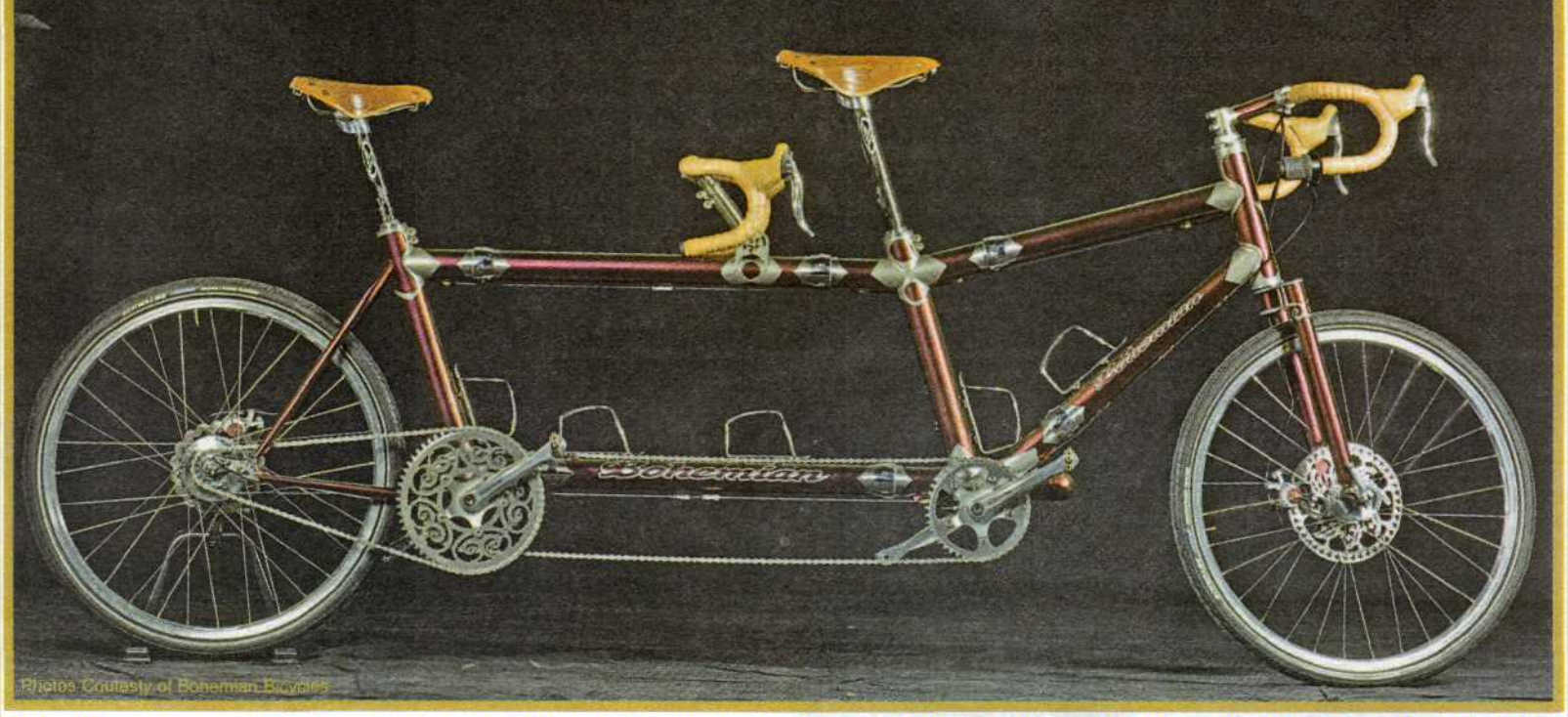
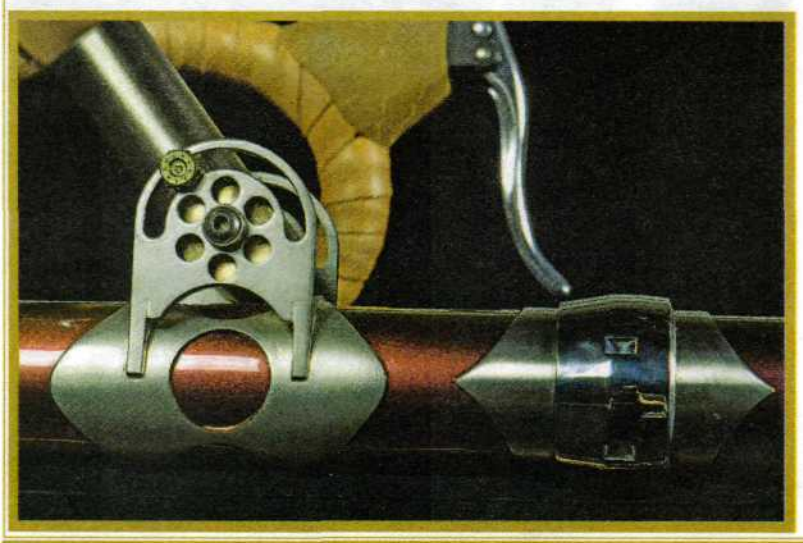
Bohemian Rhapsody

by Dave Bohm



Photos Courtesy of Bohemian Bicycles

This bike represents a complete redesign of the tandem, utilizing the open frame geometry and oversize tubing - a design I began building in 1996. One of the most important features of this bicycle is the extra length added to the stoker compartment. Along with the integrated stem, this allows easily fitting stoker sizes from 5' to 7' tall. Additionally, a third section can be added via the S&S couplers to convert this from a tandem to a triplet bicycle.



Some of the features of this completely handmade bicycle, in which all specialty items of the frame except the S&S couplers were designed and fabricated in house, are as follows:

- **Hand made Stainless steel 2" lugs throughout, 17-4 ph stainless steel used for all structural items**
- **Brand new concept and design of skeletal bottom brackets and eccentrics**
- **Integrated stoker stem allows for a a full range of fiting possibilities for your tandem partners**
- **Twin plate fork with redesigned fork safety tabs prevent possibility of accidental wheel release**
- **Rohloff drive allows for simplified gearing, reliability, one side drive and ease of packing**
- **All seat sleeves, BB shell parts, pinch bolt bindings, drop-outs front and rear, fork crown were all designed and built in house**
- **Paint is house of Kolor Kameleon Magenta to Gold**
- **Capped off with a pure silver hand fabricated headbadge**

I have always been very interested in tandems. Since I began as a framebuilder, one of my goals has been to build wonderful tandems in addition to my custom singles.

Single bicycle designs date back to the mid 1800's, tandems a bit later. The single bicycle has had almost 150 years of engineering

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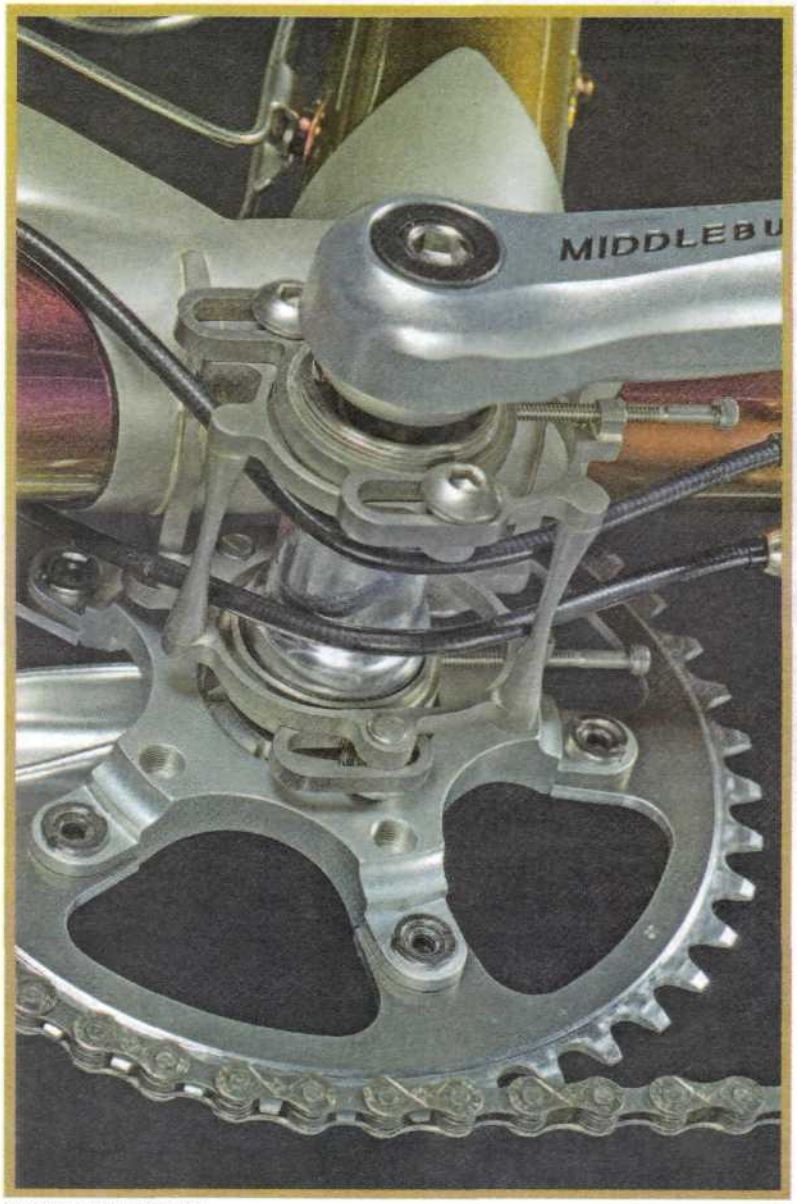

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and refinement but often tandems have had less attention and resources applied to their design.

I have always wanted to refine some shortcomings that I perceived in current tandem design. First, I wanted to address fitting. I often see tandem teams where the stoker does not seem to be able to emulate their single bicycle position. When standing, the stoker is often more upright than normal and is not able to replicate their single bike position while on the hoods or in the drops. I thought that some extra length in the stoker compartment would alleviate this issue.

Long stoker compartments are a feature of all of my tandems, but they create two issues in that current stoker stems cannot give the adjustability necessary without a lot of flexibility in the stem itsel as well as strain on the captains' seat post. To resolve this I came up with an integrated stoker stem. It is the best feature of my tandems in that it is not an afterthought but is integrated structurally on the tandem top tube. It is adjustable in 180 degrees and telescopes so that with only two sized extensions it can fit a range of stokers from under 5 foot to 7 foot tall. Although many tandem teams ride only as a permanant pair, would it not be nice to open up your tandem experience to your friends and family? This tandem allows that possibility and can be adjusted to a new stoker in minutes.

Eccentric adjustable bottom brackets have always been problematic for me personally and I thought there must be a better way. Eccentric bottom brackets have a tendency to make noise. Some designs such as the set screw type can be difficult to fine adjust. Large eccentric shells also have a tendency during welding to distort and make the fitment of the aluminum insert difficult. Joining three large tubes (downtube, boom and seat tube) to an

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eccentric shell also means that one must abbreviate the weld area substantially to mate all these tubes together.

On my Rohloff hub equipped single bicycles I had a lot of success with sliding drop-outs instead of eccentric bottom bracket shells. I began thinking about how one could incorporate this feature to adjust the tension of a timing chain on a tandem. For this I designed an exo-skeletal bottom bracket that slides horizontally and has adjustment screws to help fine tune the chain tension. The system integrates the bottom bracket bearings and the spindle as part of the structure itself. It is very easy to use. And it allows the use of an uninterrupted boom tube which solves the abbreviated welding issue I talked about previously.

This brings me to one of the most obvious design components, the large oversized tubed open frame design. I have been a proponent of the open frame design since the early 90's. Tandems have been an evolution of design using existing components and tubing. In the 70's and early 80's, tandem tubing was really just single bike tubing that had been lengthened to work with tandems. It was very short by today's standards, and the only way to increase stiffness in a frame was to add more tubing. Then companies such as Santana began to oversize their tubing and this lead to the direct lateral that is prevalent today.

I started to do some research with the thought of what the most efficient tandem frame design would be if limitations in tubing were not taken into account. What I found through calculation and FEA analysis is that it is most efficient to utilize much larger tubing and minimize the overall structure. To this end I use double butted 1.75" or 2.0" throughout the frame. This makes for a very ridged and efficient frame with a minimum of weight.

Tandem seat tubes contribute greatly to torsional stiffness, but designers have not increased diameters of these very important tubes because of the difficulty of fitting seat posts and drive-line parts such as the front derailleur. I feel that the increase in structural strength and stiffness is worth using the large diameter tubes, even though I have to custom machine specialized seatpost sleeves and front derailleur mounts. The chainstays are nearly a full inch in diameter; they are fully round, not an oval, which helps with lateral rigidity greatly. The frame is also very compact and easy to pack, breaking down into two larger pieces and 4 straight sections.

The Bohemian tandem uses the 1.5" steerer standard for the head tube. This allows full welds and large tubing diameters to be used, and looks towards the future by minimizing design differences between road and MTB tandems, and allows for different headsets (this frame uses a reduction headset to a 1.25" steerer).

The bottom bracket design

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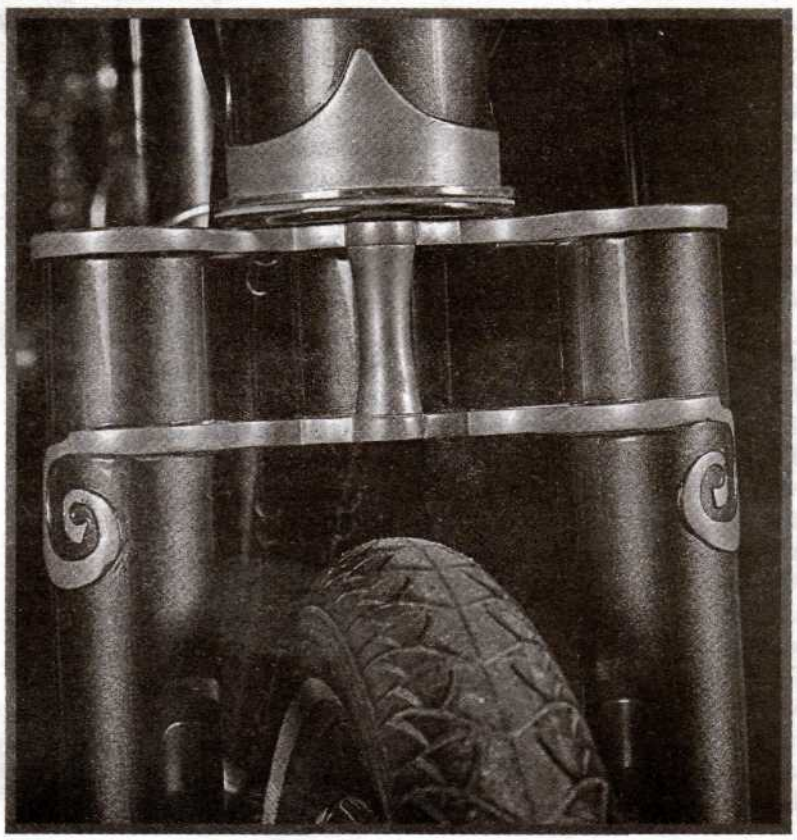

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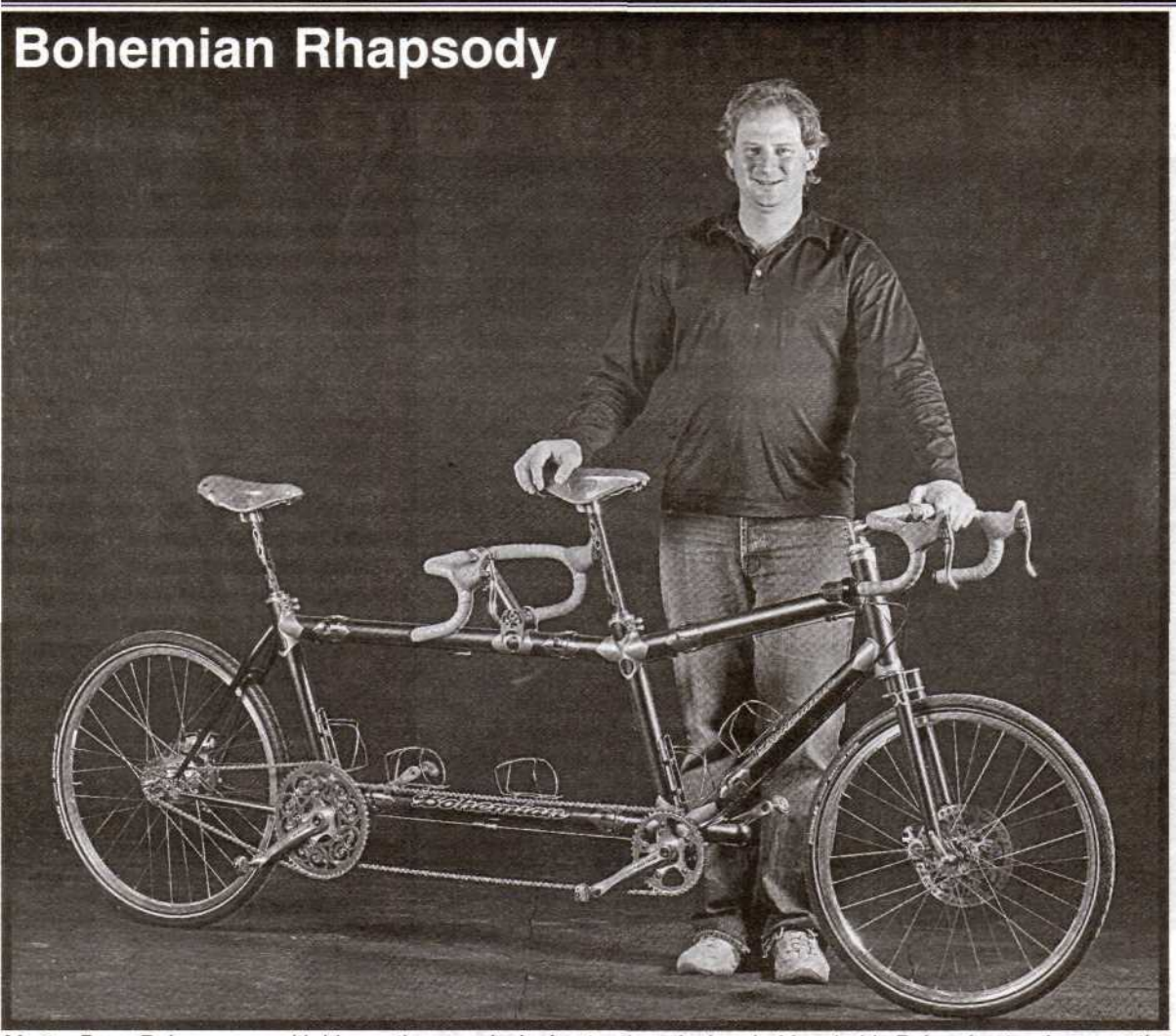

Mystro Dave Bohm poses with his exotic, award-winning tandem design. In Maceh, his Bohemian tandem won the award for the best tandem at the 2007 North American Handmade Bicycle Show, held in San Jose, California.

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also allows for a completely uninterrupted boom tube. By doing this the structural integrity of the tube is maintained and no single tube on the bike intersects another tube. This gives a full weld to each and every tube and increases strength and stiffness.

The majority of Bohemian tandems are spec'd with a carbon fork but for this particular frame I wanted dual disk brakes. For this I created a dual plate fork with a disk mount. The blades of the fork are actually seat tubes made for singles, the lowers of the fork have custom machined domes and drop-outs. The drop-outs are particularly interesting. They are a special "J" design in which the front wheel goes up and then back. This prevents any possibility of the front wheel being pulled out of the dropout during heavy braking, and still allows for easy release without annoying lawyer's tabs. The rear drop-outs are a custom design that works specifically with the Rohloff speed hub.

The Rohloff Speedhub on this frame is also part of the integrated design. The Speedhub allows for simplification of the drivetrain, ease of use and ease of packing and shipping. The speedhub offers numerous advantages for tandems, including reliability, low maintenance, ease of shifting, shifting at a dead stop, wide gear range and clean looks.

In order to manufacture all the various assemblies on this frame (front BB, rear BB, stoker stem, fork crown, drop-outs) everything was first designed, built and finite analysis tested in a program called SolidWorks. This allowed me to build the assemblies virtually; making sure everything would operate as expected and test these parts for overall levels of stress with the software. Then, all parts were either laser- or water jet-cut from 17-4ph stainless plate steel (Note: All stainless parts on this frame are made from a super high strength stainless steel called 17-4ph. It is more than 5 times stronger than standard stainless steel which allows me to design lightweight parts that are corrosion resistant.) Some parts were machined in-house on CNC equipment. Next, the assemblies were all welded or brazed together (the front BB has 12 parts to complete it). These assemblies were then finished and put aside for final construction.

Lastly is the icing on the cake, if you will, that is the lugs, paint and head badge. This is the only fully lugged tandem I have ever created. Since no lugs exist for 2" tubing I had to produce each one by hand. They started off as stainless exhaust header tubing which I mitered and TIG welded just as one would weld Titanium. The lugs were then hand shaped and the welds ground and polished. They were then assembled into the final frame. In essence it is building the frame twice. One joint for every lug and then again when final construction occurs.

The paint is a House of Kolor Shadeshifter that goes from magenta to gold. Although sometimes this effect which works so well on motorcycles and cars is lost on bicycles, this frame is of such proportion and tube size that in the sun the effect is stunning. In order to mask off all the lugs, prep, paint and then finish, this paint job represents over 100 hours of time to complete.

Lastly, the crowing glory is a pure silver hand-crafted head-badge. I make these one at a time at my jewelers bench. Each one is hand cut, embossed with small chisels and applied as part of the frame before the paint is applied.

Overall this frame is the most time intensive bicycle I have ever produced, representing more than 600 hours of design, testing, redesign, fabrication and finishing. But more than that it is not a one-off concept bike. I am integrating all these features into my standard product line.

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