

Reflections on the past, and the next, thirty-five years of human-powered flight

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The MacCready *Gossamer Condor* won the Kremer Figure-Eight Prize some thirty-five years ago. Quite a lot has happened in the world since then; just consider the rise of the global internet as one example. It may perhaps be instructive to reflect on some things that HAVEN'T happened, and I have one particular item in mind: ubiquitous personal aviation. In 1977 the "flying car" was still a topic of popular imagination, hang gliding was a rapidly-developing sport, and ultralight airplanes were not quite on the scene but in a few short years would burst onto the world stage. Yet examining our airspace in 2012 it's quite obvious that those flight developments have not become widespread but rather the reverse: they have dwindled and become marginalized. As one writer has said, the flying car never happened and WILL NEVER happen, but what we got instead were flying buses!

When things that fly are seen as boring but necessary utilitarian devices (modern airliners with every seat occupied), weapons of terror (think of Sept. 11, 2001 and the subsequent reactionary wars), or relentlessly-patient and deadly overhead specters (Predator drones), the public imagination goes searching for other forms of challenge, entertainment, and accomplishment. Personal flight has become the province of a few dedicated enthusiasts. Yet things go in cycles, and I think it's possible personal flight may have a renaissance, especially human-powered flight.

There are a lot of obstacles. Take a look at the Wikipedia entry for Sports in the United States, outdoor sports in particular, and notice the complete lack of mention of anything involving flight. Having been an active hang glider pilot in the 1970s, I can attest that being a hang glider pilot involves quite a lot of "hang waiting": idling around at launch hoping the conditions will improve. Contrast this with mountain biking and road cycling: both can be practiced nearly anywhere at any time. The estimate is that there are about one billion bicycles worldwide, and it's completely reasonable to expect that number to grow, for a variety of reasons. It's equally reasonable to expect the number of hang gliding, paragliding, and soaring pilots to dwindle, for a crucial reason: all of those sports are heavily dependent on the easy and cheap availability of petroleum.

"What?", you say "my flying device is engine-less; it burns zero fuel!" Ah, but consider that if you didn't have a motor vehicle to transport your engineless flying device to a suitable location, or even just to transport your fleshy body to the flying field, you'd be far less likely to take part in any form of personal aviation. Plus consider how difficult it would be to construct your flying device if cheap abundant energy was not available.

More than half the world's population now lives in large cities, an amazing if quite logical development. Large cities are quite hostile environments for personal flight.

Where does that leave pedal-powered flight? An interesting quandary is that with the growing use of bicycles for both sport and necessity, there are going to be more and more people of all ages that are comfortable with cycling, so pedal-powered flight will have more and more potential "engines." I was truly a freakish outlier in the mid-1970s, riding my bicycle hither and yon in the Central Valley of California. Now when I visit my old college town of Bakersfield, just south of the historic airfield where the *Gossamer Condor* won its prize and the *Gossamer Albatross* was developed, I see many cyclists of varying ages enjoying the numerous and well-constructed cycling paths tracing across that city. Many other cities around the world are creating and sustaining a vibrant cycling infrastructure.

How do we create interest in and excitement about human-powered flight? Several arguments for making such flight more popular have little validity, in my opinion. Humor me while I pummel a few of them:

- **Pedal-powered flight could encourage people to take part in health-enhancing sporting activities** - though beloved by some, including Henry Kremer and my *Albatross* project coach, Joe Mastropaolo, I just don't see why people are going to line up to do 15-minute ground-skimming flights at 20 mph in a \$100,000 carbon-fiber airplane when they could more accessibly ride their carbon-fiber road bikes at the same or greater speed through vineyards and along riverbanks with groups of like-minded cyclists, getting better exercise to boot.

- **Flight on your own power is a centuries-old dream that many desire to accomplish** - oddly enough, it's sometimes the things we DON'T dream about that become the most widespread, and most appreciated. Ancient Greeks may have looked longingly up at the birds, envying their effortless-appearing travel, but I don't think it was so much the altitude the birds achieved but their ability to cover great distances with relatively little effort that they envied. That is something eminently do-able now if you have a nice light bicycle and a smooth road! Also, look how few mentions there are in ancient texts of media-rich communication of voice and vision at great distances, yet notice there are over 5.6 billion cell phones on the planet. Smart-phones are BETTER than we dreamed we could do; just look at an old episode of Star Trek with its crude "communicators" and "Tricorders" to see how limited our dreams can often be!

- **Human-powered airplanes (HPAs) are an excellent motivator for the young to pursue science and aviation** - I don't respect the oft-repeated notion of building something complicated to "inspire" people. I think it's difficult to find a curious person, particularly a young one, who needs some sort of expensive or elaborate technology in order to find wonder and challenge in the world. Simpler is oftentimes better, and a simple interest that brings people together is far more likely to inspire people than a mechanical device like an HPA that is, let's face it, arcane and exotic.

• **HPAs inspire us to do More With Less** - this is the misguided idea behind all manner of techno-dense devices promoted by a few. For two examples, see the single-seat *Solar Impulse* airplane (wingspan of an A340, millions of Euros in cost) or the Planet Solar *MS Turanor* solar-powered boat that recently circumnavigated the globe (another multi-million Euro creation.) Though marvelous feats of engineering, salesmanship, and financing, they are both illustrations of extremely unsustainable technology, little more than play-things for the wealthy. Oh, and by the way, our planetary goal needs to be **not** More with Less, but **Less with Much Less**. More with Less is just a re-statement of Jevon's Paradox, an unsustainable strategy in a world with limits.

So where might HPAs fit in a world of large cities, post-peak oil, and growing social connections? Here are a few of my reflections:

• **Don't worry about it** - there are all sorts of groups that take part in arcane activities, from medieval weapons-use to trance-dance mysticism to knitting sweaters for chickens. Maybe that's the province for human-powered flight groups, and the internet allows such a dispersed esoteric community the chance to band together and encourage enthusiasms.

• **Simplify** - the more you can make your HPA accessible and affordable like a bicycle, the better. Antoine De St. Euxpery wrote: "*Il semble que la perfection soit atteinte non quand il n'y a plus rien à ajouter, mais quand il n'y a plus rien à retrancher.*"

Translation: "**It seems that perfection is attained not when there is nothing more to add, but when there is nothing more to remove.**" The challenge is, I think, to come up with a simple and low-cost HPA that is just barely good enough to allow people to do multi-minute flights. Strangely enough, such devices have already been built more than once. There is an entire nation that has brought this discipline in HPAs to a high art: Japan. I'll speak to that example a bit later.

• **Concentrate on flying, not building** - so many HPA projects have been dominated by personalities that like to *build* things. Try to find a way to encourage a community of flyers, not builders. This probably requires a radical re-think of any HPA project.

• **Plan for multi-hour operational life** - to design something that can do a spectacular flight, once, and then be retired to a museum is quite a bit different than designing something intended for repeated use. If your aircraft is worn out after a single outing, you've perhaps succeeded at building an artistic statement but have probably failed to do anything that will build an ongoing community of flyers.

• **Think globally** - the Japanese Birdman rally is an ongoing experiment in the art of human-powered flight. I'm puzzled that their progress has been so under-appreciated by the rest of the world. Teams there have made some incredible flights; why is the rest of the world not imitating their success?

Can we envision a mindset that sustains and nourishes human-powered flight? I think so. Some suggestions:

• Re-examine your motivations. If affordable flight is the goal, the *White Dwarf* pedal-powered blimp is a much better aircraft to emulate than *Daedalus 88*. If you insist on making a fixed-wing aircraft, you could do a lot worse (and most groups & teams do!)

than making a copy of the *Gossamer Albatross* or the *Musculair 2*.

- It's better to make a cleaned-up and simplified copy of something that already worked than it is to come up with some new configuration that may or may not be an improvement. Don't be innovative; get out there and fly!
- Closely examine what the Japanese have accomplished with their yearly Birdman Rally. Is there some way to export that success, or even better to join it? Jesse van Kuijk is in Japan right now (June 2012) preparing to compete in the 2012 event. There should be more groups following his example!

Fixed-wing human-powered flight has seen numerous examples of designs that work. Little will be accomplished by trying to come up with new designs; much may be accomplished by taking existing designs and modifying them to make them more quickly and cheaply, with the goal being human-powered aircraft FLIGHT, rather than HPA *building*.

On the other hand, no one has yet built an elegant and optimized human-powered airship. The *White Dwarf* was a stage prop built for a comedian, yet it was flown 1000 feet above the ground and on a flight of nearly nine hours, traveling nearly 100 Kilometers. One of its world records still stands, nearly thirty years after its record flight in 1984.

So in summary, I suggest the following for human-powered flight enthusiasts in the future:

- Don't get innovative; build a really nice copy
- If you insist on being innovative, build a blimp
- Take notice what the Japanese have done, and either emulate them or join them.

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Author bio - Bryan Allen has flown seven different human-powered aircraft, winning three large aviation cash prizes and setting numerous world records in the process. He works as a software engineer at the Jet Propulsion Laboratory in Pasadena, California, performing spacecraft commanding, data accountability, and ground data system support for the Mars Reconnaissance Orbiter spacecraft. He is an avid ultralight hiker. He will soon be combining two of his passions (camping and bicycling) while pedaling several hundred kilometers through France with his lovely lady Michèle.