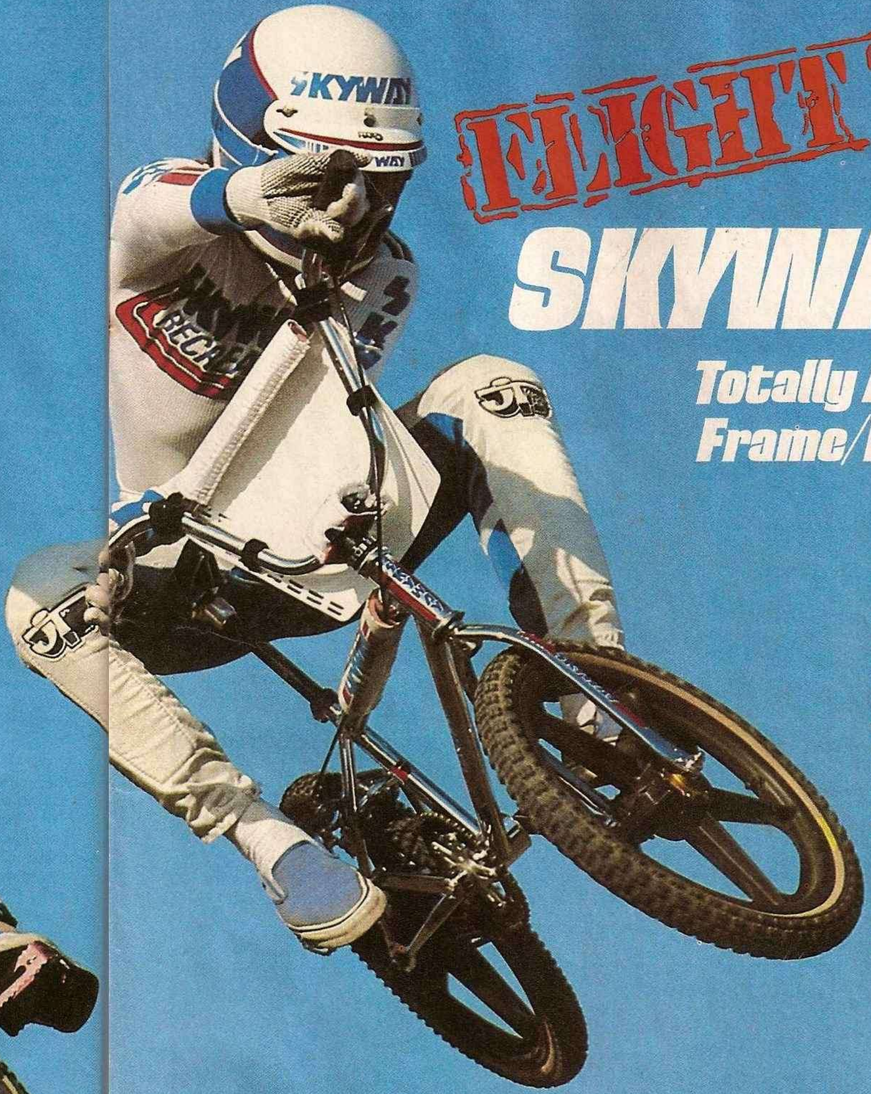
Skyway's twin terrors, Andy Patterson (left) and Bob Medrano take their Skyway T/A's up to 45,000 feet (well, we could be exaggerating a little) for a little aerodynamic experimentation.



FLIGHT TEST

SKYWAY T/A

Totally Aerodynamic Frame/Fork Set

Skyway T/A Test
by Bob Hadley
Photography by John Ker

O.K. O.K. Skyway calls their frame the T/A for "Totally Aerodynamic" but since the entire aerodynamic issue is so complicated and the data available are somewhat irrelevant to BMX, we figured it would be best to address the issue in the accompanying sidebar titled, "Aerodynamics: Just How Important Is It In BMX?". Whether or not the aerodynamic-factor is significant, well, you'll have to conclude for yourself after you read the sidebar.

The T/A's Evolution

Irrespective of the actual virtues of its designs with regard to air resistance, Skyway's aerodynamically-styled frame makes a very smart-looking bicycle. It's no surprise that Skyway put a great deal of effort into the frameset design. The official word from Skyway was that the company worked on the development of the frame for over one year. Initially, according to Craig Raudman of Skyway, once the decision was made to produce the T/A frame, it took quite a search to find someone to produce the unusual tear-drop shape they needed. After looking everywhere in the United States, Skyway finally turned to Japan, where they found two factories capable of producing the special chrome-moly tubes. The Ishiwata Seisakusho Co. Ltd. of Japan ultimately won the job, and we must say, the job they did was flawless.

There were two ways to make the odd-shaped tubing. It could be drawn through a die in the desired shape or, as in the case of the Skyway tubing, it could be drawn round then shaped in a forming die. Once the tubing was dialed in, welding it all together in the right angles became the next step. The trick for Skyway was to figure out geometry that would work as well for the huge Andy Patterson as it would for the quick and nimble pro, Bob Medrano. According to Craig Raudman, countless hours of cutting and redesigning went into the prototypes.

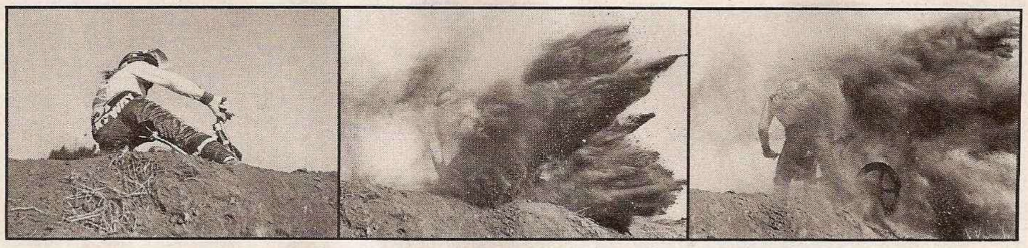
With the geometry finally nailed down, Raudman hopped a plane for Japan to get the final manufacturing specs on the tubing settled. As of this writing, the frames are being completely produced in Japan. The forks are welded then shipped to this country, where Skyway gives them special treatment which involves annealing, re-heat treating, and plating. According to Craig, this is done in order to assure and verify that the fork is up to spec.

Design Consistency

Skyway's treatment of the T/A's fork insures its strength. It is, in fact, much stiffer in resisting thrust loads than other aerodynamically-shaped BMX forks. Like the frame, Skyway's fork is very smart looking, very clean. The tapered and closed-off ends are done in a very well-thought-out manner, consistent with the look of the rest of the bicycle. That's what we like around

This is called style with a capital S. Patterson checks his Graphite Tuff Wheel for trueness. The new Graphites are so trick, it's not even fair.

"Bigfoot" Patterson plants his size 17 (or-something-like-that) foot, pivots all the way around it and puts the T/A's aero tubing to a tough torsional test along this rocky road.



Flight test pilot Patterson. . . Completing his mission: to seek. . . and destroy. . . enemy berms.

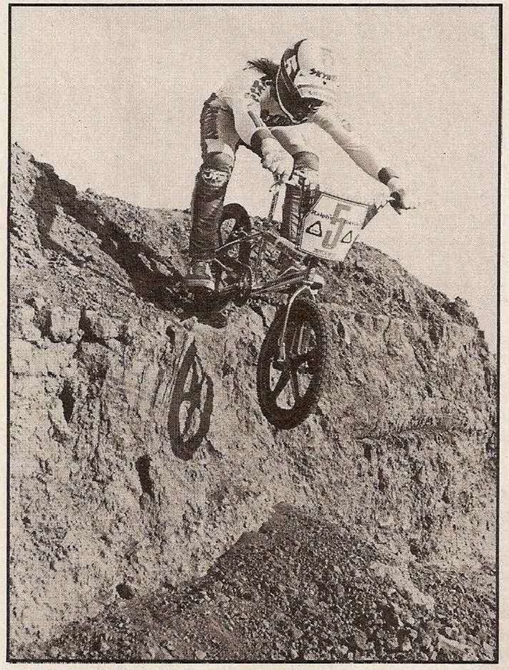
here—consistency. Skyway's fork is clean looking, strong, and lightweight.

On the frame, the top and down tubes are of identical size and shape. The tubes are welded so the sharp radius edge of the teardrop shape of each tube faces the other. This is consistent with aerodynamic styling, as the leading edge of the down tube would be the one to break the air stream. Skyway's own seriousness toward true aerodynamic efficiency of the frame is put into perspective by Craig Raudman: "The real benefit we were after was the increase in weld area that this particular tube shape gives." Examine the joint where the down tube meets the crank hanger. The big radius edge of the tube cradles under the hanger substantially. At the head tube, there is no need for a gusset as the top and down tubes attach over a greater-than-normal area.

At the rear end of the frame, we find neat-looking aerodynamically-styled dropouts spliced into tapered chain and seat stays. The chain stays flare into a larger diameter than the seat stays, offering a good-sized tube for the hanger connection. The seat stays meet the seat tube in a butt joint at the same height as the top tube, but with no overlap around the seat mast. The seat mast is aerodynamically-shaped from the hanger to the top tube. There it regains a round shape. The bike still takes a standard 7/8"-diameter seat post and seat post clamp. Where the seat mast goes from the round to the tear-drop shape is the only spot on the bike that some people think doesn't fit. Some are indifferent, some think it should've been round all the way, and others think it should've been aerodynamically-shaped all the way and used an aerodynamic seat post and clamp like Huffy's Pro Lightning uses. It is strictly a cosmetic issue. Operationally, the design functions as a seat mast is supposed to.

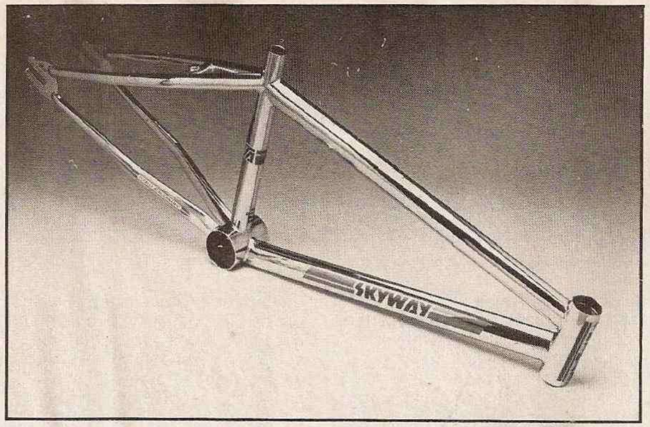
No Nodes

During our test, virtually zero hassles were encountered in setting up, adjusting, and servicing the Skyway T/A frameset. Among the many nice features on the T/A is the positioning of the brake mount in relation to the rear axle adjusting slot. It allows for virtually full-range



Part of our flight test was to see how the T/A handled in full nose dive position. During our trial we found the Skyway jet's front-end geometry to be dialed.

Make no mistake—Flight Commander Miranda has no fear of flying. Under his command the T/A earned its wings and performed like metal of honor.



No. This isn't history in the making—it's already made and ready to race. The revolutionary, new Skyway T/A frame—4 pounds, 7 ounces of airstream dirt racer.

chain adjustment with either a 900- or 1000mm-reach brake. It all depends on your preference of rear—axle positioning.

With any newly introduced brand of bicycle, we always expect some teething problems, like weld nodes that haven't been reamed out of the inside of the seat mast, or perhaps poor threading, or rough keyway notching in the fork. Our T/A frameset exhibited none of those symptoms. Skyway must be commended for a very thorough job.

Finer Points

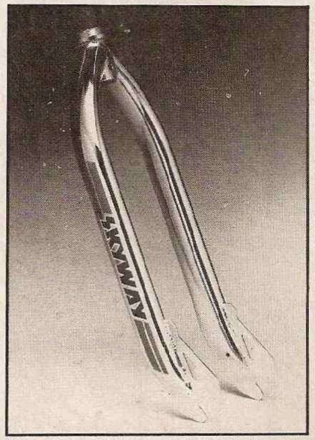
Steering, balance, forgivability, attackability, adaptability, and any other points that you care to bring up that relate to the T/A's handling, can be dealt with academically.

Steering: Grade A. Very light to the touch, quick but not unstable or squirrelly even at moderately high speeds. As with most bikes with quick steering, the more you get used to it, the better it feels, and the more comfortable you are with carving corners.

Balance: Grade A. Off the seat, it power wheelies for speed jumps exceptionally well. With the rear axle in mid-position, the bike has a very predictable balance point. With your weight on or over the seat, it is a dead-even slider.

Forgivability: Grade B. Because it's a quicker-steering bike, we can't give it an "A" for forgivability, but it is still very predictable in slides and wheelies, and when ridden right, the front end doesn't wash.

Attackability: Grade A. With its wheelbase it carves, with its balance it sticks; with its quick response it can be flicked over into a slide. It can be forced to the inside and held there.



The unique T/A fork features beautifully tapered legs, deluxe drop outs and craftsmanship extraordinaire. Weight? A featherly 1 pound, 7 ounces.

Adaptability: Grade B. Again, because it turns quickly, you can't blast off without a little orientation.

Conclusion

Skyway is one company that is respected by its customers for its quality products and willingness to back up what it sells. The T/A reflects their intention to continue to operate this way. It does its job well, and looks great the whole time. It's amazing when you consider that this is their first effort. There are a lot of companies who've been playing this game for years who can't even come close.

Aerodynamics: Just How Important Is It in BMX?

by Bob Hadley

(Note: Aerodynamics is a complicated subject. As it applies to bicycling, it is a very controversial one. In no way do we imply that the following text is a complete and conclusive view of the subject.)

Put the question right out front: Exactly how serious can one be about the aerodynamic factor in bicycling, especially in BMX bicycling? During the last two years, we've been bombarded by "aerodynamics-this" and "aero-dynamics-that," everything from rims to number plates. Is there hard evidence to justify this aerodynamic revolution in cycling, especially as it affects us in the BMX marketplace?

All published research in this area has been based on road cycles only, not BMX cycles. As we look over this information, remember, it is as it applies to road cycling. We will try to relate the information to BMX. This should be fun, don't you think?

Shimano of Japan really started the big rush into aerodynamic bicycling when they published the results of their wind tunnel experiments in conjunction with the release of their Aero line of components. According to Shimano spokesman John Uhte, they were able to achieve a 21.7% total reduction in drag (air resistance). In achieving that figure, Shimano redesigned virtually every component found on the bicycle. That 21.7% figure was based on the total reductions in drag of four individual component groups. According to Uhte, that figure fell to 20.6% when all the components were attached to a bicycle frameset and wind-tunnel tested. So that's a 21.7% reduction in drag for the components when tested individually, and a 20.6 reduction in drag when assembled on a frameset. Uhte also mentioned Araya's wind tunnel tests in which they compared their Aero frameset versus a conventional frameset and recorded a 10% reduction in drag.

To be sure, it seems that aerodynamics is a factor in bicycling. But it's important to put Shimano's results into perspective.

Aerodynamics is defined as the dynamics of gases, especially of atmospheric interactions with moving objects. Drag, or air resistance, as some prefer, is dependent on many factors. The primary factor that Shimano dealt with was the *drag coefficient* of each individual component. The drag coefficient corresponds to the *shape* of the object. The less streamlined an object is the higher the drag coefficient number is.

A bicycle's aerodynamics should not really be considered without the rider. The figure of 20.6% is for the bicycle alone and doesn't include the rider. When you add the rider, he accounts for about 85 to 90% of the *frontal area* of the object. Frontal area is the effective area presented to the air stream. It has to do with the size, not the shape of the object.

With a twenty-inch BMX bike the rider accounts for roughly 60-80% of the frontal area, considering factors such as a number plate (which increases the percentage of the frontal area taken by the bicycle) and the fact that the rider is alternately sitting, standing, and crouching in various positions at anytime.

Roughly speaking then, since that 20.6% statistic (by Shimano) applies only in regard to that 10 to 15% of frontal area that represents the bicycle and not the rider, drag over the total object (bike and rider) is really reduced only about 3%. But when looking even further into the actual mechanics of the cyclist, that figure is generous. The rider's movements interfere with the airstream around the seat, levers, derailleurs, cranks, pedals, and all the rearwardly located components. What effect all this has on the 3% figure we don't exactly know.

Let's look a Skyway's T/A frameset (frame and fork only) in the same light. Assume for a second that it offers a 10% reduction in drag over a conventional BMX frameset, as Araya's Aero frameset did compared to a conventional road frame. The frameset, at best, accounts for maybe 5% of the frontal area of the bike/rider object. It then follows that the overall effect of the more aerodynamic frameset is roughly a 1/2% reduction in drag.

Again, assuming that the previous statements are accurate, and that the aerodynamic considerations of the components and frameset decreased drag on the object by maybe 3.5%, you might say, "So what?" Right? That 3.5% may not seem significant, but there is yet another factor in the drag equation that gives the pro-aerodynamics side some valid points. That factor is the *linear relationship between drag and the square of the velocity* or speed. That means that the faster you go, the more and more important is *any* reduction in drag, whether it's the result of a lower drag coefficient or a reduction in frontal area. Example: as velocity goes from 10 fps (feet per second) (roughly about 7mph) to 20 fps (14 mph), drag increases from (a hypothetical) 100 units to 400 units. To illustrate this more dramatically, consider that as velocity goes from 20fps to 40 fps (about 28 mph) drag increases to 1600 units. Every time the speed doubles the drag increases four times. Such a factor is very significant.

The whole aerodynamic question has also been very controversial among the road cyclists. We asked a leading expert in the field of road cycling, John Schubert, to comment on the subject. He is the Senior Editor of *Bicycling* Magazine, the leading magazine for road enthusiasts in the U.S.

"A good rider might really be sensitive to the difference between, say, and aerodynamic skinsuit and a sloppy-fitting set of riding gear," he observed. "As for components, they seem to be leaning towards marketing that involves progressive levels of esoteria..."

Other Pros and Cons

Anti-aeroists question the benefits of aerodynamic components, claiming they are often heavier than comparably valued non-aero items. According to John Uhte of Shimano, in the cases where aerodynamic parts do weigh more, it's only by a few grams, and the aerodynamic benefit far exceeds that minor weight factor. One might also point out that some aerodynamic components may be lighter than conventional components.

In one particular area, there is very dynamic proof that aerodynamics has an effect on cycling. Go back several paragraphs to where we talked about drag coefficient, where Shimano dealt primarily with *reducing the drag coefficient of each component*. Obviously, their results still left some people skeptical, but there are no skeptics when you dramatically reduce the drag coefficient of the entire bike/rider object. Case in point: the Annual Human Powered Speed Trials. According to John Schubert, "After only one or two events, everyone gave up on trying to compete on an ordinary upright bicycle. They can't come within 20 mph of the speeds attained with a streamlined vehicle." A recumbent, as they are called, streamlined vehicle is a tricycle or a bicycle designed to do one thing: go fast in a straight line. The rider or riders sit low (practically lying down) inside a smooth super-thin, fully enclosed aero cockpit that's less than an inch off the ground. Such vehicles are capable of speeds up to 60 mph. Needless to say, their drag coefficient is very low. What makes the streamliner so successful can be somewhat explained by information published in "THE BICYCLE, A Module on Force, Work, and Energy," by Philip DiLavore of Indiana State University in a project coordinated by the American Institute of Physics. DiLavore discusses the flow of air around an object as either "laminar," meaning smooth, or "turbulent," meaning irregular. True laminar flow occurs only for very tiny particles moving at very low speeds. As speed increases for the bicyclist, the turbulent flow of air behind the moving object has a great effect in impeding the movement of that object. The shape of a streamliner allows for a much smoother (more laminar) flow of air around the object and leaves the flow of air behind it much less turbulent than that caused by an ordinary cyclist.

The advent of aerodynamic research for bicycles has led to a whole new area of research: low-speed aerodynamics. As David Gordon Wilson, Professor of Mechanical Engineering at the Massachusetts Institute of Technology, stated in the pilot issue of *Bike Tech* magazine, "After a century of aerodynamic research on vehicles of increasing speeds and sophistication, not all is known about low-speed incompressible flow around wheeled vehicles running on smooth surfaces."

Naturally, research and continued windtunnel testing will eventually provide the bicycle industry with what it needs to know, and the result should be more dramatic improvements in aerodynamic components.

You might try these experiments:

A. Observe a trail of cigarette smoke (preferably someone else's) as you pass your hand through it. Did you notice the smoke swirl about and break up in the turbulent air? Can you pass you hand through it slowly enough to create a laminar flow of air? Try holding your hand vertically in the rising smoke trail. Try holding your hand horizontally in the rising smoke trail. Is either flow laminar?

B. Find a safe, long, downhill strip of pavement. Coast down standing up on your pedals, trying to catch as much air as possible. Coast down in a low aerodynamic tuck. Did you notice any difference? Come to any conclusion yet?