the amount of lactate per unit of blood, expressed as a percentage.

The blood is not drawn immediately after exertion because peak levels of lactate are usually reached three to five minutes after exertion. It takes that long for the lactate to be washed out of the muscles and into the blood stream. The higher the lactate levels, the more anaerobically the paddler has functioned.

In passing, it should be pointed out that measuring the amount of lactate in the general bloodstream is really only an indirect way of inferring what went on in the muscle cells. At present, it is impossible to get into the muscle cells during exercise and thus know exactly how much lactic acid was built up. Perhaps in the future a more direct method will be developed.

The concept of anaerobic threshold is important for sprint paddlers because they do most of their races at anaerobic threshold, delving deeply into the anaerobic state only at the end. It is believed that the best way to improve anaerobic threshold — increase the amount of work an athlete can do before he lapses into an anaerobic state — is by doing a lot of training at anaerobic threshold or at levels alternating just below and just above it— "teasing" it. It is possible to precisely calculate an athlete's anaerobic threshold and thus give him a heart rate at which to train in order to best improve anaerobic threshold. Barton does not use this method, nor does he talk about the concept of anaerobic threshold at all. In all likelihood, though, his years of experience have allowed him to build an intuitive sense of where his anaerobic threshold is and he "teases" it in his training.

Types of Training

Sprint training encompasses all three energy systems, but the bulk of it is aerobic training. Sometimes the training could be a mixture of systems, particularly the aerobic and lactic systems.

At one extreme of the aerobic/anaerobic spectrum there is long, continuous paddling, which is as purely aerobic as you can get. At the other extreme there are, for example, 10- or 20-second efforts at all-out intensity, with two to three minutes of rest between them. A workout consisting of two to three minutes of work with 45 seconds of rest between efforts could be part aerobic and part anaerobic.

Intensity Scale

Before we review the different training methods, it is necessary to say a few words about intensity. In order to achieve maximum effectiveness, any kind of training must be done with the proper intensity. Traditionally, percent of maximum heart rate has been used as a guide, as shown in Figure 5.

Intensity Scale	Pct. Maximum Heart Rate
Low	30-40%
Light	50-64
Medium	65-74
High	75-84
Sub-Maximum	85-94
Maximum	95-100

Figure 5

Continuous Paddling

Continuous paddling is the core of training, being done throughout the year. There is, however, controversy over what both the optimal duration and the intensity levels should be. At one extreme is the late Dr. Ernst Van Awaken and Arthur Lydiard, the famous New Zealand track coach who coached Olympic champions in running and whose methods have been used successfully by New Zealand sprint paddlers.

Lydiard believes in "marathon conditioning runs" which are of very long duration (two hours) and of medium intensity on the scale above. Lydiard believes the intensity for this work can be too high, in which case it starts to tax the LA system rather than concentrating exclusively on the O_2 system. When this

happens, Lydiard believes, the training has become inefficient. A more direct stimulus to the O_2 system — and hence its quicker development — would occur at a lower intensity level.

Lydiard's methods have been adapted to flatwater kayaking with great success. For part of their training year the New Zealand team, which has since 1982 been winning medals in the World Championships and Olympic Games, has two days a week when they paddle 10 kilometers in the morning and 15 in the afternoon. All the other days during this time of the year they paddle 10 kilometers during one of their two workouts a day. Yet they race distances of only 500m and 1,000m.

Often overlooked in Lydiard's plan is the fact that the marathon conditioning sessions occupy only part of the training year. He also advocates whopping doses of highly anaerobic interval training later on. Essentially, Lydiard is concerned not only with giving his disciples a good endurance base for the race itself, but more importantly for a middle distance event, he is concerned with getting the athlete into shape to withstand the really hard anaerobic training that comes later. The New Zealand flatwater team does exactly the same thing. During part of their training year they undergo a large amount of anaerobic sprint training.

Continuous paddling causes the body to create a better oxygen transport system. It causes the creation of new capillary beds in the muscles used for paddling, as well as the enlargement of existing capillary beds. It also improves the efficiency of the heart, which is shown by a lower resting pulse rate. All of these things result in an increase in the time that hemoglobin-rich blood is in contact with muscle cells, thus delivering more oxygen to them and enabling them to perform longer.

Variable Intensity Training

This can be done either according to a set plan, or according to the whim of the athlete at the moment, in which case it is called "fartlek training." The goal of this type of training is to practice changing speeds, as in a race. Whenever the athlete speeds up, he is introducing an anaerobic component into his workout. He starts to go into oxygen debt and builds up lactic acid. The lactic acid level is allowed to fall during the less intensive piece that comes next. The types of variable intensity training are:

1. Climbing intensity — gradually going from a slower pace to a faster one and then holding it. The athlete typically goes through four phases:
    a. After the warm-up, he paddles at a medium intensity for 60-90 seconds (or strokes on one side, if he prefers to do it this way).
    b. He raises the pace to high intensity and does 10 seconds at that pace.
    c. He then does 10-20 seconds at submaximal intensity.
    d. Finally he does 5-10 seconds at maximal intensity, before letting the pace drop down and starting over.

The goal of the final intensity phase is more to instill a sense of paddling fast than to improve endurance. In a workout the athlete might mix five of these build-

ups in with his normal aerobic paddling.

2. Fartlek Training. There are two different types of fartlek training:
    a. Spontaneous. The paddler decides on the timing and duration of the spurts spontaneously. He varies the length of the pieces and changes the intensity according to how he feels at the moment.
    b. On set courses. The paddler has little finish lines all over the course (bridges, rocks, etc). He tries to get to each line as quickly as possible. He can vary the speeds.

Fartlek methods train the athlete to go from one intensity to another as well as to feel the proper tempo. Therefore, the pieces should not be too long — not more than 90 seconds at high intensity, 30 at submaximal and 10 at maximum. Pieces at low or middle intensity make up periods of active rest. If the work periods last more than 120 seconds, the training shifts from pure fartlek to endurance training with bits of fartlek thrown in.

Interval Training

The key to interval training is that intermittent work — bouts of exertion followed by rest — guarantees that the work will be done at sufficient intensity, which is necessary for maximum improvement of the energy system in question. This is contrasted to steady-state work in which there is no rest interval, only one long work interval, and thus the intensity level is of necessity much lower.

Intermittent work also improves heart stroke volume, the amount of blood pumped with each heart beat. Stroke volume is one of the two key factors in determining the total amount of blood pumped by the heart (the other is heart rate). The higher the stroke volume, the more blood pumped by the heart, and thus the more oxygen is transported to the exercising muscles. It is the highest not during the work interval, but in the rest period after it. With interval training, there are many recovery periods, and thus stroke volume reaches its highest level many times during the workout. This contrasts with steady-state paddling in which there is only one rest interval (at the end). Achieving maximum stroke volume many times per workout over many weeks of interval training provides a greater stimulus for improving stroke volume.

Then why not just do interval training all the time, and skip steady state endurance paddling altogether? In the first place, a year-round of interval training would be too hard and cause burn-out. Secondly, there is some evidence that while interval training will improve VO_2 MAX and anaerobic threshold the quickest, the improvements are not as long-lasting as they are if achieved through steady-state training. For these reasons, and variety, most sprint athletes use a combination of steady-state and interval training.

Five Variables

Interval training involves the interrelationship of five variables:

- Duration of work interval
- Intensity of work interval
- Duration and type of rest interval

- Number of repetitions/sets
- Number of interval workouts per week

Changing any one of these variables changes the nature of the interval training. To devise his own program of interval training, the boater and/or his coach must know how to manipulate them. A discussion of the variables and how they interrelate follows.

Duration of Work Interval

As we can see from the preceding discussion of the three energy systems, the duration of the work interval has an effect on which energy system is emphasized. To target the ATP-CP system, short bouts of intense effort are best. These would be all-out 15-second sprints, followed by 45-60 seconds of rest. This will allow the ATP-CP system to be used over and over again at maximum intensity (as long as the rest period is right — see below), which is ideal for stimulating it adequately. The short work interval prevents the onset of fatigue by preventing the build-up of lactic acid. A long rest allows ATP-CP stores to be replenished.

To emphasize the LA system, intense sprints of 40-120 seconds are best. This trains the body to operate with high levels of lactic acid (particularly with 90-120 second work intervals).

To emphasize the O_2 system, an even longer work interval of, for example, five minutes (or more), is good. Since the work goes on for some time, it is aerobic.

Intensity of Work Interval

In order to achieve maximum effectiveness in interval training, work intervals must be done with the right intensity.

To target the ATP-CP system, the work interval has to be done at maximum intensity. Paddlers typically do this as a series of sprints in the boat, but it also could be done on a paddling ergometer, which is done fairly often in slalom training.

To emphasize the LA system, work interval intensity should be "submaximal," as shown on the intensity scale above. This is typically done in the boat.

To emphasize the O_2 system, the intensity should be "high," as shown on the intensity scale above. Many people think that very low intensity work is fine for developing the O_2 system. While there may be some O_2 development at very low intensity, there is much more rapid improvement if the intensity is high.

There are several ways to ensure the proper intensity in a workout, although really good athletes can do it just by feel. The first is to buy a heart rate monitor. This is particularly useful for an inexperienced athlete doing aerobic work who has been advised through tests what the optimum heart rate range to work in is, and he shouldn't go above or below that. After a while, he can feel the proper rate and doesn't need the monitor any more. For anaerobic training, the important thing is simply to have the boaters go really hard, and the best way to do that is to have them race each other. The boaters' competitiveness stimulates them to more intense exertions. This method commonly was used by New Zealand sprint paddlers. Another way is to use the stopwatch over a set distance or a combination of this and competitive workouts.

Rest Interval

Duration of Rest Interval	Pct. ATP-CP Restored
< 10 seconds	very little
30 seconds	50%
60 seconds	15%
90 seconds	88%
120 seconds	95%
180 seconds	99%

Figure 6

In a general sense, the rest interval simply allows the body to recharge so another intense interval can be attempted. Scientifically, the length of the interval and the type of activity that goes on during it are aimed specifically at controlling the recovery of the ATP-CP system. By controlling the recovery of the ATP-CP system, one can help determine which energy system is emphasized during the workout. Figure 6 shows the percent of ATP-CP restored according to the duration of rest.

If one wishes to emphasize the ATP-CP system, long rest intervals are indicated because they allow for a complete replenishment of ATP-CP. The rest should be complete rest, no activity except stretching, easy paddling and so on.

To emphasize the LA system in the rest interval, there are two ways, one more extreme and exhausting than the other. In the first, the rest period is two or three times (or more) the work period and the recovery is complete. This might be a series of 90-second sprints with an easy paddle between work bouts ("rest-relief"). The result of this method is to dissipate lactic acid so the body is ready for another intense effort.

In the second method, however, the rest is short (say, half the work period), and involves medium intensity work. This kind of rest interval is called "work-relief." It partially blocks restoration of ATP-CP, thus meaning the next interval will be undertaken with the LA system, at ever-increasing levels of lactate. Figure 7 shows how this works:

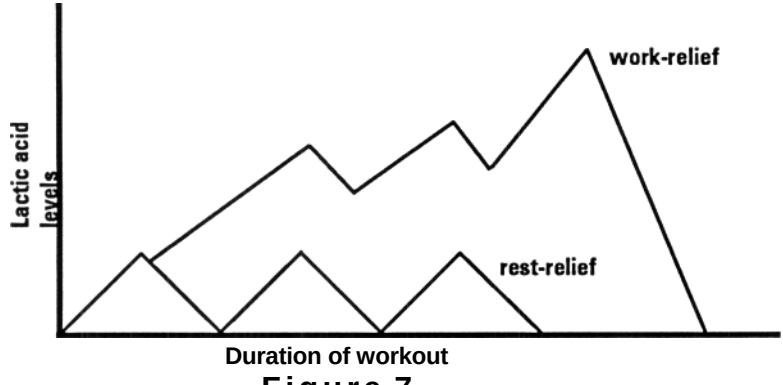


Figure 7

As can be seen above, with work-relief, each new work interval is undertaken at higher lactic acid levels, so that at the end of the workout, the level is very high and the boater has to work with higher amounts of lactic acid than he does with rest-relief.

The reader may well ask, "If the recovery is incomplete, how can the next interval be done at the highest possible intensity?" This brings us to an important concept Intensity regarding the LA system means intensity RELATIVE TO YOUR

CAPACITY at the time of exertion, not just relative to your absolute maximum. A workout of this sort, highly stressing the LA system would be: 10 X 200m at all-out intensity, with "turn-around rest," that is, turning the boat around as soon as it crosses the finish line and lining it up for another start, without ever really stopping to rest. These are very exhausting workouts and cannot be repeated every day.

To target the O_2 system, the rest interval should be short because there has been neither great depletion of ATP-CP nor great build-up of lactic acid in lower intensity work. Furthermore, the rest interval should be rest-relief, since a work-relief interval might produce lactic acid and thus make the next interval emphasize the LA system more.

Number of Repetitions/Sets

What is presented throughout this book are the levels for elite paddlers. The reader must understand that there is a great deal of difference between what the World Champion can and should attempt in training and what an intermediate should attempt. When an intermediate tries to do too much too soon he can actually get worse. With that in mind, the levels here are targets to work up to over many years of training, not levels to jump into.

Sets are groups of repetitions. The purpose of sets is to break up the total number of repetitions with a longer rest interval before starting the next set of repetitions. This added rest allows for more intensive work during work intervals.

Determining the frequency of interval workouts has to be done by each individual. So many factors enter into it that it is difficult to generalize. It depends on how experienced the paddler is, what time of year it is, how many total workouts the paddler is doing during that period, and a host of other things. In general, however, it is typical that with each successive year, the frequency will increase — as will the number of repetitions — up to a certain point when the paddler attains elite levels of conditioning and then simply maintains (or even decreases a little) that high level year after year, while perhaps improving the overall quality of what he is doing through innovative ideas and just plain experience. Basically, the developing paddler should strive to do as much as he can, but still recover from it. Checking the resting pulse rate every morning when you wake up is one way to tell. If it is five or six beats above normal, then that is a strong indicator that the paddler has not fully recovered and that he should not do a hard workout until the pulse comes down. Otherwise, he will start an overtraining syndrome.

Repeats

Repeats are done over the race distance and there is complete recovery between each bout of work. Thus, each work period is at very high intensity, that is, there is a larger anaerobic component to it. Repeats develop explosiveness and speed endurance. An example would be 10 x 1,000m with five minutes of rest.

Time Trials

Time trials should be held on a standardized course (one not affected by changing water levels, wind, etc.). Furthermore, the length of the time trial course

should be the same as the race course for which the paddler is preparing. It is not specific enough to do time trials on a 1,000m course when the actual race will be 500m, for example.

Doing time trials at regular intervals lets the athlete check progress during the year. Once the race season starts, he can even view some races as time trials.

Progressive Overload

Gradually increasing the number and intensity of intervals is the aim of training. This can be done by 1) doing each work bout at a faster pace; 2) cutting down on the rest period; 3) doing more work intervals in the workout; or 4) a combination of the three. One way to decide when to increase the intensity is to check the post-exercise heart rate. The rate is taken 90 seconds after the last interval of the workout. A lower heart rate following several identical workouts means that it is time to increase the intensity.

Discussion

It is important to understand the interrelationship between the five variables which make up interval training. By not ensuring proper intensity or proper rest, the wrong energy system might be emphasized. For example, if the aim is to emphasize the ATP-CP system, 15-second work bouts at maximum intensity followed by two to three minutes rest are best. This will allow the system to be used over and over again at maximum intensity. If, on the other hand, one were to do 15-second all-out sprints with only 20-30 seconds rest, the work would become more lactic because there would be ever-increasing amounts of lactic acid in the muscles.

To target the LA system, one good way would be through submaximal intensity 30 to 90 second sprints, followed by two to five minutes of rest. But if the intensity level is too low, there is no development of the LA system, while there might be some development of the O_2 system.

To emphasize the O_2 system, one good way might be eight-minute intervals of high intensity with two minutes of rest. But if the intervals were shorter, for example three-four minutes and of submaximal intensity, the work would be more anaerobic, although the work intervals would be too long for it to be completely anaerobic.

There also can be problems in misusing the number of repetitions or interval workout frequency. If the intensity is increased too quickly, an overtraining effect might occur and the paddler is forced to take a lot of time off in order to recover.

Thus, while it is easy to make mistakes in arranging all the variables in interval training and wind up emphasizing a system you did not intend to, it also is possible to do combination workouts in which two or more systems are worked in the same workout, indeed the same interval, such as a basically aerobic workout with some short accelerations (ATP-CP development), or longer sprints (LA development) thrown in.

Muscle

Paddling a kayak involves the use of endurance (slow-twitch) and power (fast-twitch) muscle fiber. Paddlers should be sure to develop both in their training.

Some individuals, because they are born with a higher proportion of one kind than another, tend unwittingly to stress that kind in their training and neglect the development of the other. In this case, they may have a deficiency for the type of event they wish to specialize in.

Slow Twitch — Fast Twitch

It is muscle development combined with cardiovascular conditioning that permits the intensity and volume of training necessary to maximize the body's responses to training. If muscles are not sufficiently developed, the athlete cannot sustain a high enough workload to stimulate the energy systems adequately.

There are two main types of skeletal muscle fiber: an endurance type, called "slow-twitch" and a speed and power type, called "fast-twitch." There are actually two sub-types of fast-twitch fiber as well; fast-twitch A, a slow-fatiguing fast-twitch fiber; and fast-twitch B, a fast-fatiguing fast-twitch fiber.

Slow-twitch muscle fiber requires a steady supply of oxygen, storing it for the onset of work but quickly requiring its replenishment from outside air. These fibers are very resistant to fatigue, having access to the oxygen supply through a highly developed network of capillaries.

While slow-twitch fibers are suited for endurance tasks, fast-twitch fibers may be called upon instantly for speed and power without having to wait several minutes for the oxygen supply to be replenished from the outside air. Weight training and high intensity training increases the size of these fibers and their ability to break down glycogen and use it to do work. The more fast-twitch fibers an athlete has, the faster he may fatigue, being able to work at top speed for only a very short time.

At birth, each individual is endowed with a certain proportion of each fiber, thus giving some people greater potential to become power athletes, such as sprinters, and other people greater potential to become endurance athletes, such as marathoners. From all the evidence, Barton in all probability has an unusually high percentage of slow-twitch muscle fiber, which means that he is predisposed to success in the longer events.

There are two factors that complicate the discussion of fast-twitch and slow-twitch fibers:

- It is hard to determine accurately what proportion of each an individual has. In the first place, different muscles within the same person have different proportions. Thus, if we are talking about the application to paddling, testing the leg muscles is not going to help. Secondly, different areas within the same muscles have different proportions and thus several samples have to be taken from the same muscle in order to get an accurate reading. Since this involves taking a little "bite" (muscle biopsy) out of the muscle several times, most athletes, understandably, are reluctant to permit it.

- While an individual may be born with a certain proportion of fast-twitch fibers, training can "bend" the fibers somewhat, making fast-twitch fibers function more like endurance fibers. Long duration paddles at high intensity can do this.

A sprint race consists of both endurance and power components. Endurance is simply the ability to get down the course without becoming so tired that you slow down. Power comes into play in things like accelerating the boat at crucial points, such as the start or final kick.

Continuous long distance paddles improve the function of slow-twitch fibers and improve endurance. Many paddlers use running or other endurance training (such as biking or swimming) to improve their endurance for paddling. While this certainly improves general endurance, it is not specific enough for maximum improvement in paddling the sprint boat, simply because different muscles are used in paddling the boat than in running or swimming.

Furthermore, if all the paddling is done at slow speeds, muscular power typically diminishes over time. This is because the slow paddling does not activate the fast-twitch fibers and the fibers lose some of their capacity for speed through disuse. Power training will prevent this.

When most people hear the term "power training," they think of weight training, since this traditionally has been the method for developing power in sprint racing. It should be borne in mind, however, that weightlifting, if it is done improperly, may not simulate the actual motion of the joints and limbs as used in paddling, and strength developed in one particular joint motion will not necessarily transfer to other joint motions. Also, heavy lifting seems to develop a non-explosive power.

In constructing a weightlifting routine for sprint racing, the following points should be kept in mind:

- Make the lifts as specific to paddling movements as possible.
- Select a moderate weight which allows you to move as fast as, or faster than, you would in competition.
- Before each repetition, the muscle to be strengthened should not be stretched to increase the amount of force produced and developed. If a muscle is stretched, it contracts with greater force. Stretch receptors in the muscles and tendons produce what is called the "stretch reflex." But since the use of the stretch reflex does not promote pure strength work — it supplies "free" work —it is a form of cheating and should be avoided.
- Try to vary the grip or plane of movement in the weight exercise to ensure that all parts of the muscle get developed.
- Begin with adequate warm-ups to minimize injury risk.

Paddle Relaxed

The ability to relax while paddling is the sign of a top boater. If muscle coordination is high, the boater finds it easier to relax during paddling, further lowering his energy cost. Here are two points to think about in training and racing:

- Reduce tension in all muscles not directly involved in moving the arms, back and trunk. For example, head movements and shoulder hunching, facial grimaces and so on, should be eliminated.
- Practice paddling at a given pace with as little energy as possible.

Muscle Elasticity

It is the timing of muscle forces which distinguishes the good paddler from the excellent one. Precise timing of back, torso twist, arm and hand movements allows the paddler to make use of the elasticity inherent in muscle tissue. Because a stretched muscle automatically rebounds to its resting length, it has the capacity to do "free" work and so increases the force, power, and efficiency of your movements. Some experts think this elasticity can account for half the total energy used to do work.

Repetitive work, like paddling forward, is performed at a cadence that the individual feels is the most comfortable or efficient. He chooses the cadence probably because of muscle elasticity. If he moves too slowly, certain muscles must contract isometrically to prevent this elastic force from acting. As a result, a slow paddle may become more fatiguing to him than a faster one, even though the total work is reduced. Effective use of muscle elasticity requires that he moves at some minimum speed.

Warm-Up/Warm-Down

Adequate warm-up before paddling reduces the resistance of muscle and connective tissue to joint movements since cellular tissues become more pliable with increased temperature. Warming up also prepares muscles for work by supplying them more blood and oxygen. Warmth accelerates the speed of the chemical reactions responsible for liberating energy from within the muscle.

Without a warm-up, muscles are shocked into sudden, vigorous exertion without an adequate oxygen supply, forcing the muscle to furnish much of the energy anaerobically for the first one or two minutes. An oxygen debt is created along with the production of a small but perceptible amount of lactic acid. This oxygen debt will be repaid in the ensuing minutes of exercise and result in the oxidization of the lactic acid. This process requires more energy than if a smaller oxygen debt was formed during the warm-up. Thus, warm-up enhances performance and decreases injury potential, an important point for the older athlete whose connective tissue and joint structure is no longer supple.

Adequate warm-down is equally important because it helps to dissipate lactic acid built up in the exercising muscle and bloodstream during a training session. Thus, it accelerates recuperation before the next session. Warm-down also stretches the muscles that have been used. Paddling is a repetitive activity which may cause stiffness in joints and muscle tightness. For this reason, particularly after a long session, there should be some light paddling and stretching to restore flexibility to the paddling muscles, including the latissimus, trapezius, deltoids, pectorals, biceps, triceps, forearms, and hamstrings.

A warm shower facilitates this warm-down and stretching, but sometimes it is difficult for paddlers coming off the water to get to a shower quickly. In this case, changing into warm, dry clothes is a reasonable substitute.

Chapter 3

Periodizing the Year

For many years, experienced international athletes in most sports have recognized the necessity of stressing different objectives during the year, and different objectives in off-years than in World Championship or Olympic years. Their aim simply is to reach a peak at a very specific time. In planning their training over a long period, these athletes (or their coaches) know the following principles:

- The body adapts best to fewer stresses at a time than to many. For example, one can aim to develop the aerobic system (high physiological stress) at the same time as technique (low physiological stress), but not the aerobic system and the lactic acid system (high physiological stress).
- The net adaptation is greater if you work successively on one energy system, then maintain it while concentrating on another.
- Work first and longest on those aspects of your sport which demand more time to develop. For example, it takes longer to build up endurance (3-4 months) and technique than it does speed (6-8 weeks).

Training Unit

A training unit is a single session devoted to achieving a particular objective, such as increasing speed, improving certain techniques, or race pacing, for example. A day's training might consist of several different units; however, each is designed to work on a particular weakness or reinforce a particular strength.

Microcycle

A microcycle is a group of training units combined in such a way as to achieve a total objective. For example, if increased speed is the desired goal, two weeks' worth of training units oriented towards speed development might be in order.

The units comprising the microcycle could consist of things like short sprints. Microcycles can be repeated many times during a season.

Microcycles permit the paddler to concentrate on one particular objective, which inevitably means that he will be more efficient in pursuing it. Microcycles also help avoid boredom during periods of intense training. If microcycles are not used, there is a tendency to rely too much on one standard workout or variations of it, with the result that performance levels plateau and stagnate.

In creating microcycles, the following factors must be weighed:

- The athlete should not be subjected to many extremely hard workouts, back to back, since he will have great difficulty recovering from them.
- Each training unit should pursue a specific objective and should vary from day to day so that the workouts are not dull.
- The interval between two similar training units should be long enough for the paddler to recover.
- Recovery will be accelerated if units of active recovery are interspersed between other units of training. For example, in a training session, if the athlete is switching from an endurance unit to a speed one, several minutes of easy paddling might be indicated before starting the next unit.
- However, if training units with very different purposes follow each other, active recovery units may not be necessary. For example, if a paddler is switching from a speed unit to a technique one, a separate recovery period might not be necessary.
- Workouts which stress maximum strength should be scheduled for days when the athlete is at full capacity, and not following extremely hard days, especially if the LA system is involved. A similar rule applies to workouts held in one day.
- Generally more than 24 hours of recovery are necessary from very hard workouts. Thus, one might have an extremely hard workout in the morning of one day and another hard one in the late afternoon of the next.
- The best improvement in performance comes when new stimulus to the paddler comes at the highest point in his overcompensation phase. After a paddler goes through a workout, his capacity is reduced for a while until he recovers from the stress. He then reaches a capacity slightly above the original one. The process is called overcompensation. But reversability sets in after a certain point, as Figure 8 shows. The trick of training is to have the next workout come at the highest point in the overcompensation phase. In this way the boater will enjoy the steepest improvement curve. Conversely, if insufficient recovery is allowed, the boater will actually get worse — known as "overtraining." There are various scientific methods for determining just when the next workout should be done, but they are

too impractical for the average boater to use. He has to rely on resting pulse rate and subjective feelings instead.

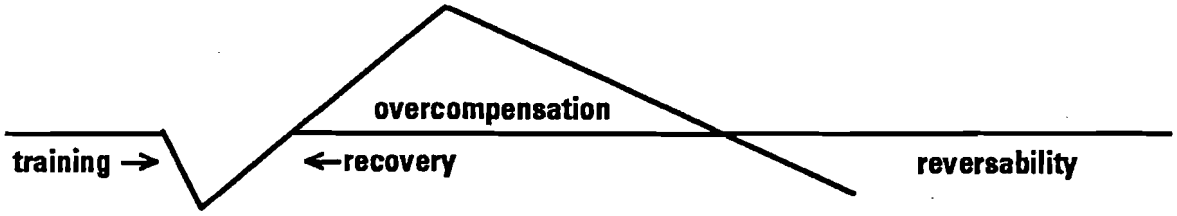


Figure 8

Macrocycle

A macrocycle is the sum of units and microcycles necessary to achieve a certain purpose in training. For example, a boater may engage in a six-month macrocycle designed to improve his aerobic system. The macrocycle may be broken down into microcycles as follows: the first, in which the boater does distance paddles with medium intensity; another, in which he adds fartlek training to increase the intensity; and a third, in which he uses interval training to make the work even more intense.

A macrocycle also is determined by a change in intensity or volume of training. For example, switching from indoor work to outdoor work would mark a change in macrocycles. In very rough terms, macrocycles often last on the order of four to ten weeks.

Chapter 4

Training Principles

However the paddler constructs his yearly plan, the following general principles should be taken into account:

- A high volume of training without sufficient intensity fails to produce improvement, just as the converse is true.
- The closer the duration and intensity of a workout approach an optimum level relative to the paddler's capacity at the time of the workout, the faster his/her improvement will be.
- If the workout is too hard, or doesn't stress the right item, the paddler's improvement will be retarded and maybe even reversed.
- The relationship between work and rest is crucial. They always should be treated together. Furthermore, they are unique to each individual and thus the proper personal formula must be found.
- While overcompensation quickly results in improvements in performance among younger athletes, the process takes much longer for more experienced ones. For the highly experienced athlete, each optimum workout will cause a slight overcompensation, but it is only after the cumulative effect of a lot of this training that large improvements come. Furthermore, the improvements do not always come at predictable intervals. There typically will be plateaus of performance followed by a sudden, noticeable improvement.
- The amount and intensity of work must be constantly increased if performance improvement is sought. Without that increase, the athlete will simply maintain at a certain level.
- The rate at which an athlete regresses following the cessation or reduction in training depends on how recent his adaptation to the high workload is. The more recent, the quicker will be his reversability.

Thus, one can see the necessity for long periods of training as opposed to "crash" programs.

Training Log

I am acutely aware that many world champions do not keep training logs. They know intuitively how they need to train and they do not need detailed records to help them. Furthermore, they simply may not have the time to fill out the log every day.

Nevertheless, I believe that keeping a good, thoughtful log is a particularly useful device for forcing the athlete or coach to think about his training. Thinking about ways to make training better, to improve areas of weakness, and fortify areas of strength is key to success in any sport.

I also believe that there are two other psychological benefits in keeping a detailed training log. The first is it gives a sense of professionalism to your work. If you are willing to write it down and force yourself to think about it, you inevitably become more serious about what you are doing. Secondly, the training log is a priceless treasure of all the work, planning, and evaluation that have gone into your training. In our sport, the greatest reward is self-satisfaction. One way of achieving that is reviewing a log from a successful year. When you read through it, you often find events were somewhat different than you remembered them. Sometimes you find that you had forgotten important conclusions you came to a year or two ago. Having in your hands the true record of the way things were gives you a tangible way of dealing with the welter of memories, thoughts, schemes, and hard work you have put in over the years.

Barton is like many top paddlers who believe that keeping a good, thoughtful log is a useful device for forcing them to think about their training.

Here is how he began keeping a log:

I think I started in 1976 or 1977 keeping an occasional training log. Part of the reason was just to remember what workouts I had done. I remember I would make up a workout that was really good, but I would forget the details a month later when I wanted to do it again. But I wasn't very religious about it. Then, in 1980, I started doing more, but it wasn't until the fall of 1983 that I wrote a really detailed log.

Purpose of the Log

The essential purpose of the training log is to help establish more quickly the precise formula which creates the best performances when they are needed. By having a historical record of training, patterns can be detected over time which can actually determine the formula. A champion who keeps no log has learned these things through years of trial and error. He may well have made the same mistake many times before finally learning the correct way. A log will allow the younger, less experienced paddler to gain the same knowledge in less time.

What Goes into the Log

The following are items that usually go in most logs. Barton records only some of them.

The Barton Mold

I. Personal Data

• **Hours of sleep.** The object is to spot the pattern which produces the best performances. It is possible to get too much sleep as well as too little sleep. Seven to eight hours is the norm for most athletes. You may find that you need X hours of sleep over Y days before you can have an optimum performance in a big race. Quality of sleep is important, too. A useful method for keeping track of this is to use a scale from one to 10, with one being very poor quality sleep and 10 being very high quality.

• **Body weight.** It is not necessary to track body weight every day, but it should be done on a fairly regular basis (a couple of times a week) and particularly before and after important sessions or races. A loss of body weight in a highly trained athlete may leave him physically below par on the big day. In this author's experience, weight loss is a common occurrence when traveling and food is not good or is too expensive. The athlete tends to not eat well. Noting a slight drop in weight may make it possible to nip the problem in the bud. By the same token, it also is possible that a paddler may find that his optimum performances occur when he weighs somewhat less than what he considers "comfortable."

• **Rested pulse.** This should be taken at the same time each day, probably when you wake up in the morning. If it is higher than normal, it may mean recovery from the previous workout is not complete, calling for an easier workout for the coming day. An elevated pulse rate also might a symptom of an impending cold or that something is bothering you emotionally. The remedy is the same, however: more rest.

II. WORKOUT DESCRIPTION

• **Plan Ahead.** Some of the best logs plan ahead what type of work needs to be done, then list the work that actually was done so it is easy to see how close the athlete came to meeting his original goals. Looking ahead helps ensure that the training will have a specific purpose and each session will be integrated into a well-thought-out program.

• **Workout Description.** First, record the date and time of the workout, then state the purpose of the session. Again, the object is to cut down on aimless playing by setting a definite target for each session. Then write down what was actually done. Finally, leave room for an evaluation. Some examples from Barton's log:

Saturday, January 17, 8.5 hours sleep
8 a.m. K-1 83 minutes. 14 km steady cruise then 1x2000 steady pace. Try not to bend right arm too much or drop left arm on push. Keep right wrist straight and open hand. 20% speed.

Wednesday, March 4, 7.75 hours sleep
6:45 a.m. K-1 63 minutes. 12 km cruise steady technique. Use the legs to twist low for good rotation — hip muscles getting tired — need to stretch hips. 20% speed.

Tuesday, May 5, 7.5 hours sleep
5:15 p.m. K-1 56 minutes. 9 km 2 sets 3x60 seconds on, 60 seconds off, rest 9 minutes. With other paddlers I can really gain on them if I put the paddle in and pull hard on each stroke — not sprinting, but make each stroke count. 80% speed.

Tuesday, August 23, 7.75 hours sleep
7 a.m. K-1 82 minutes. 12 km 10x100m, 4x250m, 1x500m. All rolling starts. Very calm. Dying on first 250m piece so tried to pace other 250's and 500m more evenly. Rates: 120's — 130's on 100's, 120 — 110 250's, 115 — 105 500, good solid strokes. Putting paddle in solidly and pulling hard on it on 100's — works better than revving it. Using rotation and technique on 250's and 500 because too tired to go nuts — good. Better speed than I thought I had at this time. Just keep working hard and concentrating on it. 90% speed.

III. Summaries
• Short summaries at the end of each regular period of work, say each week, make it easier to review what has been done. A Barton example:

Total for the week

K-1: 66 km		6.4 hrs.
K-2: 33 km		3.1 hrs.
Paddling:	99 km	9.5 hrs.
Run:	3.2 mi	.5 hrs.
Weights:	3 times	2.2 hrs.
Total Training Time:		12.2 hrs.

• A running summary of the year's work to date also is useful:

1988 Totals Through August

K-1:	2824 km	282.7 hrs.
K-2:	243 km	23.3 hrs.
K-4:	67 km	6.0 hrs.
Paddling:	3134 km	312.0 hrs.
Run:	163 mi	24.3 hrs.
Weights:	80 times	80.9 hrs.
Bicycle:	167 mi	9.4 hrs.
Mt. Bike:	7 mi	1.2 hrs.
Swim:	3300 m	1.6 hrs.
Hike:	12.6 mi	3.9 hrs.

Total Training Time: 433.3 hrs.

IV. Evaluation

• When you write up an important workout, always ask yourself the question "What did you learn from this workout?" Simply trying to answer that question in writing forces you to think carefully about what has happened.

V. Visual Appearance of the Log

• Remember, the log is not much use to you if you don't read it. Therefore, the information should be presented in an attractive way that invites and facilitates your browsing through it. In this author's experience, the most effective mode of presentation is simply to use 8.5 x 11 inch lined paper, with one sheet for each day, if possible.

Sometimes log books are issued to athletes by a sports federation or some other central committee, but they are usually not as good as simply using lined paper. For one thing, these kinds of log books usually are too cluttered; lots of little boxes all over the place that you are supposed to fill in. Most of the boxes don't even relate to paddling, but to some other sport, such as running. Secondly, such log books usually do not leave enough space for a narrative text. The detailed, subjective commentary is probably the most important thing about a log and whatever format you choose, it should facilitate the writing and reading of the commentary.

Chapter 5

How Barton Trains

This section describes how Greg Barton actually trains. It is quickly evident that, in many ways, Barton follows the principles outlined above, but does not in other ways. In some cases, he unknowingly uses traditional approaches, arriving at these through trial and error and creating his own names for them. The reader will have to decide whether Barton unfamiliar with the traditional concepts was a disadvantage, or whether he was better off working out his own solutions since they more accurately solved the problems posed by kayak training and racing.

Percent Speed: Barton's Intensity Scale

In the author's experience, reviewing total minutes of training or the number of sessions an athlete does gives a rough idea of his training (the best paddlers usually have relatively high volumes), but it does not tell the quality of the sessions. Without knowing that, it is difficult to precisely evaluate the training.

We have seen in the General Principles section how percent of maximum heart rate is used in sports training to describe the intensity of exercise. Barton did not use this system, inventing his own instead. It is important to understand his system it to understand the rest of Barton's boat training.

Most athletes' logs do not attempt to record a factor for quality, but Barton worked out a method. Here is an example, his log entry dated June 10, 1987:

> 9:30 am K-1 56 min. 10 km
> 3 x 1,000/5 min. P=30 (Pulse=180)
> headwind on odd #'s
>
> times: 3:56; 3:51; 4:01
> Feeling the work — hard going through it, keep rotating
> 70% speed

By adding up the three pieces, one can see that Barton did about 12 minutes at 70 percent speed. He says that the rest of the workout — warm-up, warm-down,

easy paddling between pieces — is all done at about 10 percent speed. Therefore, in this session he did 12 minutes at 70 percent speed and 44 minutes at 10 percent speed. But what does 10 percent or 70 percent mean, exactly?

> *I started this in the fall of 1983. After I got back from the Worlds, I was disappointed because I had stagnated that year. I needed to think of ways I could improve. In '82 and '83 I had a training log but it wasn't very detailed. And I decided I needed to work more on speed; perhaps I needed to pay more attention to what I was doing in workouts. If I was going to work once or twice on pure speed, how was I going to define it? So I came up with these percentages and decided that at least twice a week I would train at 90 percent speed or higher.*

How did he calculate percent speed? In a nutshell, 100 percent was an all-out speed, which could be sustained for about 10-30 seconds; 80 percent was race pace for 500m or 1,000m.

> *0 percent would be I was in the boat, but not working at all. There are very few of those in my training log. SAMPLE WORKOUT: I've got an inexperienced friend in a slalom boat and I'm just along side keeping up with him.*
>
> *10 percent would be a workout where I was paddling steadily, but not paddling hard. SAMPLE WORKOUT: Cruise easy, 55'. Coughing a lot — not feeling healthy.*
>
> *20 percent I consider a steady paddle where I am exerting myself, where I'm working hard. SAMPLE WORKOUT: around harbor good pace. 69'.*
>
> *30 percent In order to bump it up to 30 percent, I'd have to do some sort of varying of the tempo, where I'm increasing the speed, which could be fartlek a little bit, or really long intervals — 10 or 20 minute pieces. Also, maybe a distance race. Pulse rate would be between 140 and 150; stroke rate between 75 and 80. SAMPLE WORKOUT: 3 x Lido lap in 16' each (48 total).*
>
> *40 percent is just moving up, doing pieces that are a bit shorter — 5-8 minutes. Pulse rate between 145 and 155; stroke rate: 75-82. 45 percent is pulse of 160 and a stroke rate of 82-87. SAMPLE WORKOUTS: warm-up with few sprints then 4 x 8', with 2' rest; 4 x 2000 meters with 2-3' rest.*
>
> *50 percent is a little shorter, such as 3-4 minutes. Or maybe 5-6 minute pieces. It's a bit of a gray area. With a longer interval, sometimes if I really exerted myself, I'll call it 50 percent. Or if I do shorter intervals, but I didn't go all-out on them, or as hard as I could have, I'll call it 50 percent. Pulse rate of 165-175; stroke rate of 82-92. SAMPLE SPEED: 1,000 meters in 3:52 (light tail wind); SAMPLE WORKOUT: 5 x 4' with 2' rest.*
>
> *60 percent is maybe 2-3 minutes. Pulse rate of 170-180; stroke rate of 92-96. 65 percent is pulse of 175-185 and a stroke rate of 92-100. SAMPLE SPEED: 500 meters in 1:52-3; 1,000 meters in 3:52. SAMPLE WORKOUT: 6 x 1,000 meters, every 6'.*

70 percent is maybe one-minute repeats with maybe 30 seconds rest, that are somewhere just below race pace. Pulse is about 180, stroke rate 96. SAMPLE SPEED: 1,000 meters in 3:43-6 (light head wind). SAMPLE WORKOUT: 10 x 30", with 10" rest, rest 4', then 10 x 70" with 20" rest, then 5 x 20" with 70" rest.

80 percent is about race pace for 1,000 meters. Stroke rate is 100-105 per minute. SAMPLE SPEED: 1,000 meters in 3:39 (slight tail wind). SAMPLE WORKOUT: 8 x 30", with 30" rest, rest 5', then 8 x 45", with 45" rest.

90 percent is something like 250-meter pieces with full rest in between them. Or perhaps shorter repeats with a short rest, such as 15 seconds on/ 15 seconds off. Pulse is 180-196; stroke rate about 105-115. 95 percent is a pulse of 180 and a stroke rate of 110-120. SAMPLE SPEED: 100 meters in 18.6- 19.1" (rolling start), with short rest. SAMPLE WORKOUT: 5 x 60", with 5' rest.

100 percent is absolutely no pacing whatsoever. I'm just giving everything I've got; full rest; generally 200 meters or shorter. Pulse rate of 180 and a stroke rate of 114-130. SAMPLE SPEED: 100 meters in 17.9 - 19.1" (rolling start); 100 meters in 20.3-20.5" (standing start). SAMPLE WORKOUTS: 4 x 15", with 90" rest, 2 x 60", with 5 minutes rest, 4 x 15" with 90" rest; 10 x 20" with 100" rest.

My pulse reaches maximum (180+) at 65-70 percent speed and does not increase much at higher speeds. Speed goes up after the 70 percent mark but duration of work interval decreases and duration of rest interval increases, so heart rate does not increase.

I normally think in 10 percent increments, but sometimes if I worked a little bit harder or a little bit easier, I'd bump it up or down by five percent.

Is this all done on feel? Are there any objective measurements involved?

It's been just feel. I have not used any external measurements to judge my percent speed. It's not always proportional to boat speed. There's a little compensation for effort. For example, if I'm doing two pieces at the same boat speed, but one is longer than the other, I'd call the longer one a higher percent speed because it is more taxing on my body. I wish I had a more cut and dried method, but this is the best that I've ever heard of. I'm still not satisfied with it, though. One of the reasons I came up with this system was because I always got frustrated with traditional percentages. A program would say do 5 x 2 minutes at 70 percent. And I'd say 70 percent of what? Is it 70 percent of the maximum intensity for that piece? 70 percent of an all-out 15-second maximum? Is it boat speed? Heart rate? Nobody could ever answer. So I made up my own system. I still feel that my system could be improved.

Use of Percent Speed

How did Barton use this system of percent speed in his training? Simply put, not for planning ahead, but just for recording what he had done.

"I'd decide to do a workout just for speed, or for steady endurance work, or whatever, and then after I did the workout, I'd decide at what percent speed it was

and write that down," Barton said.

His personalized method of gauging each workout has several advantages and disadvantages, compared to the more traditional method of using percent of maximum heart rate:

- Percent speed makes an attempt to evaluate how fast the boat is moving and not just how hard the athlete is trying, although the two are often closely related. Being precisely familiar with boat speeds strikes this author as a type of biofeedback that would be very useful to a kayaker: having his own independent judgment of how fast he was moving would help in pacing, in much the same way a runner's intuitive sense of lap times would.
- It is a physiological fact that percent of maximum heart rate works well as long as the work is aerobic, but not so well when it is anaerobic. For various reasons, there is a linear relationship between increases in heart rate and increases in speed at lower levels of intensity, but not at higher levels of intensity. At these higher levels, heart rate does not go up as fast as speed does. In other words, one could not predict the differences in higher speeds as easily simply by looking at heart rate. Barton seems to have discovered this phenomenon when he saw that once he reached a pulse rate of about 180 (at 70 percent speed) his heart rate could not go up much more even though the boat could move faster.
- Barton's method has a lot of subjectivity to it, which creates a problem transferring it to someone else.
- The mere fact that Barton went to so much trouble to create a system that worked for him is impressive because it attests to his analytical abilities and his deep understanding of the sport and his training.

Barton Alternatives to the Energy Systems

Barton never had heard of the terms "aerobic system," "lactic acid system," or "ATP-CP system" until 1984 and, through 1987, did not think in these terms at all. It is interesting to note that he essentially had retained the traditional concepts and simply adopted the names used by his coaches. His terms were "speed" (90-100 percent speed on the Barton scale), which correlates to ATP-CP; "speed endurance" (50-80 percent speed), which correlates to lactic acid system, and "endurance" (50 percent speed or less), which is aerobic.

Barton's Training Year

With this background, let us examine Barton's training year. The following description is based on peaking for a big race in mid-August (like the 1987 World Championships). If the big event were later than that (like the 1988 Olympics), the first phase of the training, the endurance phase, would simply go on longer. The other phases would stay about the same length.

SEPTEMBER THROUGH MID-MARCH (26 Weeks): ENDURANCE. According to Barton, "The fall is a good time to experiment. If you're going to make

a change, such as switching paddle types or maybe changing your seat, the fall is a good time to try that."

In addition to experimentation, the two main things Barton tries to accomplish in this period are general overall conditioning, which he calls endurance training and others call aerobic training, and building strength, through weight lifting. This is a fairly traditional approach.

> *Going into the race season, you obviously want to be as strong as possible and have a good endurance base. As you get into more specific race-type training, you won't have as much time to devote to these two things, but hopefully, what you build up in the winter will carry you through.*

What is not traditional is the fact that Barton also does speed work twice a week during this period. The traditional approach would be to confine the speed training to the spring and summer. "I also wanted to keep in contact with speed," he said. "I think speed — starts, overall sprint speed — is one of my weaknesses."

Thus, during the September to mid-March period, Barton's weekly schedule would look like this:

- Three weight workouts.
- Two speed workouts. One was pure speed, and one was with resistance. Both were done at 90-100 percent speed.
- Three endurance paddles at 30-50 percent speed.
- Two other endurance workouts, such as running, swimming, or biking.

Examination of the Categories

WEIGHTS. Barton lifts weights year-round, although as the year goes on, he does less and less. The workouts get shorter and he drops to two or even one weight workout a week, stopping altogether two weeks before a major competition. He has some interesting theories about weight training; essentially, he is less concerned about how much he lifts than about observing strict technique during the lifts and varying the types of lifts about once a month.

Barton believes weight training gives you raw strength and bulk that is not developed as much on the water because paddling a kayak is not as intensive a movement or as specific to any individual muscle as lifting weights; paddling is more endurance-oriented. A typical paddling workout includes several thousand strokes involving a variety of muscles, while weight lifting allows you to isolate one muscle or muscle group and put more stress on it. Barton explains his concern about using proper technique:

> *I don't record how much I am lifting very often. I check it once a month or so, but not like most people who are very concerned about it. I'm not trying to become a weight lifter. My goal is to increase strength that I can apply to paddling, that will move the boat faster. I tend to do very precise and deliberate weight movements and I end up having much smaller increases than many other paddlers do. I am trying to isolate the muscle I am working on, as it applies to paddling, whereas other people learn how to cheat better at the movement. Take curls. You can curl a lot of weight if you throw your*

body around. As soon as you start writing the numbers down all the time, you focus too much on the amount of weight and you're not really doing anything more for yourself. In paddling, when you write down a fast time, it relates directly to what you are doing: getting faster in the boat. But in weights, you could move up 30 pounds on a lift but not benefit your paddling any more. I feel that if you start cheating, really jerking around a lot, there are two things that happen. One is you're starting to pull into play muscles other than the one you are targeting. Secondly, what happens when you get into the boat? Are you going to start jerking around there, too? Start pulling all over the place? I think some of that carries over. If you use strict technique in the weight room, you're thinking in that mode and it's a little easier to transfer that into the boat. I think people who bang out as much as they can in the weight room tend to paddle that way, too.

Four Categories of Lifts

Barton has about four dozen different upper body lifts, divided into four main categories. Each category, with sample lifts, is shown below:

1. **Back and latissimus muscle group**
    a. Pull-ups
        i. In front of the chin or behind the head
        ii. Underhand or overhand
        iii. With your own body weight alone or with weights
    b. Lat pull-downs
    c. Rowing exercises
        i. Bench row or bent-over rowing
        ii. Pulley rows — two-arm or one-arm. "On this, I try to use torso rotation, as if I'm doing a paddle stroke."
        iii. One-arm row
        iv. Pull-over — "You can use a Nautilus machine or a barbell."
2. **Chest, shoulders and tricep group**
    a. Bench press: inclined press, declined press
    b. Dips — with just body weight or extra weight
    c. Overhead military press
    d. Flies: Lateral flies or flies out to the front
    e. Nautilus shoulder machine
    f. Push downs on a lat machine
    g. French curls
    h. Pec-fly station on Nautilus machine
3. **Bicep and forearm group**
    a. Bicep curls
        i. Barbell curls
        ii. Dumbbell curls
        iii. Preacher curls
        iv. Nautilus or Universal machine curls
        v. Reverse curls

b. Forearm
   i. Wrist curls
   ii. Wrist rollers. "You take a dowel and put a string on it and attach a weight to that and curl it up."

4. **Lower torso and abdomen group**
   a. Sit-ups
   b. Stomach crunches
   c. Twisting exercises
      i. "The one you can do on the Nautilus machine."
      ii. "Get an inclined bench and twist back and forth with a weight, or a bar over your shoulders."
   d. Lower back
      i. Hyper-extensions, "A sort of reverse sit-up, where you're lifting your back up."
      ii. "Good morning" exercise

Changing the Type of Lifts

Barton takes two or three exercises from each of the four categories above and makes up a routine consisting of 10-12 exercises, which he continues for three or four weeks. He then creates a new routine. Some exercises would stay in the routine , but a number would be different.

> *I do this is because I think it helps to get over plateaus. I'll change to another exercise that works the same muscle, but maybe from a little different angle. As soon as I start the new exercise, I can make improvements right away. But pretty soon I reach a plateau. Then maybe I'll go back to the old one and find that, sure, maybe I've lost a bit initially, but not much. And then after a week or two, I've actually surpassed where I was. It's a way of tricking your mind and body into improving beyond what it felt was a barrier.*

Here are some examples:

- **50 minutes:**

4 x bench row with 130 lbs
5 x front pulls
2 x curls
2 x paper crunch
3 x dead lift 130 140, 150 lbs.
5 x pull ups
2 x hyper-extensions

- **50 minutes:**

2 x sit ups
2 x incline twist
1 x lay twist
5 x bench press
130, 150,170, 180, 170 lbs
3 x upright row. 85-105 lbs.
3 x military press 85-90 lbs.
5 x 1 back pull

- **80 minutes:**

2 x crunch machine
2 x leg twists
5 x bench press
1 x dips
3 x shoulder shrug
2 x incline laterals
1 x front lateral
2 x tricep machine

3 x pullover machine
3 x pulldown machine
3 x one arm pulleys
2 x hyper-extensions
1 x tricep pushdown
1 x bilateral machine curls
1 x incline dumbbell curls
3 minutes of situps

- **65 minutes:**

3 x pulldowns
3 x military press
3 x Nautilus crunch
3 x pullover
3 x curls
3 x hyper-extensions
3 x bench press
3 x bench row
2 x situps
2 x twists

Speed Workouts

Barton did two types of speed workouts: one pure speed and one with resistance, usually in the form of "buckets" (pulling a small bucket behind the boat). Both types were done at 90-100 percent speed. Here are some examples:

a. Speed:
- 10 x 20", with 1:40 rest
- 5 x 40" with 3:20 rest
- 3 x (10", with 50" rest; 20" with 1:40 rest; 30", with 2:30 rest)
- 6 x 30", with 2:30 rest
- 3 x (5 x 15", with 15" rest)

b. Buckets:
- 5 x 15", with 45" rest
- 3 x 30", with 1:30 rest
- 2 x (5 x 25", with 1:05 rest)
- 3 x (5 x 15", with 30" rest)

Endurance Paddles

Examples of endurance paddles:

- 8 x 3', with 1' rest
  45 percent speed
- 2 x 2000 meter time trial
  60 percent speed
- 4 x (1,2,1', with 1' rest)
  55 percent speed
- 5 x 6', with 2' rest
  40 percent speed
- 6 x 55", with 20" rest;
  6 x 45", with 20" rest;
  6 x 35", with 20" rest;
  6 x 25", with 20" rest
  60 percent speed
- 2 x (1,2,3,4,3,2,1', with 1' rest)
  50 percent speed
- 83' steady cruise
  20 percent speed
- 6 x 8', with 2' rest
  40 percent speed
- 8 x 5', with 1' rest
  45 percent speed
- 4 x 2', with 2' rest
  50 percent speed
- 4 sets: 30", 45", 60", 45", 30", with 15" rest except 30" rest after 60"
  70 percent speed

Other Types of Endurance Workouts

Barton runs all year round, right up to the big race of the year. Since he has problems with his feet, he sometimes supplements the running with swimming or biking, particularly in the fall, when he is doing more of this out-of-the-boat endurance training. Essentially, he is trying to build his general endurance during the off-season and during the race season he tries to maintain his endurance level through out-of-the-boat endurance training because he is doing less endurance paddling in the boat in the spring and summer.

> *My main training, of course, is paddling. Weights and running are the two other things. I sort of consider them at opposite ends of the spectrum, with paddling fitting somewhere in the middle. Weights are pretty much all strength, running almost all aerobic endurance. Paddling is sort of a combination of the two. So, I figure if I'm not doing as much endurance in the boat, I can still keep up some endurance by doing some running.*

Secondly, Barton uses running as a type of warm-up in the race season:

> *Sometimes in the morning when you get up, to get the blood pumping, I think you almost feel better the entire day if you get up and moving, rather than lie in bed for a while. I feel more alert the entire day. I think it gets your system ready to work. Maybe if you get up at 6 a.m. and run, it won't get you ready for a final at 4 that afternoon. But if you go for a short run 2 hours before your event, I think it may get your system into mode, ready to do aerobic work. I've never seen actual studies on this, but I've heard people talk about it: if you do some sort of aerobic warm-up before your event, after the start, your body will operate in an aerobic mode sooner. It used to be in a pre-race warm-up, you'd want to do a bunch of starts. But I feel all you're doing then is flooding your system with lactic acid, when probably what you should be doing is a couple of starts, just to get the feel, but then some longer pieces to get your body in tune with the aerobic part of it, so that right after the start, your aerobic system kicks right in, rather than to keep on producing this lactic acid and pouring it into your blood stream.*

Examples of these endurance workouts:

- 38' run: 10' warm-up; 6 x up hill
- 32' biking
- 12' run
- 34' run
- 17' swim
- 6' warmup run "hard pace"

MID-MARCH THROUGH MID-JULY (16 WEEKS): SPEED ENDURANCE IN THE BOAT. Starting in early March, but certainly by the end of March, and ending around mid-July, Barton started doing what he called speed endurance training, or "race-pace training," what traditionalists would call lactic acid training. His week at this point would look like this:

- Two — three weight workouts.
- One — two speed workouts.
- Three speed-endurance paddles.
- Four endurance paddles.
- Two other endurance workouts.

In this period I would say to myself, I'm going to move up to seven paddling workouts a week, or eight, or maybe occasionally up to 10. And I would vary that. Sometimes, I would paddle nine or 10 times and then I would take a week where I'd paddle only seven times, sort of have a harder week and then an easier week. Maybe easy, medium, hard; easy, medium hard, that sort of thing.

Here are some examples of the speed-endurance workouts (usually done between 60-80 percent speed), the only kind for which examples were not mentioned previously:

- 4 x 3', with 1' rest
  70 percent speed
- 2 x 250m with 6' rest;
  1 x 500m; 1 x 1,000 meters
  80 percent speed
- 2 x (70" with 20" rest; 8 x 30",
  with 10" rest), 5' rest between sets
  65 percent speed.
- 6 x 250m, turn around;
  6 x 200m, turn around;
  6 x 150m, turn around
  70 percent speed
- 10 x 60", with 2' rest
  70 percent speed
- 6 x 1,000m/every 6'
  60 percent speed
- 3 x 500m every 7'
  75 percent speed
- 2 x 1,000m; 2 x 500m with rest
  equal to paddle back to start
  70 percent speed
- 3 x 55" with 15" rest
  65 percent speed
- 4 x (6 x 30", with 30" rest)
  75 percent speed
- 3 x (20",30",40", 50", with 20" rest)
  75 percent speed
- 3 x (5 x 250m, with short rest)
  70 percent speed

MID-JULY TO EARLY AUGUST (THREE WEEKS): SPEED IN THE BOAT. At this time, the weekly schedule would look like this:

- Four — six speed paddles.
- Two — three speed-endurance paddles.
- Four endurance paddles.

MID-JULY TO RACE DAY (TWO WEEKS): REST. In the last two weeks before a World Championships or Olympics, Greg is worried primarily about resting and feeling technically good. All his training is geared around this.

I feel that my best races have come when I felt technically the best. The boat just feels comfortable and the stroke really smooth. Everything just feels like it's clicking right on. Physiologically, I may not even be at my peak, but I just feel that I am able to apply myself much more effectively. And sometimes even going into a race, I will do some endurance-type work, or race pace, speed-endurance-type work, more than you would really think you should be doing when you are resting, just because I start getting a feel for the stroke at that time. The first time that happened to me was in 1980. A month before the Olympic trials, I wasn't really feeling very well at all. I went to the Canadian trials, and just got hammered. Then, I arrived at our trials a week

early and started doing some really long workouts. Everybody thought I was crazy. I wasn't really killing myself, but I was putting in quite a bit of time on the water. By race day, I was feeling so comfortable in the boat, my strokes were right on. I won three out of four races at those trials. (See Appendix VIII.)

Chapter 6

Technique

This section discusses Greg Barton's ideas on the techniques of paddling and racing sprint boats. Since it is only one person's view, it should be taken merely as suggestive of what might work for some people, but not necessarily all people. Technique depends in part on a person's anatomy: someone with extraordinary arm strength might do more work with the arms than someone with extraordinary back strength. Body segment lengths come into play, and so on. For example, Barton is 5' 11" and weighs 175 pounds. Someone who is 6' 5" and weighs 205 pounds might not be able to do things exactly the same as Barton. So the reader is advised to take what he can from this section and try it to see whether it applies in his individual instance.

Outfitting the Boat

Barton has a few general ideas about outfitting boats:

- Train in the boat you're going to race in. There are small differences between boats and you want to become very familiar with the way a boat feels, how it accelerates, how stable it is, and how it reacts on the start.
- More important even than the hull speed of a boat is how well it is outfitted and how comfortable you are in it.
- All outfittings should be tight. For example, if you have a loose footrest which gives on each stroke, there is a little loss in the transfer of power each time.
- A stiff boat is important. This is usually more of a problem in the team boats, especially the K-4.
- The boat should be "on weight" — not heavier than race weight. In fact, Barton believes that it's a good idea to have the boat itself be

underweight and then brought up to the required weight by adding additional weight directly under the seat, as low down as possible to help balance. "The boat I raced at the Olympics was about two kilos under weight. So it had extra weight added below the seat and it did seem to make a slight difference."

- Fiberglass and wood can be equally good; however, fiberglass requires less upkeep.

Seat and Foot Position

A central question in outfitting a boat is how to trim it properly fore and aft. This, in turn, is determined not just by where the seat should go, but also by where the footrest should go, because if the feet are closer or farther away from the bow, it will affect the trim. The first question, then, is "how much should the knees be drawn up towards the chest?" Barton's ideas:

I feel that your knees should be up some to facilitate rotating the torso as you reach forward for the stroke. But you need to make sure that when you take a stroke, your stroke-side leg can go almost straight. It should be just short of completely locking out. It can go nearly straight, but there should be a slight bend, maybe a few degrees. If you lock out, there's a jerky motion, a slight hesitation, in getting the knee back up for the next stroke. If you have a slight bend, it's a lot smoother.

It is possible to draw the knees up too much. Greg has noticed that when the knees get very high, it is harder to rotate his hips on the seat. Hip rotation, he believes, is a crucial part of body rotation: his aim is not to twist just the upper part of the torso, but to twist from the hips. The lower the knees, he believes, the easier it is to rotate the hips. The angle of his thigh bone is a big part of it:

The more vertical your thigh is, when you push, the more you drive the bone down into the seat. You have to push harder to gain the same effective hip rotation. The more horizontal your thigh is when you push, the more you drive back, and the easier it is to get hip rotation. So there's a kind of in-between, where you still want to have some bend in your leg when you're rotating as far as possible, but you don't want too much bend because you would be limiting your hip rotation.

Footrest

Barton believes that in the K-1, the feet should be close together on the footrest for two reasons: first, it allows him to push into the center of the boat, which he believes allows a more effective transfer of power; second, it facilitates steering.

"My feet touch the rudder all the time," he said. "If they didn't, it would take too long to move them over to hit the rudder." But in team boats, in the non-steering seats, "it would be all right to have the feet a bit further apart for comfort."

How much of the foot should be in contact with the footrest? Just the ball of the foot? Barton likes to have a bit more than this. According to him, "the more contact you can get, the better." For this reason, some people like to install full board footrests which go all the way to the bottom of the boat. Barton doesn't go this far, though, because of the uniqueness of his feet.

"I also heard Einar Rassmussen say that if the footrest goes down too far, it causes him to bounce the boat too much," he noted. Rassmussen, the Norwegian who has probably competed internationally longer than anyone still racing, has been a friend of Barton's since 1978 and knew his brother, Bruce, before that. In sum, Barton compromises by recommending "a fairly wide board" for the footrest.

Footstraps

Barton believes footstraps are "really important." A number of kayakers think the boat is more stable with footstraps on the footrest.

"A lot of stability actually comes from your feet and legs and how you use them to compensate for the effects of your upper body when you're twisting," he said. But because of steering, he noted, the straps should not be too tight. "You need a little leeway" to be able to move the feet around. In the non-steering seats of team boats, however, the straps should be tight.

Position of the Seat/Footrest Unit

Once the paddler has determined the proper distance between his feet and his seat, the next question is where to put the seat/footrest unit so the boat is properly balanced fore and aft. Barton believes this is best accomplished by having someone look at it from shore (or video it). Aspects to look for are:

- When the boat is sitting still with the paddler in it, the bow should be "level or even down a bit."
- When moving at race speed, the bow should be "up a little bit," but it shouldn't be out of the water at all. "If the first six inches of the bow are out of the water, say, then you might as well be paddling a boat that is six inches shorter." (The longer the boat at the water line, the faster it is.) "You definitely want the full water line of the boat in the water, and I think there should be at least an inch or so of the bow in the water."

Height of the Seat

Barton's seat is seven centimeters off the bottom of the boat (lowest part of seat to bottom of boat), although he did not know that until asked to measure it. He does it simply by feel. There is a basic trade-off concerning seat height. Generally, the higher the seat, the more leverage, and the "better the attack" (catch) on the water, but the lower the seat, the more stable the boat is. The decision should be left to personal preference.

Barton generally does not raise or lower his seat depending upon conditions. "I like to get used to the height of the seat and just leave it there." In abnormally rough conditions, though, where stability is a problem, he might lower it, but he generally does not do this for one good reason:

> *Seat height has to be coordinated with paddle length. The higher you're sitting, the longer the paddle should be because you're further from the water. Conversely, if you lower the seat, you have to go to a shorter paddle, otherwise, you'd tend to go too deep in the water.*

For a beginner, it probably does make sense to change the height of the seat—start out really low so to acquire balance control, then raise it over time. "If you've got a lot of boats with different stabilities, you could keep the seat at an ideal paddling height and just move the paddler from boat to boat. But usually a person has access to only one boat, and has to change the height of the seat as he gets better."

Padding the Seat

Barton uses a half-inch thick foam pad which he lays on his seat before getting into it. He prefers the pad for two reasons:

> *One is comfort. The other is more points of contact with the boat. At the '83 Worlds, I actually developed tendinitis in my rear end. When I'm paddling, I'm pushing with my legs. It helps you gain more rotation if you use your legs, actually rotating your hips back and forth on the seat. I had no pad and the seat is like a dish and I was driving my butt bones into the back of the dish with each stroke. Then I went out and did some running sprints and the combination of the two things caused me to develop tendinitis in my rear end, which is an extreme case. I think if you're more comfortable, you can paddle better, so now I use a pad. The other good thing about the pad is that it bridges the gaps between your rear end and the seat. If the seat is not perfectly contoured to your own anatomy, the pad will tend to squish down in areas where it's tight, and fluff out a little in areas where it's a little loose, and that will give you a better fit with the seat.*

Experimental Seats

Over the years, people often have wondered whether it would be possible to construct a seat which would facilitate body rotation by actually having the seat move during the stroke. A rotating seat built around a central pivot was tried in Sweden several years ago. Barton presently is experimenting with a similar seat developed by the Hungarians.

> *The seat is split so there is a right half and a left half, and they can move back and forth. Also, there's a pulley out front with a cable that goes from one half out around the pulley and back to the other half, so that as one side goes back, the other side is forced to go forward. Otherwise, if you pushed, both sides would go back. I think there is some potential here. It helps you to develop more rotation, a lower-down rotation, instead of just rotating your upper back and shoulders, but it's a lot tippier. You're more unsure of the stroke, especially at higher speeds. You're used to having a solid point fixed in the boat and as soon as you start moving that, it can throw the stroke off. I don't know if the sacrifice in stability is worth the potential gain.*

Use of The Rudder

A moment ago we saw how Barton likes to position his feet so they are just touching the rudder because this is the easiest position from which to steer. Theoretically, one would think that a top paddler would tend not to use the rudder very much because it would slow the boat. In reality that is not the case. Barton

uses the rudder on almost every stroke:

> *What happens is, subconsciously, you're always making small corrections. You need to; that's the reason the rudder is there, so that you can concentrate on paddling with the most effective forward stroke possible, without worrying about making small stroke modifications and leaning. I would try to use the most efficient forward stroke I could and let the rudder take care of the small corrections. Since my feet are right next to the rudder, every time I push, my foot flattens out and nudges the rudder. When I push on the other side, it nudges back. Maybe the thing is moving a couple of millimeters each stroke. I realize this isn't ideal, but I think most people do it. I don't see how it could be changed unless you came up with a new steering system, but even then, I fear steering would be more of a conscious thing you'd have to think about and that would take your focus off the race, and you would probably have to do it quite often anyway, maybe like every four or five strokes.*

Differences in the Team Boats

Outfitting the team boats, Barton believes, is quite similar to the K-1, with the following differences:

- While you are trying to achieve the same position of the hull in the water as in the K-1, there are multiple seats, so they all must be moved around to trim the boat.
- If the boat is underweight, it is possible to move a weight around to balance the boat, a more feasible option in the team boats than in the K-1.
- The steering position is the same as in the K-1, but the other paddlers may spread their feet apart more for comfort. Spreading them too far, however, can cause the boat to roll from side to side too much.

The Paddle — Background

At the time of the Olympics in 1988, Barton used a 223 right-hand controlled wing paddle for K-1, with the blades offset at 82 degrees. He never changes the length of the paddle for training during the year, although before he went to the wing he used a slightly shorter length.

A word or two about the derivation of the wing paddle is useful because it is still being developed and who is to say that the optimal design has yet been achieved? Also, some concepts and terms that are important to technique are introduced here.

Perhaps the biggest revolution in sprint racing since the introduction of offset paddle blades in 1936 was the invention of the wing paddle, and its advent has changed paddling technique significantly. The essential concept of the wing, as explained by its inventor, former Swedish National Team coach Stefan Lindeborg, is that it reduces "slip," the backward sliding of a paddle blade in the water.

It is traditional in kayaking to think of the paddler as putting his paddle in the water and then pulling his body and boat past the blade rather than pulling the paddle through the water past his body. In reality, though, some of each occurs,

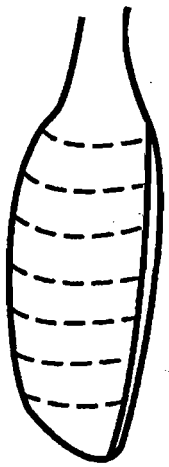
and the backward movement of the blade in the water is called slip. Stefan Lindeborg sought to reduce this.

He also sought to convert what he considered a natural flaw in paddling into an advantage. Instead of pulling the paddle straight back during the forward stroke, paddlers inevitably tended to let it flare out to the side. Lindeborg thought he could harness this flaring into a way to reduce slip.

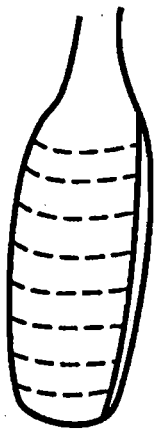
In the mid-1980's, after much calculation, testing, and trial and error, Lindeborg developed a new paddle blade which was shaped like an airplane wing (hence the name). It revolutionized the sport. The wing was shaped much like an airfoil, with a curled back lip on the outboard edge of the blade as it came through the water. The crucial concept was taking advantage of the blade's sliding out to the side, away from the boat. When the new paddle slid out to the side, it generated "lift" in the water — that is, created a vacuum on the bow side of the blade — in much the same way an airplane wing creates lift. This lift tended to hold the blade forward in the water, thus minimizing or eliminating slip. After Britain's Jeremy West won the 1986 World Championships in both the K-1 500m and 1,000m using the wing, more and more people started to use it.

In 1989, Barton's Norwegian friend, Rassmussen, developed some important improvements for the wing by twisting the blade on its length-wise axis and making the blade's tip wider. Norman Bellingham, Barton's K-2 partner, once said that "Einar Rassmussen likes to talk a lot and Greg Barton likes to listen a lot, so they make a good combination." Barton amplifies:

> *Actually, I think he first mentioned the idea of twisting the blade to me in 1986, at Paris. I remember thinking he was on to something. Over the years, he's probably built 40 to 50 different wing designs and in order to build so many, he's had to develop a very quick construction technique. He'll come up with an idea, put a bunch of Bondo on a blade, and get a belt sander and grind the thing down to the approximate shape he wants. He doesn't even finish it out; he's got like a 36-grit belt sander finish on it. Then, he stretches some kind of special heat shrink plastic or vacuum bag plastic over it and that makes it smooth enough to use as a mold. Then, he just vacuum bags on top of that and builds a blade and glues the blade onto a shaft and wraps carbon fibers around the joint. It's crude, but it works and it allows him to make a lot of prototypes very quickly. He doesn't even bother to make two blades. He just tries out the new blade with an old one and if the new one feels good, then he'll make a second blade for the other side.*



Swedish Wing Blade



Norwegian Wing Blade

Figure 9

In a nutshell, the Swedish wing improved the middle and later parts of the stroke; Rassmussen improved the beginning (see Figure 9). Lindeborg was able to take advantage of the blade's sliding away from the boat and used it to create lift, but he did not deal with one other natural tendency of a blade in

water, the fact that the blade also pivots (the top goes forward while the bottom goes back) due to the pulling with the lower arm and the pushing with the top one (see Figure 10).

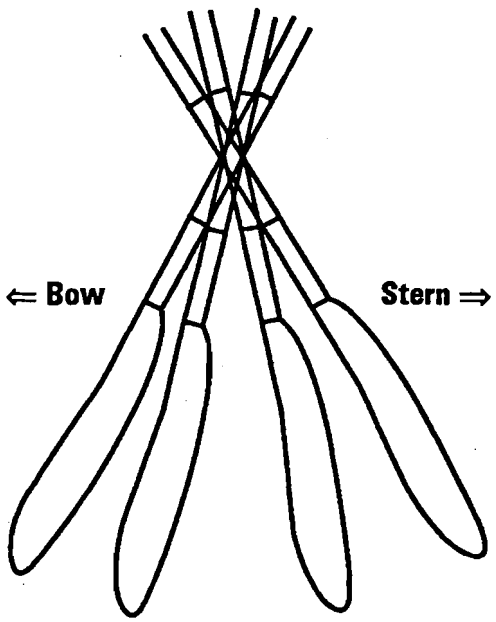


Figure 10

How the Blade Pivots

When the wing blade went through this pivoting, its cross sections were not always ideally lined up with the way the paddle was moving through the water, and the further you get off the design angle of the wing, the less efficient it is. The top part of the old wing blade was moving sideways and forwards in the water and it was desirable to have the wing sections lined up for that. But the bottom was moving sideways and backwards and you wanted to have the wing sections lined up differently for that. The solution: put a twist in the blade.

Widening the tip was designed to make the wing more effective on starts. The original Swedish wing was tapered and had a narrow tip, like an airplane wing. This was based on airplane wing theory which postulates that a long, tapered wing is best because it reduces "end effects," the effects of the air at the end of the wing as it slices through the air. However, wing paddles differs from an airplane wings in an important way: the airplane wing goes through the air continuously, but the blade is taken out of the water repeatedly. As a result, the problem of end effects is not as critical to the wing blade. The original Swedish wing was good for steady pace paddling, but not as good for starts. The power phase of the stroke was shifted more towards the back of the stroke because you were losing the front part due to less blade area going into the water. The solution: a less tapered blade with a wider tip.

In pondering all of these developments, Barton has decided that there should be more experimentation and development of the wing paddle:

> *Perhaps there should be more twist in it than Rassmussen has. I'm not sure. It becomes really complicated but if you know exactly what is happening to each person's blade in the water, it should be possible to calculate what the proper amount of twist should be for each person. And it'll vary between people, depending on how much their blade pivots in the water, and also how vertical it is — how high your top arm is on the push-through. There are always compromises you have to make in all of these, but you would take into consideration what the paddle angles are and the amount of pivot there is in the stroke.*

The Paddle — Constructing and Outfitting One

The first step in constructing and outfitting a paddle is to determine its overall length. According to Barton, a common mistake is that people tend to equate it too

closely with body height. There is an old saying in the paddling world that the way to choose the proper length is to stand a paddle up straight and try to hook your fingers over the top. If you can't, the saying goes, the paddle is too long. If you can get more than that over the blade, the paddle is too short.

> *I don't agree with that at all; you don't want to go to that extreme. People think there is a linear relationship between body height and paddle length, but there isn't. It's true that the taller person needs a longer paddle, but not as much as the height difference would indicate. For example, somebody who is 10 centimeters taller than somebody else should not use a paddle that is 10 centimeters longer; he'd use one that is two to three centimeters longer.*

There are reasons for this: first, a person's height is usually in his legs, which do not come into play when seated in the boat; and second, the taller person also has longer arms, making it easier to reach the water.

Then how is proper length determined? According to Barton, put the person in a boat and consider the following variables:

- Seat height. Be sure to take seat height into account.
- Top and bottom arm height during the stroke. If the paddle is too long, the person will be paddling with his hands too high in the air — above eye or forehead level with the top arm. If the paddle is too short, the hands will be too low.
- Ideally, the paddler should completely bury the blade right at the start and then keep it at that depth all the way through the stroke. There is a trade-off in paddle length here. A longer paddle makes it easier to bury the blade completely right at the start, so you'll have a stronger catch, but it also makes it easier to go too deep at the finish and cause you to pull out water and drag the boat, so you have to compromise. If someone is missing water at the catch, a longer paddle may be called for, while trouble getting the blade out may call for a shorter paddle.
- There is a difference in team boats. The K-2 sinks lower in the water than the K-1, so if he is stroking the K-2, Barton needs a shorter paddle, 221 centimeters instead of 223. If he is in the back seat, he uses the same length as in the K-1 because he has to paddle a bit wider due to the increased width of the boat. This compensates for the fact that the boat is lower in the water. Back seats of a K-4 may use an even longer paddle.

Grip Width

Once the overall length of the paddle is chosen, the next question is how wide the grip should be. Here Barton believes the traditional method of grasping the paddle, resting it on your head and seeing whether the arms form right angles is adequate:

> *This is fine for beginners, but after you've paddled for a while, you may want to move your hands one way or the other. For example, my hands are in a little bit from right angles, maybe a half inch on each side.*

As a point of reference, there are 68 centimeters from Barton's small finger to the end of the blade (or 16.5 centimeters to the beginning of the blade).

Indexing the Grips

Barton, like most paddlers, prefers to have an oval shaft where his hands grip the paddle. In fact, he insists on indexing (placing raised ridges on the round shaft to make it oval) on both sides:

> *A lot of paddles are made with just the control hand indexed. That always struck me as odd. I want to get the same feel on both sides. It always makes me feel off balance to have something on one side and not on the other.*

Indexes can be made in a number of different ways. First, the shaft can simply be made oval, which is easy with a wood shaft. With the round carbon shaft many paddlers use, an index must be built up. This is done with tape, using heatshrink material over a piece of wood or plastic, or using a lightweight filler like microballoons in resin to build the shaft, then sanding the raised section smooth.

Offset of the Blades

Barton uses wing blades that are offset 82 degrees, the same as his old, traditional paddle. The way he came to 82 degrees is interesting:

> *A lot of people switched to less than 85-90 degrees offset with the wing, but since I had already been at less than that, I stayed the same. Struer, the manufacturer of the paddles we used at that time, claimed all his paddles were offset 85 degrees. I had one which was my favorite paddle and after a while I realized that it was less than that. It was about 82 degrees, so when I started making my own paddles, I made them 82 degrees and kept that with the wing.*

Angle of Attack

The angle of attack is the angle at which the blade enters the water, as seen from a top view looking down. In airplane terminology, the angle of attack refers to the angle of the leading edge of an airplane wing. To get lift, the leading edge has to be up as it goes through the air — a "positive" angle of attack, or a "high" angle of attack. With the wing paddle, the angle of attack is the position of the blade edge furthest away from the boat as the blade goes through the water. The more the outboard edge of the blade is in front of the inboard edge — the higher the angle of attack — the more the paddle will tend to go out to the side (See Figure 11).

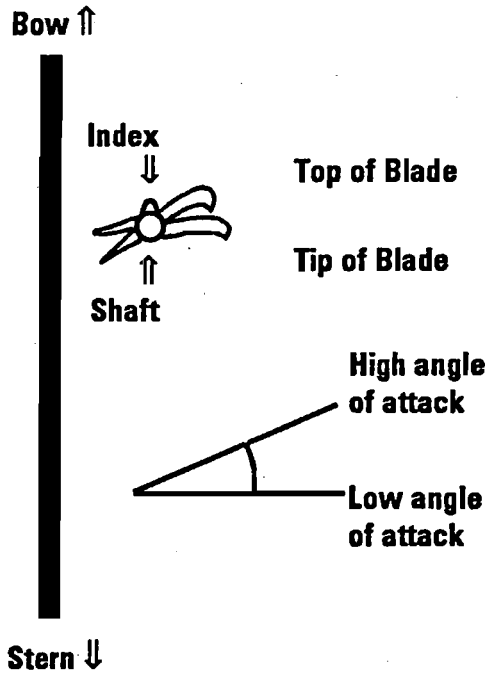


Figure 11

How the blade is positioned on the shaft relative to the index can affect the proper angle of attack.

I tend to index them so that when I put the blade in the water, the outward edge of the tip is about perpendicular, with respect to the center line of the boat and the index. That means that the rest of the edge, which is twisted, will be even more forward, has an even higher angle of attack.

It is this angle of attack that makes the wing slide out to the side when Barton starts to pull back on it. His description of how this works is interesting:

I try to think of pulling back but having the paddle on rollers so it could move freely sideways if it wanted to. Then I think that as I pull back, someone is tapping his finger lightly on the shaft, so besides coming back, the paddle is also sliding out. I'm not going to try to resist this rolling. I'm letting the paddle be free-flowing out to the side.

Weight of the Paddle

Barton believes that 700 grams is a good weight for a paddle. This is possible using carbon fiber materials.

Generally, each blade and the shaft should all weigh about the same—about 225 grams. I don't think there are many paddles out there that are that light, but the one I used at Seoul was.

Break-Apart Paddle

Barton uses a special break-apart paddle for his racing and training which he designed and constructed himself.

There are two reasons for this. First, it's easier for transport. You have the two halves of the shaft. Then, there's a sleeve that goes inside both of them, just a smaller diameter tubing. A tight fit and a stainless steel pin hold it all together. It's a lot easier to carry something that's only half as long. Also, there's less likelihood of damage because I put the halves in a rigid cylindrical case. The other reason is I can adjust the length of the paddle. At Seoul, I raced two events with two different paddle lengths, but I used the same paddle for both. I really like getting used to the way a paddle feels. A lot of paddlers are pretty picky about that, and get emotionally attached to it.

Other Equipment — Spray Skirt

Everyone knows that spray skirts should be used in rough water conditions to prevent water from coming into the boat, but they also can be used in a few other situations:

- In team boats to prevent the spray of the paddlers from getting into the boat.
- In a head wind to streamline the boat. Without a spray skirt, wind can get into the boat and slow it down.
- For warm-ups. The skirt traps body heat in the boat and can be used for warming up, then taken off later for the race.

A lot of people like to use spray skirts all the time, but I like to go without them whenever I can because it feels freer that way.

Forward Stroke Technique

The following is Barton's overall concept of technique:

What you're trying to do is be as efficient as possible. That means using your strongest, most powerful muscle groups to best advantage, getting the most power you can from all parts of your body. It also means applying power in a forward direction, not making the boat move up and down, or sideways, or any way other than forward.

This all sounds simple enough, but the hard part comes in trying to implement it. Before we get into a phase-by-phase description, there are a few main ideas to keep in mind:

Vertical Blade

A key principle of kayaking is keeping the blade as vertical as possible as long as possible during the stroke. Vertical means in two planes: as seen from the side and as seen from the front. The closer the paddle is to vertical as seen from the side, the more pull force generated because due to more "projected" blade area in the water, to use a physics term. For example, assume you have a light in front of and at the same level as the blade, and then you have a screen in back of the blade. If the blade is vertical, the projected area is the same as the area of the blade. If you tilt the blade forwards, the projected area is a lot smaller. The effective area that you can pull against in the water is the projected area. Having a smaller projected area is like using a smaller blade. Concerning the view from the front, it helps to have the wing blade vertical in this plane, too, because the cross sections of the wing are more lined up with the way the paddle is designed to move through the water and generate lift. The farther you get from the design angle, the less lift it will generate.

Rotation

Barton believes that using good body rotation is crucial because it allows you to use your large muscle groups instead of just your arms. It brings into play the back, abdominal, obliques, shoulders, and many other muscles. It also allows you to keep the paddle vertical longer.

Barton believes that beginners need to practice this rotation right from the start and that it is closely linked to good balance; therefore, they should start in stable boats and, when they can rotate satisfactorily in those, be encouraged to move to tippier boats.

You have to force them to leave the comfort zone. If you don't leave the comfort zone, you don't improve. When you are rotated completely out, just before the catch and the paddle is in the air, it's one of the most unstable positions, yet one of the most important positions in paddling. The natural tendency is either to go in the water right away—go in short—or not rotate out. You have to fight that tendency.

One drill for this is to take a few strokes and then pause just before the catch, with the paddle hovering in the air just above the water, trying to keep the boat balanced.

> *The important thing is to pause just before you'd go in the water, not at the back of the stroke. Pausing at the end of the stroke is more comfortable, but this causes drag at the end of the stroke and slows the boat down. You need to think of the stroke as a continuum. You get the blade in and then you get it out. If you want to rest, you rest in the air. Other people tend to blend the whole thing into a steady motion. I think of it as though I'm taking a stroke on one side and then a different stroke on the other side, like a canoe. The break is just before the catch. That way, you follow through on the entire stroke. You don't drag at the end and slow the boat down.*

Avoid Pitching, Rolling, and Yawing

Pitching is the technical term for bobbing the boat. Rolling is rocking it side-to side, while yawing is turning the bow from side to side. All three are common occurrences for less experienced paddlers and slow down the boat because they disturb its glide.

When people begin learning rotation, they sometimes confuse it with leaning fore and aft, especially when they are tired. Leaning fore and aft allows them to get as much reach as they are supposed to get by rotating, but, unlike rotating, it causes the boat to pitch.

> *Proper rotation doesn't cause pitching because when you're rotating, you're pivoting about an axis. For every part of your body that moves forward, there's another part moving backwards. So, it should all balance out. Pitching is caused by moving your entire body back and forth.*

Other causes of pitching are improper angles of the blade in the water. This could be caused by not inserting the paddle vertically enough, due to the balance problems and wanting to slap the water for stability, or shooting out too fast with the top arm without pulling on the bottom one enough, causing the blade to pull up on the water.

Rolling is another balance problem caused by attempting to involve the whole body in the stroke, but not compensating for shifting weight enough to keep the boat level. Yawing is caused by failure to control the inevitable tendency of the boat to turn away from the stroke side. Even paddlers like Greg Barton yaw a little bit, but they usually do not pitch or roll much.

At The Catch

We now look at the forward stroke in the traditional phase-by-phase approach — catch, pull-through, exit, recovery. At the catch, you want to have your body rotated out, which means that your knee on the side away from the stroke should be pushed down almost straight. You should be rotating from the hips, too, not just from the upper shoulders while keeping your hips straight.

Your bottom arm should be nearly straight, but like the leg, not locked out. Being locked out can be a dangerous position with which to enter the water. The shock can hurt your elbows or shoulders.

The push elbow should be bent, but never more than 90 degrees and usually a good deal straighter than that. This differs from stroking with the traditional paddle. With the traditional paddle, you needed to bend your lower elbow at the end of the stroke much more in order to keep the paddle close to the side of the boat and yet not go too deep. So when you exited the water, the exiting hand was closer to the side of the boat than with the wing. This meant that as this hand came up and became the pushing hand of the next stroke, it started out close to the head. By way of contrast, the wing stroke goes out to the side, so you finish a stroke with the exiting hand further from the side of the boat, and thus starting as the push hand in the next stroke further away from the head. This enables you to keep your top arm much straighter both during the pull-through and the push, which is good because it enables you to use your back more and your arms less.

The most important thing at the catch is to get the blade in the water as quickly as possible and bury the entire blade — but no more than that — before you start pulling back on it. Barton sometimes puts pieces of red tape at the tops of his blades so when he looks at a video of himself he can judge whether he is at the right depth. This results in a top arm push at eye level.

"This is what I learned years ago," he said. "Then, in the late 70's and early 80's, a lot of people, especially the Soviets and East Germans, tended to push out at shoulder level. But when the wing appeared, top arms started going back up again."

Initiating The Catch

To initiate the catch, the paddler should use both arms to push the paddle down into the water. "The catch is like spearing the water and a lot of it is done with the top arm." As he inserts the paddle into the water, Barton brings his top arm forward a little bit to help get a good, clean catch.

It is important to insert the blade as close to the side of the boat as possible for three reasons: 1) it makes the paddle more vertical, as viewed from the front; 2) since the wing paddle moves sideways from the boat, a wider start a wider finish, which isn't good — it's easier to pull when the paddle is closer to the boat; and 3) the closer the paddle is to the boat's center line, the less it will cause the boat to yaw.

The Pull-Through

Barton appears to execute the pull-through almost entirely with the body and not the arms. He appears to plant the paddle when he is rotated completely out, and then simply holds the paddle in the desired vertical position while he unwinds his torso. It looks as though the arms simply provide a link between the paddle and the body.

Once the catch has been initiated, he takes care not to push out too soon, or too much with the top arm. For Barton, the top arm push is about 25 percent of the force on the blade and the pulling about 75 percent. He thinks about using the top arm "almost as an anchor," as though the top arm was locked in place and he is pulling as hard as he can with all the muscles on the stroke side — back, shoulders, obliques, and arm. He lets the top arm almost stay stationary at this point because he is trying to get a "high pivot" point on the shaft.

What is a high pivot point? During the stroke, as seen from the side, there is a

point on the shaft that does not move either forward or backwards during the stroke. It is the place where the top arm pushing the shaft forward merges into the bottom arm's pulling the paddle backwards. This is called the pivot point. If you were to put the paddle in the water and just push hard and not pull at all, you would have a very low pivot point. If you did the opposite — didn't push at all, and just pulled — you'd have a very high one. A high pivot point is desirable because it keeps the blade vertical longer (See Figure 12).

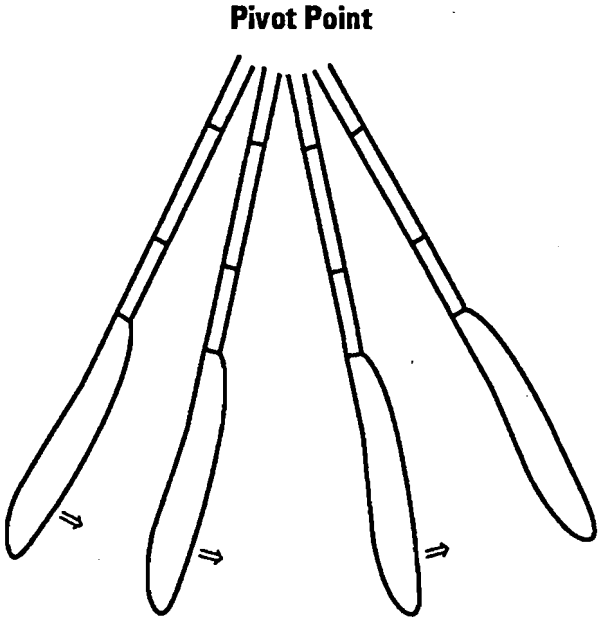


Figure 12

Pumping with the Legs

Not only is he thrusting back with his leg on the stroke-side, Barton also is swaying his knees inboard and outboard to compensate for the shifting of his torso weight during rotation. As he rotates out for a stroke on the right, his knees sway to the left; as he rotates to the left, they sway to the right.

Crossing Over

With the wing paddle, Greg crosses over with the top arm quite far — past the other side of the boat. Here is what he tries to think of:

If you look at the stroke from the front view, as I'm pulling with the bottom arm, the blade starts moving out to the side. But the top arm moves right with it; they are moving together. So if you look at it from the front, the angle of the shaft stays the same throughout the stroke. In the traditional paddle stroke, the angle always changed throughout the stroke: the bottom arm would pull straight back, but the top arm would start by the head and come across the

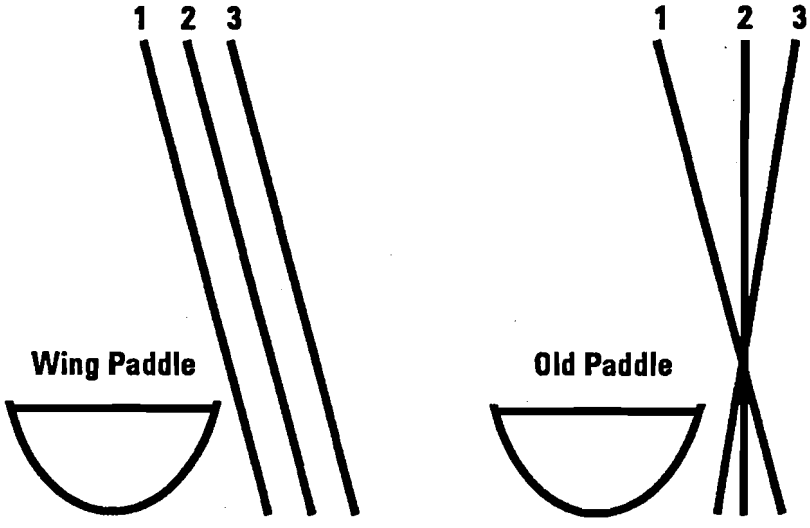


Figure 13

body a bit, inboard, during the stroke and end up more vertical than when it started. Keeping the same angle is more efficient. It helps develop the flow on the wing blade better. I like to think that both hands are on ball bearings, but connected, so that they can move out to the side together. (See Figure 13).

Barton believes it is important to avoid dropping the top hand a lot after the stroke is completed. If you do that, it causes you to lift up water at the back of the stroke and pull the side of the boat down into the water.

Application of the Power

When he takes a forward stroke, Barton thinks about the following things:

I try to get maximum power on as soon as possible in the stroke, but you don't want to slap the water at the catch. That's really important, getting the blade in the water, instead of thinking about pulling back right away. Submerge it first, then pull on it, and then keep the power on evenly throughout the stroke.

The Finish

Barton believes you should start to take the blade out of the water when it passes your knees and it should be completely out of the water as it passes your hip. You need to think about the blade not getting buried too far in the water so you can avoid a problem with the release. This means possibly bending the bottom arm slightly to keep the blade at the required depth.

"This is not as critical as it was with the traditional paddle," Barton remarked, "but you still need to think about it."

He also thinks about "counter-rotating," a term he picked up from his old coach, Andy Toro. Counter-rotating means continuing your rotation even after you're pulling the blade out of the water. You don't simply finish the stroke and abruptly pull the paddle out of the water. That causes a slight braking action on the boat. Instead, it is better to continue to rotate a little more even when the paddle is out of the water. That way you are sure not to stop the blade in the water.

The Release

The wing is both better and worse than the traditional paddle on the release. It is worse because it lifts more water at the release, due to its thicker size. Overall, though, it is better because of the way the blade moves out to the side. This way, you can keep the power on the blade right up to the end, even when you take it out (counter-rotate).

Summary

The following describes how Barton thinks about his forward stroke:

It helps if you think that someone has taken a series of poles and driven them into the water, down into the bottom on both sides of the boat, and you are able to grab each one and pull yourself by. Only take it a bit further and pretend that you've got this big old row boat that's out in front of you and you're actually suspended just above the water behind it, pushing it forward

with your feet. So, you're grabbing this pole and trying to push the boat forward with your feet. And there's another pole on the other side and you do the same thing with that. If you think of it that way, it really helps to get the forward force on the legs. In paddling you have to transfer your power to the boat and the two places you are touching are your feet and the seat. But I think the forward force is coming almost entirely from your feet and your rear end is stationary.

Modifications

The following modifications in forward stroke can be made depending upon circumstances:

Starts

The start of a race requires a quite different technique. Essentially, you start twice, the first phase being a few long, hard strokes to get the boat moving, and the second phase being 15-20 strokes with the rate up at 140 or 150 beats a minute. Here are Barton's thoughts:

The first two or three strokes on each side I try to think about getting a really hard pull on the water, pulling the boat 'out of the hole.' The boat is kind of sunk down in a hole and I'm getting it up and moving. It's even all right on the first few strokes if you think you can accelerate the boat more by moving your body fore and aft, to do that. It's a no-no once the boat is moving because it makes the boat pitch. But on these first few strokes, the boat doesn't have any steady glide to it anyway. I try not to put the whole blade in the water for these first few strokes, maybe three-quarters to seven-eighths of the blade. And also, I pull straighter back. By not putting as much blade in the water, it allows you to pull back without the wing blade wanting to do weird things on you. If you try to do a normal stroke on the start, it's like starting out in 10th gear on your bicycle. Not going so deep and letting the blade slip a little, helps to get everything going easier. Then once you get the boat up to speed, you want to lengthen out into a normal wing stroke.

Stroke Rates

Barton's "traveling stroke rate," the rate at which he would race the bulk of a K-1 10,000m race, is about 80 strokes a minute. In a 1,000m, it's about 100 strokes a minute. This is low; most top paddlers would be about 110 in the 1,000m. In a 500m race, Barton would be 110-115, and others at 120 or even 130. Barton believes that at these higher rates, the technique stays the same but the rate goes up because the athlete is pulling harder on the paddle and cutting down on the "air time," the amount of time that neither blade is in the water.

Once you've got a flatwater boat up to speed, and you're running a smooth boat, not bouncing it, it will maintain most of its speed, so you can have a slight pause, or quite a bit of air time in between strokes, and the boat will maintain its speed. But if you're accelerating, the acceleration dies as soon as you take the paddle out of the water. So you want to get it back in again as soon as possible. That can mean slightly less rotation because you may not

have time to keep counter-rotating or extending out. It can be that you'd use your arms a little more and your big back and hip muscles a bit less, because it's quicker to get small muscles into play than big ones. At the slower speeds, it's easier to be efficient. But at the higher speeds, there's a loss of efficiency in just trying to move the muscles that fast.

Team Boats

The main difference in the team boats is the increased stroke rate. But Barton believes that it's important to use the whole body during these faster strokes.

Your overall rotation is probably less in the team boats, because the stroke rate is faster and you don't have the time to rotate out. But I think it's important to use the whole body for the rest of the stroke, because you can put a lot of power on. Because the stroke rate is higher, you might think you want to use the arms more, but you have to resist that.

Paddling in Waves or Wind

Generally, in waves you should paddle lower and wider for stability. Paddling lower gives you a much wider base to balance yourself on and lowering the arms lowers the center of gravity. In wind, you want to paddle lower and wider for the same reason and also because in head or side winds, having the paddle lower makes it less susceptible to being caught by the wind. If you have a steady side wind, sometimes it helps steering and stability to lean into the wind steadily. In a tail wind, paddle normally. In a head wind, you generally want to have a really long, hard stroke, with a lower stroke rate. Keep air time to a minimum, though. If the paddle is out of the water, the wind can blow the boat backwards. In a light head wind, the stroke rate would be only two or three strokes a minute lower; in a strong one, maybe even 10 strokes lower.

Visual Breakdown of Barton's Stroke

1 Front

2 Front

1 Side

2 Side

1 Back

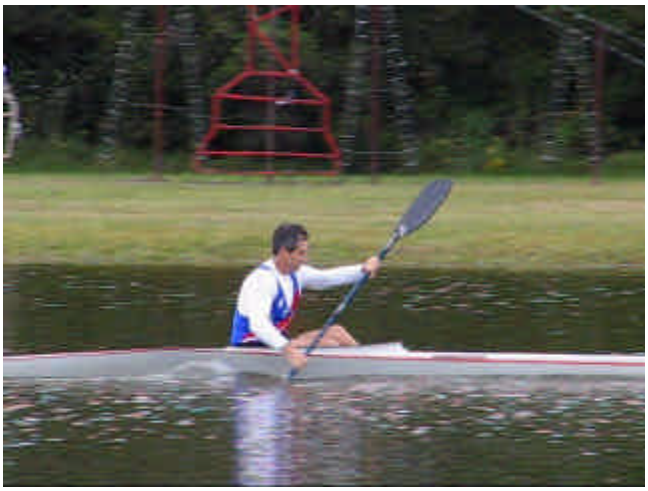
2 Back

Visual Breakdown of Barton's Stroke

3 Front

4 Front

3 Side



4 Side

3 Back

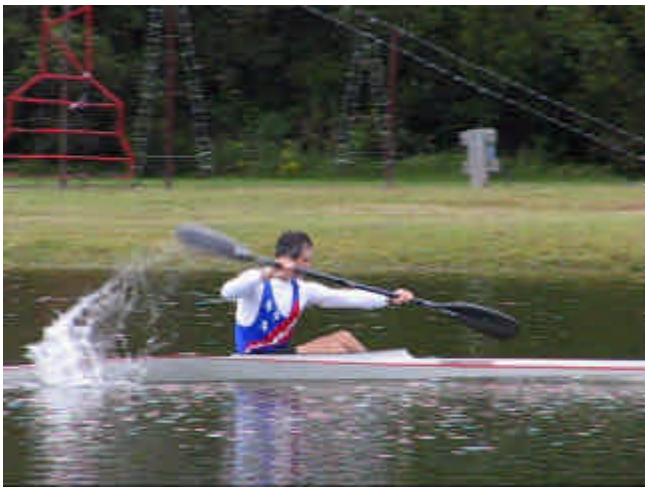
4 Back

Visual Breakdown of Barton's Stroke

5 Front

6 Front

5 Side



6 Side

5 Back

6 Back

Chapter 7

Mental Preparation

In addition to the literature that exists on the physiological side of training, there is also a literature on the mental side. In this section, we compare it to the mental practices that Greg Barton employs.

In a very general sense, the literature on mental training is of two types. First, there are techniques for helping the athlete concentrate. These usually focus on improving the athlete's training during the year leading up to the big race, but they come into play during the race as well. Secondly, there are techniques for relaxing the athlete so he is able to perform up to his level of ability. If he is able to relax in the tense situation, the argument goes, nervousness or even panic cannot break his concentration and deflect him from his pre-planned race strategy. The relaxation techniques are most useful on race day itself, but they also have application during the training year.

Breaking the two categories down further, we have the following four areas:

- **Improving self-image.** The premise here is that if you want to change human behavior, the first thing you have to do is change the person's self-image. In this case, the athlete is convinced he is capable of an outstanding athletic performance. Self-image is usually controlled by the self-conscious, so a lot of self-image training is aimed at ensuring that subconscious motives are helping, rather than hindering, the athlete.

- **Setting goals.** The literature on this usually focuses on helping people set ambitious long-term goals and then set realistic short-term ones for reaching them, as well as generating the emotional commitment necessary for following through with the plan.

- **Improving concentration.** Mental rehearsal is one of the mentioned techniques in this category. In essence, it is the technique of thinking through in elaborate detail what you are about to do—a big

race, or even a training session — so that you are fully prepared to do your best in it. The idea is that the subconscious mind cannot tell the difference between an actual experience and one that is vividly imagined; that is, if you are able to think in great detail about what the race will be like — how hard it will be at the end, what the water temperature is like, what the smells are, what the crowd is doing, how well you are pacing yourself — it will be exactly the same as actually doing it, and you will therefore be able to familiarize yourself with it even without doing it.

• **Controlling anxiety.** Hypnosis, autogenic training, transcendental meditation, the idea of competing against yourself and not others, and listening to relaxation tapes are all examples of ways to control anxiety.

We will see how Barton has come to use some of these principles through years of experience.

Barton's Mental Approach

While he does not have an elaborate system of mental training, Barton does advocate the following:

1. **Have a precise reason for whatever it is you are doing.**

I think it helps if you know why you're doing something, rather than just having a coach give you a program and you follow it blindly. I think it helps if you can actually visualize yourself gaining benefit from a workout that you are doing. For example, if you are doing a weight workout, you can say, "O.K., this is making me stronger so I can pull harder on the paddle so I can go faster." I think a lot of it is subconscious; if you really believe in what you are doing, it's a lot more effective than just doing it because someone's telling you to do it. There's more of a purpose. It's sort of a philosophical thing: Why am I doing this? If you can answer that, it's easier to motivate yourself to go out there and do the workout than if you are doing it just because someone tells you to. At times, even if your assumption is wrong, it's better than having no assumption at all. If somebody honestly believes that doing a lot of 250 meter sprints will improve his aerobic base, it probably will, although he might do even better doing some longer pieces. At least he has a purpose for doing it.

But Barton also means having a good reason for doing competitive kayaking at all:

For me, it is a personal challenge just to see whether I can really go fast enough to win the World Championships, or to break a certain time. To me, that's a thrill in itself — just seeing how fast I can go, whether I can do it or not. But there are other aspects as well. I do enjoy paddling, but not every day. Sometimes the drudgery of the workouts gets pretty boring. But I like being healthy and being in good shape and I enjoy a lot of the people I meet at the competitions. But I'd say those are the side benefits. The main reason I do the sport is just the thrill of seeing how well I can perform.

2. **Use mental rehearsal before training sessions.**

If you think about what you are going to do in a workout before you get out there, it's much easier to concentrate when you get there because you've already thought it through. For example, if I've been having problems with getting my blade buried at the start of the stroke, I just think about how it's going to feel, even when I'm not on the water, like when I'm waiting for the bus or something. Or, if you think about a workout you are going to do and how you should pace the pieces, how it's going to feel at the 250 meter mark, then when you get out there it's easier to concentrate because you have a game plan.

3. **Train with other people selectively.**

There are certain times when I prefer to train alone and others when I prefer to train with groups of people. They both have benefits. Training with others makes it easy to motivate yourself. When you know someone else is going to be at the workout at 5:30 a.m., you're motivated to get down there and practice. And once you get on the water, if you've got three other boats that are your speed, then you see the results of your efforts a lot more clearly. If you're out there hanging even with somebody and then you start pulling harder on each stroke, you can see that you're moving ahead of him. It's a lot more motivating to see that when you work hard, you're ahead of those guys and when you slack off, they're ahead of you. Also, maybe you can learn something by watching the others. Perhaps somebody has a certain way of starting and always has good starts in a race. You can pick up something there.

But there are disadvantages of training with others. The main one is getting caught up in simply trying to beat the others rather than actually concentrating on the specific purpose of the workout. For example, if you're working on technique, a lot of times you want to hold back a little instead of going berserk out there. You want to think "O.K., I want to reach way out and have a straight arm at the catch." But as soon as somebody creeps up beside you, you throw all that out the window and do whatever you have to do to win. Another thing I've seen is that people start playing little mind games in the workouts. Some people know that once they get ahead of this other person, they can break that person's will and the other person will back off. The goal of the workout becomes to get ahead in the first 15 strokes of each piece, and whoever is behind gives up and allows the person who is ahead to just cruise for the rest of the piece. But if you're on your own, you can concentrate more on pacing out the workout the way it should be done, using a good, hard effort for the entire piece and not just getting ahead and sitting on it.

The following three are his mental approaches to big races:

1. **Use familiar routines at race sites.**

If you can use the same patterns on race day that you have developed in training, I think this helps to calm nerves a lot. Even though you are in a

strange location and there are a lot of strange people and the competition is coming up, if you have a familiar warm-up routine, something you've done over and over again in the past, I think it helps you to just think about the task at hand: you're going out there and you're going to race hard, and you're going to pace it out the way you thought about in training rather than worrying about all those other distractions.

2. Be by yourself just before the race.

It works best for me to go off somewhere and do some stretching and lay down. I've never practiced anything like transcendental meditation or yoga, but I think what I do is similar to what people do when they meditate, like getting relaxed and doing some deep breathing, sort of concentrating on your breathing, in and out, so that you're tuning into your body, rather than worrying about all these outside distractions you have. And then I think about what I'm going to do in the race, how the start's going to be, what I'm going to do on the first few strokes, and what I intend to do in the middle of the race, how it's going to feel and what position I'll be in. And then what the finish will be like. Will I kick at the finish or am I going to try to go out hard in the early middle and just hang on at the end?

3. Stick to the race plan.

When I'm at the start, I try to think about doing my own best time, rather than worrying about some other person two lanes over who has a fast start, or a fast finish. You do have to be aware of what they can do and have a race plan which takes that into consideration, but I think you need to stick to your race plan and not change it because somebody jumped out a boat length at the start and then you give up, or decide you have to make it up right away rather than realizing you have another 800 meters to do it. If you have a race plan of where you're planning to gain and where you're really going to pour it on, you're better off sticking to that rather than letting somebody else dictate your race. Dictate your own race.

Chapter 8

Race Day

This section outlines Greg Barton's activities on race day itself. He likes to get up at least two to three hours before a race or heat, so his body "is well awake and ready to perform." And he figures if you know in advance that the race is at 7 a.m., and you are going to have to get up at 5 a.m., you need to get your body used to getting up at that hour, so you have to start doing it a week or so ahead of time.

If Barton has to get up early in the morning, many times he will go for a short run, "even if it's only a half mile, just to wake up and get the blood moving." This is followed by a light breakfast, and traveling to the race course.

For breakfast, he avoids high fat and high sugar foods, concentrating on complex carbohydrates, such as breads, cereals, and fruits.

> *The problem I have found with high fats and overeating just before a race is that they cause blood to rush to my stomach to digest the food, instead of to my muscles, where I need it for the race, and that makes me feel sluggish. So if I eat some kind of complex carbohydrates, it's a more gradual release of the energy into my system. Also, I've heard talk about high sugar being bad before a major event. A lot of it depends on the person and the length of time before the event. When some people eat a lot of sugar, it actually makes their blood sugar go down. You get all this rush of sugar into your system and then your pancreas secretes a lot of insulin to take care of the sugar and that actually makes your blood sugar level drop below normal. So, if you eat something that is a little more slow-releasing into your system, it gives you a more steady blood sugar level. Then, I'd also avoid eating anything that would upset my stomach. I wouldn't eat any spicy pepperoni an hour before my race because I would be burping it up. And if you're feeling really nervous, you probably ought to eat a little less than normal because when people get nervous, their digestive system slows down and they're left with this food sitting in their stomach.*

Double Warm Up

Once at the race course, Barton often does a "double warm up." He goes out in the boat and warms up for about 20 minutes, comes back in and stretches on shore and rests for about a half hour, then goes out right before the race to warm up again.

In a typical first warm up of a double warm up, Barton would go about four kilometers, which is a convenient distance because many of the regatta courses are two kilometers long, so you can just go down and back. Usually, he would paddle the first two kilometers "at a nice steady pace, not too hard." On the way back, he would "pick it up" for a bit — do a 500 in two minutes, then he might do a 250 at a slightly higher pace and go in. That would all take about 20-24 minutes.

He would plan to be on shore doing some stretching, deep breathing, and resting, from 20-60 minutes, depending upon how long he felt the second warm up should be. That, in turn, is determined by how he feels after his first warm up.

> *If I felt really good and strong in the first warm up, I'd do a minimum of warm up right before the race. But if I'm still feeling kind of sluggish, I'd go out and do some more sprints, maybe a start or two, and perhaps another one or two longer sprints, if I feel I need it. I also think a lot of it is just your mental state. If you're feeling good, then you'll race better. And I make that decision during the first warm up. I think it's whatever I feel like doing that day, whatever makes me happy. If I'm happy, I'll probably race better.*

The second warm up would generally begin about 15-25 minutes before the start of the race, depending upon how he felt. He would paddle about 1,000m, and then pick it up for a little bit — maybe do a start, or a rolling start, and one 250m piece.

> *Generally, I like to do a sprint about five minutes before the start of the race. So, I'm paddling easily and maybe every couple of minutes, I'll pick it up for about 30 seconds, not really hard, like maybe a 60-second 250 pace, something like that, to get the blood moving, but not produce a lot of lactate. It would be about 60-70 percent speed.*

The warm up ends about five minutes before the start and from then until lining up for the start, Barton likes to "cruise around" the start area in big circles at 10 percent speed. He likes to get into the blocks at the same time the majority of other boaters do.

> *I don't like to get there first and just sit, waiting for the others. But I also don't like to get there last, and feel rushed.*

Modification of the Warm Up

Barton would not do a double warm up before each and every heat or race.

> *A lot of times, if I'm racing a series of heats and semifinals, and then the finals later that afternoon, the heats and semis act as a warm up for the finals. The fact that I have already gone out a couple of times that day and gotten my heart rate up a little bit often means that I will not do the double warm up before the finals because I'm already feeling pretty good. Another thing*

I've noticed is that the warm up time seems to vary. When I'm feeling my best, I can get by with less warm up, but you often don't know how you'll feel until you get out there for the first warm up.

Post Race

After the race, Barton does a warm down. If he has to go to boat control, he does that first. If not, he proceeds directly to the warm down, which consists of turning right around after the race and paddling back up the course at 10 percent speed.

But if I have another high intensity race coming right up, like at the '88 Olympics, then I'd do a higher intensity warm down, maybe 60 percent speed, to work aerobically to help get rid of the lactic acid.

If he has another race or heat later in the day, Barton would try to eat a little bit right after the first one.

Maybe I'd pack a banana or some sort of food with me and have something right after I got off the water. I'd observe the same dietary principles I mentioned before: avoid fatty foods and something that would really weigh my stomach down. I'd eat lighter foods, like fresh fruit, grains, bread, then drink some. Plain water is fine.

Generally at races, Barton eats a big supper because that is the only time of the day when he can eat a large quantity of food since he does not want to have a full stomach when he is racing. Since he needs to get the proper caloric intake in order to avoid running out of energy for the next day, supper is the only time he can eat a lot.

Barton's schedule for race day starts with timing everything out backwards from the time of the race.

If the race is at 9 a.m. and I want to have a 20-minute warm-up, that means I have to be on the water at 8:40. And if I want to have a half hour after my warm up to come back and stretch and relax that means I have to finish my first warm up at 8:10.

He does not write out the schedule for the day; he just keeps it in his mind.

Race Strategies

Many factors go into planning a race strategy, such as whether it is a heat or a final, a big race or a less important one, and whether you are a world-class boater or not. For example, if you are a paddler of lesser ability trying to get into the finals at the World Championships, you will have to race the semi-final as though it were the final, but if you can qualify for the final relatively easily, then you need to conserve energy in the semi-final, so it is difficult to generalize about what approach is best for all people. Except where noted, this section deals only with the strategies that have worked for Barton.

In a heat, even if he expects to qualify easily, Barton believes it is best to start out really hard:

I've seen people get caught. Figuring they had an easy heat, they go out easy and look up after a while and suddenly they're in fifth place and there's some

new hot-shot they didn't know about who is way ahead of them and they end up getting bumped out of the race, so I feel it's better to go out hard and then look around to see how the race is progressing. If you're easily in the top three, and there's nobody else around, then you can slack off a little bit.

Many race strategies center around making a surprise sprint somewhere during the race and demoralizing the opposition enough that he gives up. These sprints could come at the start, where someone gets way ahead, in the middle of the race, where someone suddenly jumps out ahead, or in the closing sprint.

People like to have a fast start, especially in the 500, because they think it devastates the person next to them. If somebody pulls a boat length on you at the start of a 500, that's hard to make up, and it's possible that the person left behind is going to have a poor race because he's so discouraged by what's happened. By the same token, if you're grinding along side-by-side with some guy and all of a sudden, BOOM! you sprint for 100 meters and pull ahead by a length, it can give you a psychological advantage and the other person a disadvantage. The same thing can happen at the end. If you know you have a faster kick than somebody else, you know you can go down the whole course even with him and just sprint by in the last 100 meters. One of my psychological advantages is a strong finish. A lot of people think that to beat me, they have to be ahead before the finish. And as soon as I get ahead of them, they give up. For the person who is having these things done to him, the best defense is to try to race his own race and not adjust to someone else's race. Once you adjust, you can fall into their hands. So in preparing for a race, I always tell myself I'm going to stick with my plan and give it whatever I've got, no matter what place I'm in. I'm going to race as hard as I can all the way to the end. If I'm in eighth place coming into the finish, I'm going to try to move up to sixth or seventh. I think that's the best attitude, because when people start playing these sorts of games, the easiest person to take advantage of is the guy who gives up. Once you have the attitude of trying as hard as you can, you rarely come in last in the finals. There are usually a couple of big egos that will blow up in the finals, have a bad start or get behind and get psyched out and end up quitting the race or slowing way down. If you race your best race, you'll end up beating a few people, even if you're the slowest one out there.

For Barton, having his best race translates into trying to have his fastest time, rather than more tactical concerns:

While it may help to take into account what the opposition is doing, if you try to beat somebody by being fast at the start in order to discourage him and hope that he will give up, but you end up going two seconds slower than your best possible time, then you really have to think hard to justify that strategy because you could be beaten by someone other than the guy you were keying on. So, I usually pick a strategy that will allow me to do a fast time, regardless of whether it is better psychologically.

And to have his fastest time, Barton believes he does best by pacing the race out fairly evenly:

If I try to put in a burst of speed at a fast pace, I start producing a lot of lactic acid. I pay a lot when I try to go at a very high speed. I don't have the same natural speed that some of the top racers have.

Pacing

Figure 14 shows splits for a 1,000m race at various final times, in both even pacing (reading straight across from right to left), and at a pacing that is more typical of many racers, including Barton (reading diagonally across from right to left). For example, if you want a time of 3:40, for completely even pacing, you would have to do the 100m in 22 seconds, the 250m in 55, the 500m in 1:50, and the 750m in 2:45 (reading straight across from right to left). But even though he was trying to pace evenly, Greg would probably be closer to the diagonal splits — 100m in about 21.3, 250m in about 53.4, 500m in about 1:48.2, and 750m in about 2:43.5.

Why the difference between the even pacing and the actual pacing? Even though he advocates even pacing, Barton believes it is important to get off to a relatively fast start — the first 50m to 75m or so of the race:

I feel it's important to get up to race pace as soon as possible off the start, not maximum pace, but race pace, so you can do most of the race at that pace. You can probably reach race pace at 50 meters or so, and what you do after that depends on your strategy for that race. For example, especially in the 500, people often keep accelerating the boat past 50 meters up to 100 or even

(Pacing Chart courtesy of Reg Hatch)

1,000m	800m	750m	600m	500m	400m	300m	250m	200m	100m	50m	25m
4:20	3:28	3:15	2:36	2:10	1:44	1:18	1:05	0:52	0:26	0:13	0:06.5
4:16	3:24.8	3:12	2:33.6	2:08	1:42.4	1:16.8	1:04	0:51.2	0:25.6	0:12.8	0:06.4
4:08	3:18.4	3:06	2:28.8	2:04	1:39.2	1:14.4	1:02	0:49.6	0:24.8	0:12.4	0:06.2
4:04	3:15.2	3:03	2:26.4	2:02	1:37.6	1:13.2	1:01	0:48.8	0:24.4	0:12.2	0:06.1
4:00	3:12	3:00	2:24	2:00	1:36	1:12	1:00	0:48	0:24	0:12	0:06
3:56	3:08.8	2:57	2:21.6	1:58	1:34.4	1:10.8	0:59	0:47.2	0:23.6	0:11.8	0:05.9
3:52	3:05.6	2:54	2:19.2	1:56	1:32.8	1:09.6	0:58	0:46.4	0:23.2	0:11.6	0:05.8
3:48	3:02.4	2:51	2:16.8	1:54	1:31.2	1:08.4	0:57	0:45.6	0:22.8	0:11.4	0:05.7
3:44	2:59.2	2:48	2:14.4	1:52	1:29.6	1:07.2	0:56	0:44.8	0:22.4	0:11.2	0:05.6
3:40	2:56	2:45	2:12	1:50	1:28	1:06	0:55	0:44	0:22	0:11	0:05.5
3:36	2:52.8	2:42	2:09.6	1:48	1:26.4	1:04.8	0:54	0:43.2	0:21.6	0:10.8	0:05.4
3:32	2:49.6	2:39	2:07.2	1:46	1:24.8	1:03.6	0:53	0:42.4	0:21.2	0:10.6	0:05.3
3:28	2:46.4	2:36	2:04.8	1:44	1:23.2	1:02.4	0:52	0:41.6	0:20.8	0:10.4	0:05.2
3:24	2:43.2	2:33	2:02.4	1:42	1:21.6	1:01.2	0:51	0:40.4	0:20.4	0:10.2	0:05.1
3:20	2:40	2:30	2:00.0	1:40	1:20	1:00	0:50	0:40	0:20	0:10	0:05
3:16	2:36.8	2:27	1:57.6	1:38	1:18.4	0:58.8	0:49	0:39.2	0:19.6	0:09.8	0:04.9
3:12	2:33.0	2:24	1:55.2	1:36	1:16.8	0:57.6	0:48	0:38.4	0:19.2	0:09.6	0:04.8
3:08	2:30.4	2:21	1:52.8	1:34	1:15.2	0:56.4	0:47	0:37.6	0:18.8	0:09.4	0:04.7
3:04	2:27.2	2:18	1:50.4	1:32	1:13.6	0:55.2	0:46	0:36.8	0:18.4	0:09.2	0:04.6
3:00	2:24	2:15	1:48	1:30	1:12	0:54	0:45	0:36	0:18	0:09	0:04.5
	2:20.8	2:12	1:45.6	1:28	1:10.4	0:52.8	0:44	0:35.2	0:17.6	0:08.8	0:04.4
					1:08.8	0:51.6	0:43	0:34.4	0:17.2	0:08.6	0:04.3

Figure 14

200 meters, then they start to tire out and slow down. Say your maximum speed is five meters per second, the very fastest that you can go, and four meters per second is your 1,000 meter race pace. You want to get up to four meters per second as quickly as possible. There are two reasons for this. The first is that for return on your investment, you get more from paddling the boat at four meters per second than you do at five. If you are at four and put as much power on the stroke as you can, you're still accelerating the boat. But if you're already at five, even if you put maximum power on you can't make the boat go any faster. That's the first reason for a fast start. I've heard others, too, but I don't know whether they're true or not. I've heard it said with the ATP-CP system, it's a "use it or lose it" syndrome, in that for the first five to ten seconds of the race you can put maximum energy into your pulling and it won't strain your lactic system or your aerobic system, as long as you drop off maximum right afterwards. You're not paying anything for it. You could either go slow off the line and be tired at the end or go fast off the line and be tired at the end! I've also heard it said that going off fast pulls your aerobic system into play faster. That's important because even more important than paddling at your maximum aerobic capacity is how quickly you can reach it. And lastly, a fast start is good for you psychologically. For people like me who appear to have really strong middles and ends to their races, it's not that they are going faster there, it's just that they are dropping off less than the others.

Wake Riding

According to International Canoe Federation rules, wake riding is illegal in all but the 10,000m event. A boater can be disqualified for doing it, but it is done all the time and is a major factor in sprint racing.

Generally, Barton doesn't think much about riding anyone's wake in the 1,000m because it is very difficult to win a race by doing this: in order to ride wake, he would have to be two to three seconds behind, which would be hard to make up right at the end, so it is rare that someone can win a 1,000m race after wake riding, but people have won Olympic and World Championship silver and bronze medals by doing it. More typically, it is boaters who are the sixth, seventh, or eighth fastest in the race that can benefit from wake riding if they happen to draw a lane next to a fast boater.

Once you get four to five seconds behind, if the leader is in the middle of his lane and you're in the middle of yours, you're going to hit his wake. And your choices are either to ride it or eat it. You can ride it and it will help you, or you can not ride it and it will hurt you. There is no middle ground. So the sensible thing to do is ride it. If you are counting on riding it, you can go slow off the start and catch it at the 150-meter mark and ride it for 850 meters, but if you go hard off the start, you may not catch it until the 700-meter mark and get to ride it for only 300 meters. So the thing to do is go easy off the start and be rested at the end so you can pull up a place or two at the finish. The other strategy is to go over to the side of your lane, right down the buoy line. Since wakes come off diagonally, being over on the side allows you to ride closer to the boat making the wake. It is illegal, but it is rarely enforced.

Indeed, Barton believes the rules regarding wake riding should be made stricter. At present, the rules call wake riding "hanging." The rule says "it is forbidden to hang," and it goes on to say, "and no boat may be within five meters of another boat." But Greg believes the ICF is interpreting hanging simply as being within five meters of another boat. He points out that it is possible to hang and be further than five meters away, and that should be clamped down on.

The ICF could police this better by making sure that people stay in the middle of their lanes. The lanes in most international races are nine meters wide. I think if it looks like a guy is purposefully going over to the side of his lane, and the guy in the next lane over is ahead of him, it should be assumed that the first guy is going over to ride wake. I think they should red flag it and throw him out. If somebody goes in the middle of his lane and still catches a wake, then that's just life. He can't just stop and let the wake pass him, but if he is in the middle of the lane, he has to be another one or two seconds back to catch the wake, and that greatly diminishes the benefit of the wake.

Strategies in the 10,000m

The 10,000m race is a tactical one and, unlike the 1,000m, where the person who can do the fastest 1,000m time trial would usually win, the fastest person often does not win the 10,000m. Wake riding (legal in the 10,000), paddling in packs of boats, and negotiating turns are all key.

The start of a 10,000 is as fast as for a 1,000, or for some people, even faster. The 10,000 is a pack race and it is important to establish your position right away in the front pack if you want to do well. After that, after the first 1,000 meters, the pace slows way down. There are usually three packs. To win, you have to have a good position in the first pack. If you're back, getting bounced around in the wakes and people are crashing into you, it's all over for you as far as winning goes.

Assuming you make the first pack, there are other considerations. In the early part of the race, all you need to do is be in the first pack, but sometimes the first pack splits and if you are at the end of the 20-boat pack, you're going to be left behind with no way to catch up. The best strategic point is to be one of the first few people in the first pack, including being the leader.

It's true that the closer you are to the lead, the harder you have to work. You are constantly responding to other people trying to move up on you, but the leader is also in the best strategic position. In turns, the leader has the right of way. The rule says that as long as the leader's body is in front of the next guy's bow, the leader has the right of way, so he cannot be pinched off. He has total freedom to cut the buoy close on the turn and the followers sometimes even have to back off a bit to give him room. I generally like to be one of the first three boats. For one thing, I have the endurance to maintain a relatively higher pace throughout the race and still have enough left for a sprint at the end.

The leader also has the option of weaving back and forth, thus making it harder for others to stay on his wake and thus possibly enabling him to break away for good.

Turns

Being on the inside of a turn is riskier but faster while being on the outside is safer but slower. The inside has shorter distance, but you can get pinched off. If your bow is not up with the leader's body, he is allowed to cut you off and you may well have to stop paddling for a moment. The outside of the turn is safer, in that you always have a place to go; you cannot get boxed in. Being in the middle is the worst alternative of all, because you usually end up hitting paddles.

Coming out of the turn is as important as going into it, because a breakaway can be made there. Especially if you are attempting a breakaway going into the turn, you must continue to push it coming out of the turn, or the others will simply catch up again.

The last turn is the crucial one, because from there it is only 500m to the finish. Whatever position you have coming out of that turn is your position for the final straightaway. Here there are two basic strategies. One of them is to have the lead and try to hold on to it. The other is to try to come from behind by riding the leader. People have won from both positions.

Appendices

I. A Comparison of Training in Slalom, Sprint, and Wildwater

In attempting to capture what Greg Barton did for the 1987 season, extensive use has been made of his training log. The author believes, by the way, that logs from such champions are probably the most valuable resource a student of sports training can get and that not enough study has been made of them in the past. It is possible to go through these logs and summarize in charts the work done. One of the key modes of recording the work is the concept of "minutes per week" in several different categories, for the entire year. This is a format the author has used in books on slalom and wildwater racing, too, so someone interested in a cross-discipline comparison may, for the first time, consult the summary data in the following table for world champions in the three kayaking disciplines of slalom, sprint, and wildwater, for selected years.

Training Time in Average Minutes per Week

Richard Fox, Slalom, 1985
Total Training: 789 minutes

Whitewater Gates	379	Weights	81
Flatwater Gates	11	Stretch	58
Downriver Training	136	Bike/Swim/Run	92
River Play	32		
Water Training	558	Total Athletic Training	231

Greg Barton, Sprint, 1987
Total Training: 690 minutes

Flatwater	474	Weights	135
		Running	46
		Bike/Swim/Other	14
Total Water Training	474	Total Athletic Training	216*

* Numbers do not match exactly due to rounding.

Claude Benezit, Wildwater, 1981

Total Training: 566 minutes

Whitewater	68	Weights	68
Flatwater	302	Cross-Country Skiing	49
		Running	47
		Other	31
Total Water Training	370	Total Athletic Training	195

It's wrong to say that this data represents all "top" paddlers in the respective disciplines, but it suggests that slalom may take the most time, followed by sprint, and lastly wildwater. Furthermore, it suggests that top slalomists may spend a larger percent of their total training time in the boat than the others, followed by sprint, and then wildwater. Probably this is due to the fact that slalom requires more varied skills than sprint or wildwater and therefore requires more time in the boat to develop these skills. (For comparison, gymnasts often spend six or more hours per day perfecting their skills.) Total training time should therefore be greater for slalom, but continuous physical exertion is a lower percentage of the total because some of the training is idle time analyzing the water or the gates. It is not readily apparent, however, why wildwater should require less training time than sprint, and it may be just a difference in training methods between two individual athletes.

II. Barton's 1987 Total Training
(in minutes per week)

Week No.	Date	Total Train	Water Train	Total Athletic Train	Athletic Breakdown: Weights	Run	Bike	Swim	Other
42	11/3-9	588	282	306	156	60	90	0	0
41	11/10-16	318	66	252	108	30	0	108	6
40	11/17-23	642	384	258	138	36	48	36	0
39	11/24-30	882	498	384	246	18	72	48	0
38	12/1-7	684	438	246	222	0	0	24	0
37	12/8-14	510	198	312	174	48	54	30	6
36	12/15-21	522	198	324	198	84	90	0	24
35	12/22-28	624	162	462	264	84	0	36	6
34	12/29-1/4	108	54	54	54	0	0	0	0
33	1/5-11	504	331	173	125	48	0	0	0
32	1/12-18	618	336	282	210	36	36	0	0
31	1/19-25	609	321	288	156	72	0	0	60
30	1/26-2/1	683	329	354	228	84	42	0	0
29	2/2-8	642	333	309	220	47	42	0	0
28	2/9-15	588	258	330	216	114	0	0	0
27	2/10-22	660	336	324	222	102	0	0	0
26	2/23-3/1	798	360	438	228	108	102	0	0
25	3/2-8	847	415	432	234	126	60	12	0
24	3/9-15	612	384	228	198	30	0	0	0
23	3/16-22	876	528	348	198	54	96	0	0
22	3/23-29	834	558	276	168	48	60	0	0
21	3/30-4/5	942	738	204	162	42	0	0	0
20	4/6-12	816	498	318	210	54	36	18	0
19	4/13-19	756	510	246	132	48	48	18	0
18	4/20-26	948	744	204	150	54	0	0	0
17	4/27-5/3	582	492	90	54	30	0	6	0
16	5/4-10	678	534	144	108	36	0	0	0
15	5/11-17	912	690	222	186	36	0	0	0
14	5/18-24	546	522	24	0	24	0	0	0
13	5/25-31	714	624	90	78	12	0	0	0
12	6/1-7	696	546	150	108	42	0	0	0
11	6/8-14	774	684	90	54	36	0	0	0
10	6/15-21	678	660	18	0	18	0	0	0
9	6/22-28	822	678	144	66	30	48	0	0
8	6/29-7/5	828	702	126	78	48	0	0	0
7	7/6-12	894	702	192	102	0	30	0	60
6	7/13-19	858	708	150	120	30	0	0	0
5	7/20-26	610	544	66	48	18	0	0	0
4	7/27-8/2	714	648	66	36	30	0	0	0
3	8/3-9	737	695	42	0	24	0	0	18
2	8/10-16	570	540	30	0	30	0	0	0
1	8/17-23	678	630	48	0	48	0	0	0
Totals		28,902	19,858	9,044	5,655	1,919	954	336	180
Avg./Week		688	473	215	135	46	23	8	4

III. Barton's 1987 Monthly Workouts
(expressed as sessions per day)

Month	Workouts	1/day	2/day	3/day	4/day	5/day	off
November	51	6	15	5	0	0	4
December	49	8	16	3	0	0	4
January	42	14	14	0	0	0	3
February	46	10	18	0	0	0	0
March	58	7	18	5	0	0	1
April	58	7	15	7	0	0	0
May	57	10	11	7	1	0	1
June	70	4	8	11	3	1	3
July	63	6	12	11	0	0	2
August	59	6	4	9	2	2	1
Totals	553	78	131	58	6	3	19

NOTE: Five-a-days were done on race days when Barton had many heats and went for a warm-up, heat or race that many times in a day.

IV. Barton's 1987 Water Training Time

The notion of paddling on the water year-round always has struck this author as a key ingredient in rapid improvement in canoeing and kayaking, whether it be whitewater or flatwater, but for many years — and even today in some places — there is resistance to it. The author's theory is that what started out of necessity — it was simply too cold to paddle in European winters — acquired a false rationale. The rationale was that it was better to concentrate on weight lifting, running, cross-country skiing and general athletics for three or four months because it gave one a mental break from being in a boat. For many years, countries following this strategy could win the world championships or Olympics in both flatwater and whitewater, so it became the accepted way.

In retrospect, however, it appears that they were winning for other reasons. They were better-organized, had full-time athletes and government subsidies and they were not competing against athletes who could train on the water all year. What started out as a convenience then acquired a false rationale retarded the sport's development for a long time. The breakthrough to paddling hard on water all year round started with the American whitewater paddlers in the latter 1970's and led in fairly short order to their winning a number of world championship medals.

The development of year-round paddling in flatwater, ironically, seems to have come a bit later, with the emergence of the New Zealanders and Australians. Subsequently, people like Britain's Jeremy West and American Norman Bellingham were able to duplicate those benefits. It is possible that Greg Barton would have gotten better faster had he started paddling outdoors year-round sooner than he did.

In the following table, we can see a breakdown of the 1987 on-water time by percent speed. It is the only method this author knows of in any type of canoeing in which an athlete's entire year — at least the water training — can be expressed with an accompanying evaluation of intensity. It appears likely that methods such as this, or perhaps improved versions, will be an important part of training in future years.

The reader should bear in mind that the 10 percent speed category consists mostly of warm-up and warm-down and the easy paddling time between hard efforts. It was not that Barton consistently went out with the objective of paddling really easily as the major objective of his workout. It is simply that every bit of his paddling time is accounted for here, whereas other boaters may tend to ignore the very low intensity paddling time altogether.

Barton's 1987 Water Training Only (in minutes per week)

Week No.	Total Water Train	Water training expressed as percent speed																		
		100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
42	282	3		5						60		28		18						168
41	66																66			
40	384			3						42					40			65		234
39	498	6									20			106		20			60 . 78 .	208
38	438			3						32		25		25				66		287
37	198			3							6 . 25								54 .	110
36	198																198			
35	162																32	130		
34	54																			54
33	331									19			32 . 24					122		134
32	336	3		4						10			30					83		206
31	321		4		4							45		40						228
30	329		8							42			24							255
29	333	7										74								252
28	258	2		4						22								65		165
27	336	6								12						34		20		264
26	360		8								60			49						243
25	415	7								10				96				63		239
24	384									4			40					29	118 .	193
23	528	1								21		39			53		47			367
22	558	7					10			30		40			48	24				399
21	738	4		8						46		40		32		65		74		469
20	498	4		8						39		20	30	32						365
19	510	6					18			10		42		32				69		333
18	744	3		5			10			75		32				75		92		452
17	492	8					21			22						110			54 .	277
16	534		7		12					25			4			12				474
15	690		6	8	21		6	14	20	53				32		90				440
14	522		6		13		17			30							41			415
13	624		5	11					11		16	14	3		36		50			478
12	546		6				11			23			62			123				321
11	684	3			11		26			23			17		20			51		533
10	660			4	2		8			20			22				62	20		522
9	678							14		18		32 . 18			48		80		62 . 55 .	351
8	702							32		6		18			48	32	75		116	375
7	702		3			10		13			48		51 . 42		16		30		48	441
6	708		14				16	28		7		24		18						601
5	544	3			5		2			24			10 . 16					36		448
4	648	4		15		20		4		17			10					65		513
3	695	7		22		9	4	13				19			16			27		578
2	540				6		32	15		19				6						462
1	630				13		7			3			26 . 36		2					543
Totals	84	125		94		209				770		656		556		870		1,649	13,397	
	37	8		42		133				199		370		140		160		359		

V. Barton's 1988 Total Training
(in minutes per week)

Week No.	Date	Total Train	Water Train	Total Athletic Train	Weights	Athletic Breakdown Run	Bike	Swim	Other
48	11/2-8	642	408	234	150	54	0	30	0
47	11/9-15	696	426	270	174	84	0	12	0
46	11/16-22	744	426	318	180	96	42	0	0
45	11/23-29	744	474	270	132	96	42	0	0
44	11/30/12-6	570	354	216	192	24	0	0	0
43	12/7-13	672	396	276	198	78	0	0	0
42	12/14-20	312	126	186	132	54	0	0	0
41	12/21-27	600	306	294	162	108	24	0	0
40	12/28-1/3	612	378	234	150	36	48	0	0
39	1/4-10	696	372	324	204	90	30	0	0
38	1/11-17	654	348	306	228	36	42	0	0
37	1/18-24	678	366	312	210	60	42	0	0
36	1/25-31	708	384	324	222	72	30	0	0
35	2/1-7	756	444	312	240	42	30	0	0
34	2/8-14	792	486	306	240	66	0	0	0
33	2/9-21	678	366	312	198	72	42	0	0
32	2/22-28	705	519	186	120	66	0	0	0
31	2/29-3/6	786	522	264	198	66	0	0	0
30	3/7-13	708	450	258	180	78	0	0	0
29	3/14-20	792	498	294	192	72	30	0	0
28	3/21-27	792	522	270	198	72	0	0	0
27	3/28-4/3	870	666	204	138	66	0	0	0
26	4/4-10	834	522	312	228	84	0	0	0
25	4/11-17	810	642	168	132	36	0	0	0
24	4/18-24	876	594	282	234	18	30	0	0
23	4/25-5/1	834	630	204	144	18	42	0	0
22	5/2-8	552	480	72	72	0	0	0	0
21	5/9-15	870	696	174	138	36	0	0	0
20	5/16-22	780	570	210	126	0	84	0	0
19	5/23-29	708	558	150	108	6	36	0	0
18	5/30-6/5	738	660	78	18	18	42	0	0
17	6/6-12	588	522	66	0	66	0	0	0
16	6/13-19	714	480	234	144	12	42	36	0
15	6/20-26	582	540	42	36	6	0	0	0
14	6/27-7/3	684	678	6	0	6	0	0	0
13	7/4-10	672	594	78	54	0	0	24	0
12	7/11-17	648	552	96	96	0	0	0	0
11	7/18-24	732	648	84	60	0	0	24	0
10	7/25-31	660	432	228	84	30	6	0	108
9	8/1-7	960	660	300	120	72	108	0	0
8	8/8-14	918	672	246	120	78	0	12	36
7	8/15-21	870	612	258	120	48	0	0	90
6	8/22-28	732	570	162	132	30	0	0	0
5	8/29-9/4	648	564	84	42	42	0	0	0
4	9/5-11	822	660	162	90	54	18	0	0
3	9/12-18	504	432	72	42	30	0	0	0
2	9/19-25	708	624	84	30	54	0	0	0
1	9/26-10/2	432	396	36	0	36	0	0	0
Totals		34,083	24,225	9,858	6,408	2,268	810	138	234
Avg./Week		710	505	205	134	47	17	3	5

VI. Barton's 1988 Monthly Workouts
(expressed as sessions per day)

Month	Workouts	1/day	2/day	3/day	4/day	5/day	off
November	56	5	24	1	0	0	0
December	41	13	14	0	0	0	4
January	51	12	18	1	0	0	0
February	50	8	18	2	0	0	0
March	59	8	18	5	0	0	0
April	57	9	15	6	0	0	0
May	53	10	17	3	0	0	0
June	67	7	14	5	3	1	1
July	70	8	9	7	2	3	2
August	68	8	8	12	2	0	1
September	72	3	8	11	5	0	3
October	4	0	0	0	1	0	0
Totals	648	91	163	53	13	4	11

NOTE: Five-a-days were done on race days when Barton had many heats and went for a warm-up, heat or race that many times in a day.

VII. Barton's 1988 Water Training Only
(in minutes per week)

Week No.	Total Water Train	Water training expressed as percent speed																		
		100	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10
48	408			7						14		30		30		104				223
47	426			5						26		20		70		49				256
46	426		4		1					22		20		30		36		50		263
45	474		4					8		16		58		39		27				322
44	354			3						53		43				36				219
43	396		5					10		16		30		35		36				264
42	126									8										118
41	306													40				209		57
40	378									16		66				36		67		193
39	372			4				5				32				74				257
38	348		4			10				32		36								266
37	366			5				13		35						24				289
36	384			5						38		51								290
35	444		4							35				40		84				281
34	486		5							21		58				86				316
33	366			3				14		20		28				18				283
32	519		4		1			16		21		8		18		18				75 . 358
31	522		4		3		9			9		15				92				390
30	450			4		2		5		12		30		32						329
29	498		8			10				12		4		15			40		36	373
28	522		6				5			22				24		64		49		273
27	666		2		3		8			10		12		16		75			147	393
26	522		5		7					13				16		45 . 24				74 338
25	642		4			12						29		32		30		7		36 492
24	594		6		3					15		15		40				65		36 414
23	630		6					24		10				32		25		36		64 433
22	480		3			12		4		12				24						36 389
21	696		10					11		21				48		82				66 458
20	570		7							37		37		15						474
19	558					8				23		5		20					126	376
18	660		10		4					20				10		30				52 534
17	522					4				10				24				25		44 18 . 34 . 363
16	480					5				28		8		24		13 . 24				378
15	540		3		5									26		29 . 36				54 30 357
14	678		1				8		3			20		36		44				566
13	594		2				7		8			9		20		22		24		44 40 418
12	552				8				8					26		49				37 38 386
11	648		1				7		7			8		15		13		30		57 510
10	432													14				80		110 228
9	660									21				18		18		40		48 100 65 350
8	672		1							48				24		32 . 92				60 415
7	612		2					4		12				22		35		16 . 42		110 369
6	570				9		10			15				46				99		391
5	564		3				19		11					23				15		37 456
4	660		3			5				37				24				3		3 63 56 466
3	432			2		11				7				48				6		44 58 52 204
2	624			8				6				37				8		9		5 551
1	396					8		3		4				11				16		61 293
Totals	113		91		158		448		1,037		1,131		847		1,924		860		16,622	
	45		19		60		181		233		323		24		0		109			

VIII. Last Two Weeks before 1987 World Championships

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Fly to Germany	K-2 6x25", 1' rest; 3x1', 2 rest. 50%	Run 9'	Run 6'	Run 8'		Run 8'
					K-2 2x1,000m 60%	6x70", 20" rest; 4x30", 10" rest.
		3x1,000m every 10', 65%	K-4 5x500m, 5' rest. 70%	2x1,000m, 10' rest. 70% rest. 70%		
		K-2 2x1,000m, 10' rest. 70%	6x500m, 100m easy. 80%	3x500m 100m easy. 80%		
Run 8'	Run 7'	Run 6'	Run 9'	Run 7'	Run 5'	Run 7'
6x250, every 2:. 80%	K-2 1x1,000m; 1x500m. 50%	K-1 Warmup 21" 50%	2x1,000m, 2' rest. 50%	K-1 warmup 21'. 50%	K-1 warmup 500, 250m. 50%	K-1 warmup 500m,
250m.						45%
30' paddle at 40%	500m at 40%	1,000 heat 70%	K-1 cruise, 50%	1,000 semi, 70%	K-1 1,000 final, 80%	K-1 10,000 final, 50%
		K-2 1,000 heat, 80%		K-2 1,000 semi, 70%	K-2 1,000 final, 80%	

IX. Last Two Weeks before 1988 Olympic Games

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
6x25", 60" rest; 4x1', 2' rest. 90%	1,000m, 60%	Run 8'	Run 10'	Run 8'	Run 8'	2x500, 50%
Weights	K-2 2x1,000, 10' rest. 70%	K-2 5x500m, 70%	2x1,000m. 70%	6x250, every 2'. 80%	5x70", 20" rest; 4x30" 10" rest. 70%	K-2 1,000m, 500m. 50%
Run 22'	1x1,000m. 70%	45' at 40%	K-2 1,000m at 60%	K-2 Five starts. 90%		
Run 9'	Run 8'	4x500m, 250 easy. 60%	Run 8'	Cruise 37". 20%	Run 8'	
4x500m, 250 easy. 50%	K-1 warmup 500, 250m. 50%		K-1 warmup 2x500, 1x250 60%		K-1 warmup easy 500m, then harder 500 and 250m. 50%	
	K-1 heat 70%		K-1 semi 75%		K-1 final 80%	
	K-2 warmdown 20%		K-2 warmdown 20%		K-2 warmdown 20%	
	K-2 heat 75%				K-2 final 80%	