

# SkyVoyager and SkyFi

## How Astronomy Came to the iPhone: a Personal Story

By Tim DeBenedictis

There was an unusual stretch of warm, clear nights this past January in northern California. During the midst of what should have been our rainy season, a few friends and I took advantage of the unseasonably pleasant weather to observe the winter constellations. I personally hadn't laid eyes on the Orion Nebula since the 90s, and it was time to check out this and other winter sights again.

I'd brought along my Meade LX-200, my 15-inch MacBook Pro, and copy of *Voyager 4.5* to do the driving. (Note: I'm also the principal developer of *Voyager* these days.) Unfortunately, it wasn't long before I'd tripped over the serial cable connecting my scope to the computer, somehow damaging my USB-serial adapter to the point

where the computer and scope refused to talk to each other again.

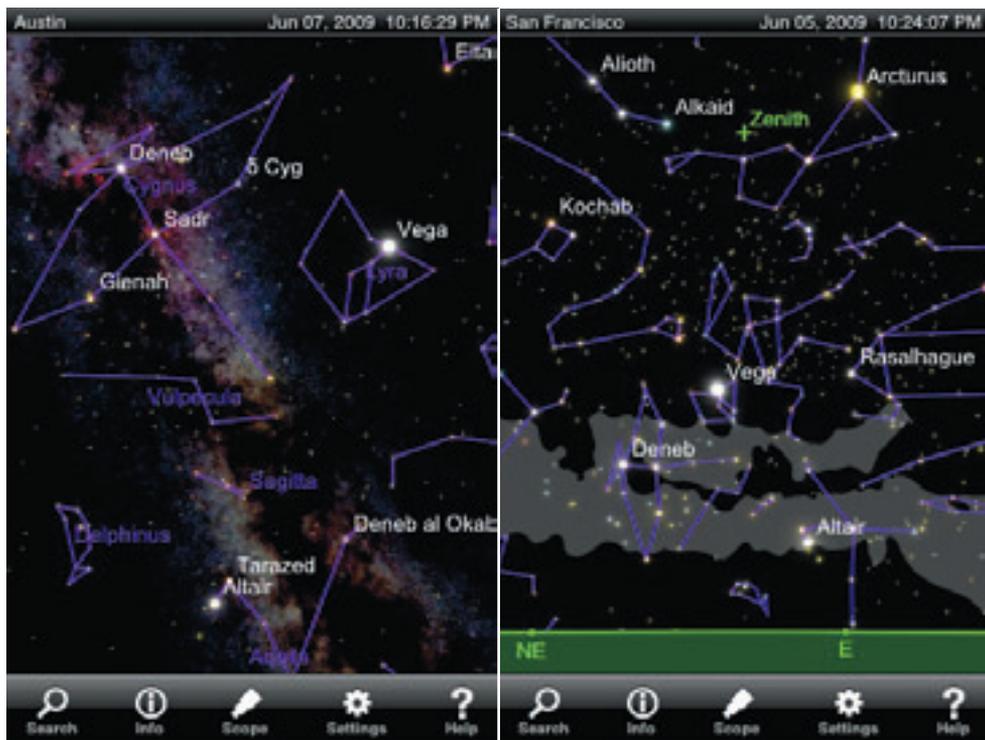
Luckily, I had my iPhone with me. I'd been working on an iPhone astronomy app; at this point, it was barely more than a database that could spit back some coordinates when given an object's name. But that was enough to get us observing again. We could at least manually tell the scope where to point, now that we had the coordinates of the things we wanted to see. The missing piece was a means of actually controlling the telescope with the iPhone. (Punching in all those RAs and Decs on the LX-200's hand controller sure got tedious!)

One of my friends that night, happened to be a software engineer at a well-known Bay Area electronic design firm. "Tim," he



said, "I could build you a low-cost wireless-to-serial adapter that would let you control that scope with your phone." I was skeptical, at first, but the more we talked, the more I was convinced that he might just be able to pull it off.

Later that night, my friend and I serendipitously managed to identify a dim red star skimming the trees along the southern horizon. It turned out to be Canopus. (Canopus! From the latitude of San Francisco!) I took it as sign that the impossible might someday be made real.



Left: Closeup of the Summer Triangle and Milky Way.

Right: Wide-field view of the Eastern horizon.

## Hard Times Bring the Unexpected

By the beginning of March, 2009, the recession had started to get really scary. As we watched the Dow sink below 8,000; then 7,000; then 6,500, our project became a motivator for us - it was something positive to focus on, as the world around us appeared to be coming apart at the seams. Even non-technical friends began to take an interest, as all of the possible uses for the device we were building became apparent. The iPhone app generated a lot of interest as well, as mo-

bile computing - and Apple's platforms in particular - seemed to be the one bright spot in an otherwise gloomy sea of dismal economic news.

I'd made some progress on my iPhone app, and my friend had completed some proof-of-concept experiments on his WiFi-to-serial box. But it was clear to both of us that we had a lot more work ahead than we'd bargained for.

Serendipity struck again, in the form of an out-of-the-blue email from Bill Tschumy, one of our "power users" at Carina Software.

Bill was a skilled programmer, author of the astronomy freeware program *Where is M 13?*, and an avid observer. He'd recently endured a family tragedy, during the midst of which his startup company had closed. And he wrote to us offering his services, wondering if we might have some work available.

While we didn't have the resources to hire a full-time employee, I sorely needed the help on the iPhone project - so I decided to take his offer. It paid off handsomely. By mid-April, we had an iPhone application that, despite some rough edges, worked well enough to show at the NEAF symposium outside New York City.

## Astronomy on the iPhone - Done Right

We called the iPhone application *SkyVoyager* - a nod to the venerable *Voyager* desktop software upon which much of its code was based. Getting *Voyager's* 15-year-old code base to run on the iPhone proved challenging. Apple required us to rewrite much of our code in its idiosyncratic *Objective-C* language. Moreover, the iPhone and its "phone-free" counterpart, the iPod Touch, have roughly the computing horsepower of a desktop PC from the mid-1990s - a far cry from the 2+ GHz multi-core CPUs I'm used to having at my disposal. (For those new to Apple's mobile platforms, think of the iPod Touch as the iPhone without the phone - it has the high-resolution multi-touch screen, the WiFi internet capability, and can run all the apps; but does not

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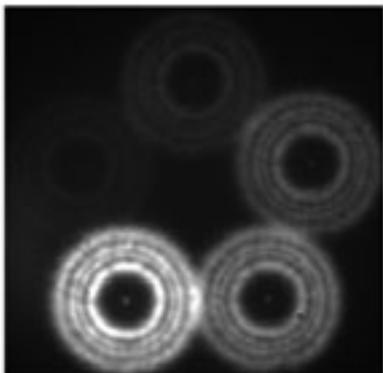
Left: SkyVoyager's database information for the Hercules Cluster.  
Right: Scope control interface, pointing the telescope at M 13.

make phone calls, nor incur any monthly billing charges.)

Despite the hardware limitations, we managed to get all of the following into *SkyVoyager*:

- Every major planet and moon in the solar system (counting Pluto, which we “grand fathered” in despite its demotion in 2006);
- Several hundred asteroids, comets, and satellites; including the ability to download new orbit data from the Minor

- Planet Center and Celestrak.com;
- 312,800 stars to roughly 10th magnitude, with data from the SKYMAP, Hipparcos, Washington Double Star, and GCVS catalogs;
- 32,000 deep sky objects to mag. 15; including the entire NGC and IC catalogs;
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## SKYVOYAGER AND SKYFI

prints, all nicely formatted to fill the iPhone's screen;

- More than 1,000 descriptive essays of various astronomical objects and topics; including the illustrated introduction to basic astronomical concepts from the *SkyGazer* desktop software that we bundle with Benjamin Cummings' college astronomy textbooks.

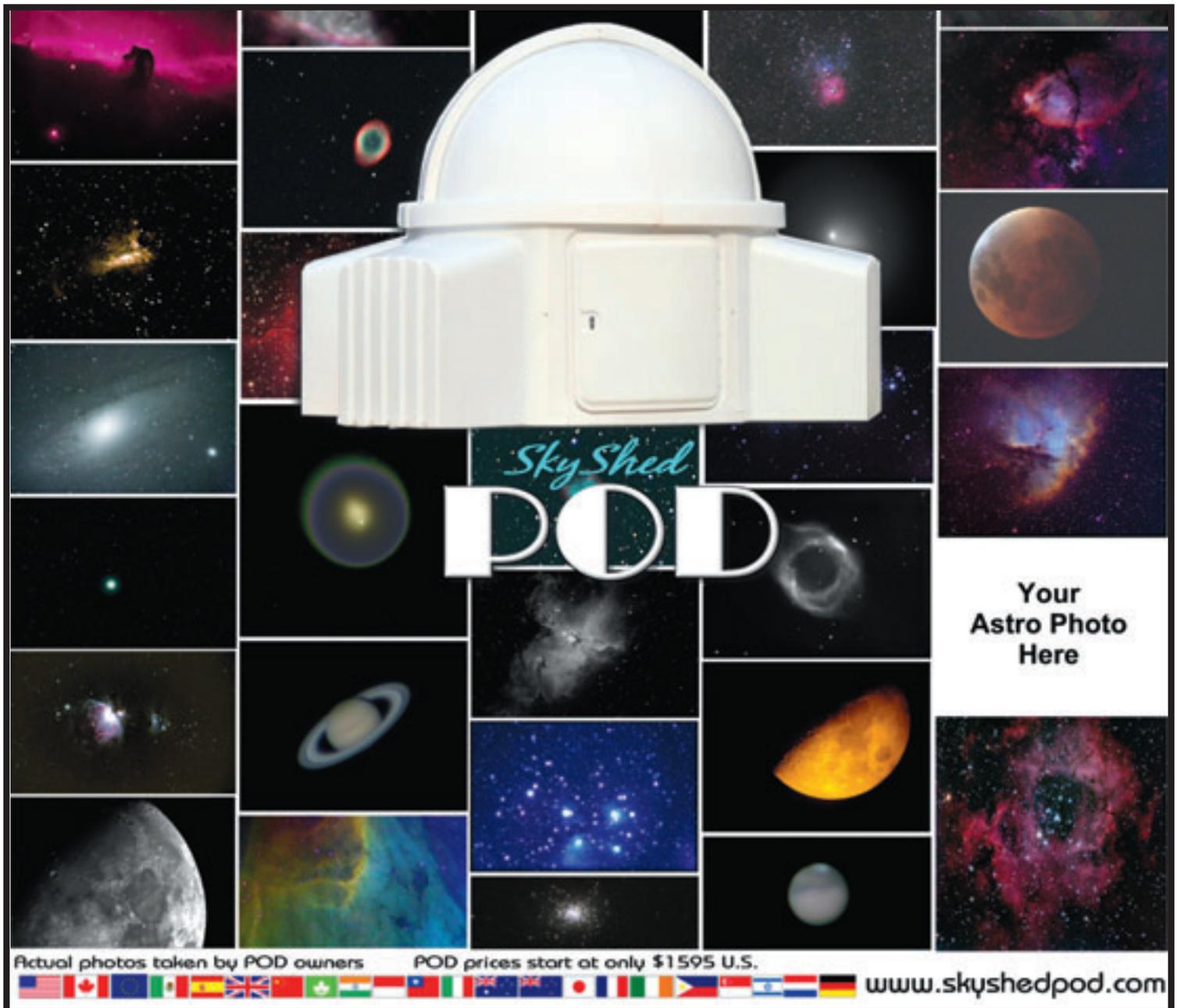
*SkyVoyager* became a complete astronomy field reference, small enough to fit in your pocket, yet containing far more data

than the *Peterson Field Guide* or *Norton's Star Atlas*. Unlike a printed atlas, *SkyVoyager* has the ability to dynamically display the sky from anywhere on Earth, at any time in the current or previous century, with sub-arc-second precision and colorful detail.

In early June, I took a week away from six months of frenetic work to rejuvenate on the remote southern coast of Hawaii's Big Island. One especially satisfying moment on that trip was watching the full Moon rise over the Pacific, not far from brilliant Alpha and

Beta Centauri, and the Southern Cross - all exactly as predicted, and depicted, by *SkyVoyager* running on my iPhone.

Apple finally released *SkyVoyager* for sale on the iPhone app store the day we got back from Hawaii. As of this writing, it has yet to receive anything less than a 5-star review. I can't thank Bill Tschumy enough for taking the chance to write to us at what must have been a tremendously difficult time - and for delivering fantastically inspired work in the weeks after.



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**SkyVoyager with SkyFi in use at the telescope.**

**The Development of SkyFi**

*SkyVoyager* has one more ability which, as of this writing, is also unique among iPhone astronomy applications: it can control (most) GoTo telescopes. In order to do this, it needs some way to relay commands from the iPhone or iPod's WiFi to the serial port on the telescope. SkyFi is that relay.

Early on in the development of SkyFi, we looked at the other WiFi-to-serial adapters available on the market. Most of

them were designed for industrial applications, and hence difficult to use, and/or prohibitively expensive. None of them were battery-powered, and therefore not appropriate for field use.

We also considered bluetooth. While bluetooth was intended to be the wireless successor to serial communication, bluetooth devices have a reputation for being notoriously flaky, and requiring difficult-to-configure drivers. Bluetooth hardware is not standard across most laptops

or mobile devices; WiFi, on the other hand, has been near-universal for many years. Bluetooth doesn't have the range or bandwidth that WiFi allows. WiFi uses standard TCP/IP networking protocols; since TCP/IP is the language of the Internet, our solution potentially allows a telescope to be remote-controlled over the internet - something bluetooth was never designed for. The final nail in the coffin for bluetooth was that at the time we started developing *SkyVoyager*, Apple's iPhone OS did not allow 3rd-party applications to access the iPhone's built-in bluetooth hardware. It simply wasn't an option for us.

We managed to get our first SkyFi prototype working in April, after a long night involving many cups of coffee. We were successfully issuing GoTo commands to my Meade ETX telescope from my iPhone, and watching the scope FOV bull's-eye indicator march across the screen. It was quite a relief, since I was scheduled to get on a plane to New York City for NEAF the next morning.

As with all complex technical projects, you don't always get everything right the first time. Our biggest hurdle turned out to be the FCC. Despite its low-power transmission, our first prototype just didn't ... quite ... pass. The redesign which resulted from our initial failure turned out to have much better range, greater bandwidth, and flew past FCC noise testing requirements. The redesign also gave us a chance to in-

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clude some niceties that we'd left out of the original prototype, such as a two-color status LED, and a much more compact RJ-11-style serial connector.

### SkyFi, Materialized

By the time you read this, our revised SkyFi adapter should be well into the advanced production phase. Here is an overview of the product that has taken shape.

- SkyFi is very compact, barely larger than an iPhone. It can be easily attached to your telescope's mount or tripod; a strip of double-sided Velcro is included for that purpose.
- SkyFi accepts four AA batteries, and has a typical battery life of 8 to 12 hours under continuous use. SkyFi can also be powered from an external source, like a car battery or a wall socket. Power adapters for both AC (120V, 60Hz) wall socket input and DC (9-12V,

1.2A) cigarette-lighter socket input are available.

- Once powered on, SkyFi creates its own 802.11 wireless network. By default, this is an open wireless network called "SkyFi", but you can rename it and password-protect it later on. Join this network from your iPhone, laptop, or other computer, and - voila! - you're ready to use SkyFi. As long as your computer or iPhone gets its IP address by DHCP, no additional network configuration is required.
- You can use SkyFi with your WiFi-enabled laptop or desktop computer, as well as with an iPhone. Our *Voyager 4.5* software, running on a Mac or PC can also talk to your telescope wirelessly, using the computer's built-in WiFi.

The final revision of SkyFi is innovative enough to have received provisional patent protection (and as of this writing, a utility patent is also pending).

### The Future, and the Dream

Something notably apparent at many star parties is that most of the attendees are middle-aged or retired. Amateur astronomy is need of fresh faces. I find that young people today are just as fascinated by the night sky and the cosmic questions that it inspires as any generation before - yet people today don't seem to go out and actually look at the stars as often as they did even a generation ago. Perhaps it's because we tend to live in increasingly light-polluted cities; perhaps two decades of computer-generated animations have jaded our appreciation of reality; but whatever the case, amateur astronomy today seems to have become the pursuit of a grayer generation.

At the same time, as mobile computing has become an increasingly prevalent part of our daily lives, people have become increasingly attached to their phones. We use them dozens of times a day, creating an attachment which becomes unexpectedly personal. Whether you are in iPhone user, or an Android person, or a Palm user, or a Blackberry user, is almost a character trait. Mobile devices have made the world an increasingly connected place, and will only become smarter - and more ubiquitous - in the future.

My greatest hope is that products like *SkyVoyager* and SkyFi help bridge to gap between these two opposing trends. By putting a complete guide to the night in the pockets of millions of people, we hope to spread awareness - and enjoyment - about the universe in which we live. Every night, a countless number of people look up and ask, "what's that?" *SkyVoyager*, and smart phones in general, give them the ability to answer that question, using a device which is ubiquitously available, and intimately familiar.

Will this vision actually come to pass? I don't know. It will take time. But maybe not that much time - only six months ago we were standing on a hilltop, wondering how we could see the stars better, using just what we had in our pockets. ■■

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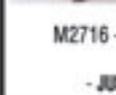
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