

INTERVIEW

Steven K. Roberts

Steve Roberts is a high tech bicycle nomad. His BEHEMOTH (Big Electronic Human Energized Machine...Only Too Heavy) is his third generation computer and communications-laden recumbent bicycle. Roberts has travelled extensively across the U.S. riding the BEHEMOTH. When we met up with him, he was towing his recumbent bicycle around in a trailer he calls The Mothership.

While 40 year old Roberts is hardly your typical user, his endeavors have provided a most unique and challenging testing ground for a number of products and technologies. Perhaps more important, Roberts is a Human Energized Publicity Machine, having appeared in dozens of articles (including one on the front page of *The Wall Street Journal*), TV programs, and radio programs (a BBC World Service "Megamix" piece on Roberts was taped at Datacomm Research Co.'s office).

Now Roberts is moving from roadway to seaway. His latest project is The Microship--an amphibian sea kayak/trimaran with solar, sail, and human power. Roberts plans to begin construction in June, 1993 and resume full time travel in early 1995.

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WIP: What is Nomadic Research Labs' mission?

Roberts: NRL's or my own? NRL exists to wrap a business framework around my nomadness -- yielding the illusion of stability along with cash-flow from publishing and speaking about the adventure and associated technology. My own mission is quite different: I found a way, about ten years ago, to blend all my passions into a lifestyle.

What this translates into is full-time wandering via machines that render my physical location irrelevant via computers, communication links, and on-board power generation resources. The passions -- learning, tinkering, radio, networking, adventure, romance, change -- are all so deeply intertwined that there is no longer any distinction between work and play. I just build nomadic platforms, travel and write with them for a while, meet interesting people, hang out in the network, and throw myself into every intriguing new technology that comes along.

It's a lousy job, but someone's gotta do it...

WIP: Tell us how the BEHEMOTH came about.

Roberts: Well, BEHEMOTH is the third-generation system, probably the last of the bicycle line since I'm moving next to water. The first, the Winnebiko, was in some ways the most elegant--just a custom recumbent bicycle with solar panels and security... upon which I carried laptop and modem. It was sleek and efficient, and I rode it about 10,000 miles in a convoluted path across the US... but I couldn't write while riding.

This led to the Winnebiko II, which I pedaled about 6,000 miles on both coasts. A handlebar keyboard and integrated micros let me write and do email while riding, though the on-board machines were pretty anemic and the system architecture was absolutely inflexible. After a few years I grew tired of editing with a soldering iron and decided to do it right.

BEHEMOTH was developed with the intent of making EVERYTHING an addressable

device in power, audio, and datacomm domains -- not to mention the quest for some very robust computing tools. It involved 3.5 years of work, help from about 150 sponsors, and the generously donated time of some 40 volunteers. Most of this took place in Silicon Valley and Santa Cruz, with the last 18 months of the project hosted at Sun Microsystems.

WIP: How is your work financially supported?

Roberts: Well, I've always had a policy of not asking sponsors for money -- just products. Being on the payroll would make me appear to the media as just another publicity stunt, and destroy any technical credibility I may have. I've had a few offers, but I don't want to fly anybody's flag.

Unfortunately, I am not independently wealthy <sigh>, and must actually work for a living. This I do by freelance writing for a variety of markets, going on speaking tours around the US (I'm writing this in a motel in Evanston, Wyoming), and occasionally taking on a consulting job. I also have a few books on the market and publish my own quarterly newsletter, *The Nomadness Report*, which is a lot cheaper than this one. [EDITOR REPLIES: Then why is it you, not I, who rides a \$300,000 bicycle?] Send \$15 to NRL, PO Box 2185, El Segundo, CA 90245, say you saw it here, and ask for a flyer on Computing Across America and The BEHEMOTH Technical Manual while you're at it.

WIP: Give us a rundown on the computer and communications capabilities on-board.

Roberts: BEHEMOTH's original design goal was to render my physical location irrelevant -- without any loss of computing resources, connectivity, or operating convenience. As such, it contains a broad (and in some ways, redundant) array of systems. The main console machine is a Macintosh, with handlebar chord keyboard and ultrasonic head mouse. This is my primary work environment for email (Eudora), writing (Word), and graphic database management (GeoQuery and ACT!). It also is the GUI to my distributed control architecture, which consists of three 68HC11s

running New Micros FORTH.

There are also a couple of Ampro DOS machines--one running the Private Eye helmet-mounted display and the other a VGA screen behind the flip-up Mac LCD. The former handles macro expansion from the handlebar keyboard as well as diagnostics; the latter runs OrCAD and Autocad. And the "big iron" in terms of raw computing power is the SPARCstation behind the seat (I've always wanted to ride a unixcycle). This is to support still video, the new CAD software, and Morningstar PPP for Internet connectivity via CellBlazer modem and cellular phone.

The communications links are diverse, since another goal was to have near-100% probability of being able to reach someone, somewhere, anytime, from anywhere. As such, the comm tools include ham radio (HF, VHF, UHF, ATV, packet, CW, SSB, and AMTOR), 2 cellular modems, and a Qualcomm OmniTRACS terminal that has been integrated into a custom Internet mail path between Eudora on the Mac and a SPARC on CERFnet in San Diego. There are also some smaller tools: Motorola RNET for backpack-bike communication and a Motorola NewsStream text pager attached to the H-P 95LX palmtop.

All of this, of course, is powered by solar panels and interfaced into a reasonably consistent control architecture,

WIP: Describe the GPS and security features

Roberts: There are 6 inputs to the security decision matrix, as well as 6 possible actions. Any combination of the former can trigger any combination of the latter, and these collectively form "security macros" that are applied to various operating conditions (parking in front of a restaurant is a very different case from leaving it out in a backyard overnight).

The inputs are microwave proximity, physical motion, access panels opening, cables

being unplugged, wheels moving, or GPS satellite position fixes changing significantly without the right password. Clearly, if the latter are occurring in correlation with others, then we have a major alert and all hell breaks loose: speaking locally, beeping me with pocket pager, sending a help message via the Qualcomm satellite terminal, beaconing on ham packet frequencies, and dialing 911 to issue a voice help request tagged with lat-long data.

WIP: Describe the highlights of your nomadic adventures.

Roberts: Well, to really do that justice, you need the Computing Across America book as well as the "Miles with Maggie" sequel-on-disk (\$15 each from Nomadic Research Labs). There have been 17,000 miles of encounters romantic and bizarre, a decade of philosophical insights, three complete system versions with over 150 sponsor relationships, dozens of layovers, a few accidents and minor disasters, and countless observations about life in this strange land (and this strange network).

WIP: Which mobile data services have you used on the road? What is your assessment of their performance?

Roberts: I have used various cellular modems to access the networks, the receive-only Skypage service (Motorola NewsStream on H-P 95LX), and an extensively customized implementation of the Qualcomm OmniTRACS system. Let me comment briefly on each.

First, the cellular modems. While not a "mobile data service" per se, the effect is the same: nomadic connectivity. I use a Telebit CellBlazer for high speed file transfers and PPP, and a Microcom MNP 10 unit for slower but lower-overhead interactive work- and I'm about to try UDS Motorola's new modem. Cellular is my choice for highest bandwidth while mobile, but it is severely limited by the fact that cellular service is not universal: the places I most want to be are quite often not covered by cellular service, by definition. Though I sometimes carry a 6-element Larsen cellular yagi with 10 db gain to extend range over 100 miles, I generally reserve the cellphone for times when

I'm near town. (It's also too expensive, and roaming is still a nightmare!)

The HP95 with pager is a nifty product, though again it is limited to metropolitan areas. This has some wonderful applications and is nice and small, but I am troubled by the fact that it doesn't close the loop: since the system can't know where a user is, it uses bandwidth in ALL markets on every message. I've listened to the frequency on a scanner, and it is almost continuously busy.

The system that is currently most optimal for wide-range nomadness is the Qualcomm OmniTRACS implementation. This is likely to become commercially available soon--BEHEMOTH is the first live test site and results have been very encouraging. There are tens of thousands of these satellite terminals in the field... almost all mounted on 18-wheelers and used for driver-dispatcher communication. Custom software was written for this project, consisting of a new tool in the Mac's Comm Toolbox that interfaces with Eudora (email system), and some code in a SPARCstation in San Diego that sits on the Internet. The net effect is a transparent (though slow) email path that is alive all the time and functions equally well regardless of location within the continental US (with other regions of the world requiring a ROM change). (Contact John Noerenberg at Qualcomm, 619-597-5103 for more info.)

WIP: Describe your vision of the ideal mobile computing platform.

Roberts: It's lightweight, globally connected, cheap, low-power, high-bandwidth, waterproof, and unbreakable, of course. Realistically, I see this as something that is not tied to a vehicle, but is a personal accessory--perhaps an oversize wristwatch with a chord keyboard, voice I/O, and small touch-sensitive screen. The wireless link should also support transparent backup/sync with your "home machine" for saving or fetching text, images, and so on. Moving from a richly connected environment to the boonies should involve, at worst, only a graceful degradation of data rate--no need to suffer major mode changes, manual selection of different transport media, or other familiar indignities.

I suggest the "personal accessory" model rather than notebook or palmtop packages because even the most robust of today's portables involve a degree of physical inconvenience that is quite unacceptable for such simple, frequent tasks as looking up a phone number or jotting down a quick note. I, as well as most other users I know, still carry a notebook and calendar along with my laptop--depending on paper for anything involving quick, convenient access. Obviously, this is rather poorly integrated, and today's pen-based systems are not too effective with such random text. I want to be able to take notes in mid-conversation with an armload of groceries, deal with urgent mail at the beach without worrying about sand and salt water, and abuse it the same way I abuse my watch (not baby it the way I do my computers).

The ideal mobile computing platform needs to be quiet, discreet, and so comfortable to wear that it is always with you.

Actually, the IDEAL is one that's integrated with the brain, but let's only take this fantasy ahead one decade at a time...

WIP: What practical benefits do you see flowing from your work?

Roberts: Well, personally, it has made my life endlessly exciting--no small feat. But I suspect you have a somewhat more global context in mind.

Few people would be interested in owning a "clone" of BEHEMOTH, or, for that matter, my next machine (the Microship). But it does seem to be useful in an indirect sense, as a demonstration platform, almost a caricature, of the technologies that are finally, after decades of false promises, freeing us from the tyranny of the desk. Although I have actually developed very little in terms of primary components, the system integration exercise has brought together components from a variety of industries into a single tool for liberation. (Some might argue that a 580-pound bicycle is anything but liberating, but we're talking philosophy here...)

Speaking of philosophy, the other useful benefits have to do with being a public demonstration that you can invent your own lifestyle alternatives that beat the freedom-security trade-off, that art and engineering blend synergistically, that being obsessed with a distant objective reduces everything in between to the level of "obstacle," and that all this technology is, despite all its tiresome vertical market orientation, FUN!

WIP: What role do you see for nomads in modern society? Will the nomadic lifestyle become more popular?

Roberts: One of the best things about this nomadic life is that my neighborhood of friends, collaborators, and resources has become global. This is no mere metaphor; it's real. I have also become a wanderer among mines, each populated by specialized high-tech miners who create the tools that make my wandering possible--and the effect is a dramatic symbiosis in which I benefit deeply from their work while sharing insights gained from others... often linking them together directly.

Consulting can be defined as communication that takes place at the boundaries between specialties.

As the increasing complexity of industry forces deeper and deeper specialization, there is a growing need for wanderers (generalists) who can provide much more focused insight than a monthly trade journal or annual conference. This is one type of nomad, but not the only one...

Nomadics is also a license to explore, a perfect context for journalism in any field, and a great way to play for a living. It also reduces overhead dramatically while rewarding the nomad with agility unmatched by desk- and house-bound competitors. And, I must emphasize... it's FUN. Yes, I think it will become more popular (despite bureaucrats and governments that bristle at the very thought of alternative lifestyles).

WIP: Several computer firms are planning to pursue consumer markets -- do you see a consumer market for mobile devices?

Roberts: Of course. The elite cadre of current high-tech nomads have no exclusive claim to the notion of "freedom through communications." Popular demand across the full spectrum of humanity will force this stuff to become cheap, small, and rugged. Look at the market penetration history of cellular phones--first the yuppie executive, now anyone who can afford the minimal hardware cost and off-peak special rates. The market will be driven by games, money-saving information services, personal communications, and of course, sex.

WIP: Will we all live--to some extent--in cyberspace in the future?

Roberts: Well, I don't know. It seems likely that increasing communication bandwidth coupled with hints that cyber hardware will become commonplace virtually guarantees that everything from shopping to the average phone call will include multisensory components. Remember that there are market forces at work, and if someone can sell products more effectively by letting someone try one on during the commercial break in a live action erotic cyberdrama, then they're going to spend a lot of capital to make it happen. Whether it will be an entertainment medium or true work environment remains to be seen, but I would bet that the work-at-home crowd will see teleconferencing and design applications for some of the same hardware that delights those of us bent on titillation and amusement.

WIP: In what ways do you hope your work drives mobile computing forward?

Roberts: Certainly the most obvious is through publicity, the ongoing automatic spin-off of doing anything that's notably different from the norm. Recurring images of mobile computing via bicycle have already had effects, admittedly impossible to quantify, in spreading general awareness of the supporting technologies. Every few years, I build a new system that integrates a wide range of vertical market components into a tool for liberation, and even if there are never any direct product spin-offs (due to my own laziness in pursuing such things), the project should continue to serve as an

educational tool and test bed for new ideas.

WIP: Could you comment on the importance of passion in developing new products, and how BEHEMOTH presents an opportunity to interact with technology purely on the passion level?

Roberts: Well, you just said it. I firmly believe that art without engineering is dreaming; engineering without art is calculating. Passion is the energy behind this, for that's what keeps creative folks obsessed with finding solutions long beyond that point at which crank-turners give up. You can see it all across the industry: look at any product that breaks new ground, and behind it you'll find brilliant visionaries and tinkerers motivated much more by pushing the big envelope than by waiting for little ones with paychecks.

BEHEMOTH and related projects are excellent contexts for this sort of thing because, by definition, they are not commercial. It's art. It's fun. And it is only the passion that keeps me coming back for more. (Believe me, there is no automatic correlation between fame and fortune, cliches notwithstanding.)

WIP: What's next?

Roberts: The Microship. Starting June of 1993, I'm building the successor to BEHEMOTH -- an amphibian sea kayak/trimaran with solar, sail, and human power. It will be a much sleeker and more capable mobile communication platform, optimized for the aquatic environment, and I hope to resume full time travel in early 1995. Stay tuned!