

Triton Fun Company

Science Newsletter October 2006

# Science Newsletter

## October 2006

### The Space Shuttle Chronicles: To KSC and Back Again – an Engineer's Tale

J. Bartlett

#### Special points of interest:

- Space shuttle
- Telescopes
- Triton Fun stuff
- Superfluous questions

We are always looking for **contributors** to the Science Newsletter. If you would like to write an article about a science subject you are excited about, or contribute a superfluous question, or if you would like to be on our **mailing list** for future newsletters, please e-mail us at:

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It was April 2005. I was at the Kennedy Space Center (KSC) in the Vehicle Assembly Building (VAB) standing on the mobile launch platform (MLP). I looked up and could see above me the Space Shuttle Discovery's three Main Engines (SSME's). These are the engines that are at the aft end of the orbiter. I had been in the VAB before, but I had never been in such close proximity to one of the fully stacked shuttle vehicles. The Vehicle Assembly Building was very impressive, and seemed to me to be bigger on the inside than it looked on the outside. But I was really in awe of the two gigantic solid rocket boosters (SRB's) and the enormous external tank (ET) that Discovery was mounted to. But I wasn't there to gawk: we were on a tight schedule to fix a crucial piece of hardware on this magnificent machine.

The year before, when I was still working in California, I had been named project manager for the redesign of a thermal protection system designed to protect the main engine nozzles during re-entry. The old design had a bad habit of cracking and falling off the engines, sometimes when the shuttle was still on-orbit and before re-entry had taken place. My team, including materials engineering experts, aero-thermal engineers and technicians had spent the last year or so redesigning the system. Our

redesign was an insulative coating made of a rubber-like material which was applied to the nozzles in areas which would be most sensitive to re-entry heating. We had done careful work and analysis and our confidence in the system was high. We finished the installation of our brand new redesigned system onto the engines on schedule. The time after shuttle stacking is jam packed with roll-out preparations and, had our installation gone too long, we could have delayed roll-out or possibly even launch. After all, this was STS-114, the post-Columbia return-to-flight mission. I had never seen a roll-out before and it was an honor to be present for the roll-out of STS-114, America's return-to-flight.

The days counted down toward launch, and the team was proud that the maiden voyage of our new design would be on the 114 mission. But shuttle launch processing can be fickle sometimes and this process flow proved to be fairly fickle indeed. It turned out that a problem on another part of the vehicle was found and Discovery would have to be brought back to the VAB ! Launch was being pushed back until July ! And after all the photos I'd taken of THE return-to-flight roll-out. I should've known better.



Finally, July rolled around. Our redesigned system has been installed since May. The team was worried it could have been disturbed or even damaged during the 2-month interim. I went out to the pad to check – all good, no worries. Launch day finally arrived. I positioned myself between Orbiter Processing Facility 3 (OPF 3) and the VAB, about 4 miles or so away from the pad. Words cannot truly describe the launch experience. I was overwhelmed by the sheer magnitude of the power of the vehicle as she shot into the eastern sky. I swore I could feel some heat from the Solid Rocket Boosters once Discovery cleared the tree line. They say that the Vehicle Assembly Building “sings” during a launch and sure enough, the VAB was emitting this very odd, almost eerie, tinkling sound.

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## Space shuttle, continued

It was an experience I'll never forget and one in which I learned some interesting engineering lessons.

The STS-114 mission proceeded and went fairly well despite another foam shedding event during ascent. After 14 days in space, the astronauts, including commander of the mission, Eileen Collins, demonstrated that the shuttle is ready to return to work and thrilled the world with their exciting exploits. On August 10, 2005, Discovery re-entered the atmosphere and made a perfect landing at Edwards Air Force Base (EAFB) in California. The moment of truth had arrived! Did our redesign hang on to the orbiter during Discovery's re-entry through scorching atmospheric plasma and high aerothermal buffeting? Did the design do the job? Were the main engine nozzles protected? What would post-flight inspections find?

Though I was confident in our design and the engineering experts on my team, I secretly was preparing myself for the worst while hoping for the best. Turned out to be a good strategy because our post flight inspections showed that our new design fared only marginally better than the old design. Could the system be further refined to solve the problems? I looked forward to a new challenge. But as it turned out, the structural analysis of the nozzle had been improved and it was determined that our thermal protection system was not even needed.



**Magnificent machine**

Space shuttle main engines; the red on the engine nozzles are covers that protect them and are taken off before launch

The nozzle was robust enough to not need additional thermal protection. Thus my project was cancelled. Maybe not such a happy ending, but I was fortunate enough to have worked with some great people in Florida on a highly interesting project and I learned valuable lessons along the way that will aid me in my career going forward. I learned what project management is like in the real world: some projects succeed and some projects fail. And when they fail, you learn from them and move on. And, as the reader may have noticed from the story from this journey from California to KSC and back again, it's that you can't get very far in aerospace (and Kennedy Space Center in particular) without having to learn dozens and dozens of acronyms. Long Live NASA and the Space Shuttle Program!



**This thing is big !**

Shuttle External fuel tank and Solid Rocket Boosters. This is Space Shuttle Discovery (OV-103) being transported out of the Vehicle Assembly Building to the launch pad atop the Mobile Launcher Platform which itself is on top of a massive crawler. It moves at a lightning fast 0.9 mph.



**Return home**

Discovery after landing at Dryden Field (Edwards AFB) and our first look at the engines after touchdown. The orbiter is processed and put aboard a special 747 to be brought back to Kennedy Space Center for its next flight.

## Calling all Southern California astronomy clubs !

**Triton Fun Company** would like to publish a directory of all astronomy clubs in Southern California. This booklet will be provided to all clubs either free (or at minimal charge to cover the cost of printing.)

If your club is located in Southern California (say, anywhere south of Fresno), please send us a flyer or other page containing information about your club: name of your club, where it meets, when it meets, star parties, newsletter, officers, contact info, dues, and any other information you would like to see included. This booklet can then be handed out at star parties or other events to advertise your club. Also, if you would like to run a paid ad for an astronomy-related business (say, a telescope store), you can purchase ad space in this booklet as well.

Send your info to: [sales@tritonfun.com](mailto:sales@tritonfun.com) or call us at: **800-778-0560**



## “How Powerful is Your Telescope ?”

T. Falconer

John Dobson has been quoted as asserting that “If you own a telescope, you have a moral obligation to share the view!” Perhaps this is the Golden Rule as applied to amateur astronomy. At any rate, many telescope owners follow John’s instruction by participating in “public” star parties. The venue to which the telescope owners bring their instruments may be a city street corner for “sidewalk astronomy,” or a public park away from the worst light pollution to allow showing fainter denizens of the night sky.

Of course, people who look through your telescope always have questions, especially if the “target” is anything other than our Moon. Many of these questions ask for clarification of the nature of the target object, but the two most common questions are: “How powerful is your telescope?” and “How much did your telescope cost ?” As with most scientific questions directed at experts from neophytes, the “teacher” has the problem of couching the answers truthfully at a suitable level of understanding that is neither overwhelming nor misleading (nor patronizing).

I have been “sharing the view” in my telescopes for a long time, originally fairly casually and infrequently as an individual, and in a more frequent and organized fashion since I joined an astronomy club with a good outreach program. If you are just beginning to “share the view” with your telescope, please allow me to suggest something that plays against that first question: **Don’t use too much magnification!** The various sights of the night sky look best in their native surroundings. In other words, frame them with sufficient dark sky that the first-time viewer can recognize the target as belonging to the night sky.

I didn’t recognize this principle immediately. But one particular experience demonstrated it most convincingly. Before describing it, let me set the “technological” scene.

Years ago, my father built our first telescope from scratch. Using a mirror grinding kit from Edmund Scientific and an assortment of gadgetry and material from the Douglas Aircraft salvage yard, he constructed a 6-inch f/7.8 Newtonian reflector on an equatorial mount. The optics were superb until one reached the eyepiece, which was merely a home-built Ramsden of one inch focal length. The images were clear enough, but the apparent field was only a little over 25°, the true field *barely* allowing the Moon to fit in her entirety. Purchased from Cave Optical a few years later, our first “good” eyepiece was a Galoc Erfle of 16.3 mm focal length that provided *both* more magnification (73x) *and* a *larger* field of view (~1¼°) and so relegated the Ramsden to the shelf.

But it was a *subsequent* eyepiece purchase from Edmund which really showed me how to use a telescope according to the Golden Rule as applied to astronomy. This inexpensive treasure was a war-surplus Erfle of 32mm focal length that required a custom adapter to fit our 1¼” focuser. It provided only 37x magnification, but the true field was nearly 2° – almost four apparent lunar diameters. It was this rig of 37x on the 6-inch f/7.8 that provided the key experience.

During the period that I was living at home and commuting to college via bicycle, my sister was entertaining a girlfriend during the late afternoon. When evening fell, I dragged out the telescope to show the Moon to the two girls, shortly before the visitor’s mother came to pick her up. It turned out that the visiting girl had never seen the Moon through a telescope before, and upon seeing our satellite thirty-seven times closer, she was virtually overwhelmed by the sight. When her mother arrived, the girl literally dragged her out of the car, exclaiming, “Mom, you *have* to see this!”

Subsequently, I realized that it was not simply the sharp image of our satellite in considerable detail that was so enthralling. It was the fact that the white Moon was “presented” with a **large** swath of dark sky framing it!

Even today, I occasionally receive additional feedback that “low power is better.” Now and again a visitor to one of our public star parties tells me that he or she likes the view in my telescope better (than in somebody else’s) because he or she can “see the whole Moon” in view.

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\*\* Send us your superfluous questions for a future issue ! They can be on any subject. The funnier, the better. M.D., our editor, appreciates the help and will send you a free Triton Fun coffee mug as compensation for your question. Or write an article for us and be read by professional and amateur astronomers and scientists in the U.S. and Canada ! \*\*

## Superfluous Questions:

1. Who first discovered Supernova 1987A?  
a) George Abell   b) Rolf-Peter Kudritzki   c) Ian Shelton   d) Andrew Howell
2. Where was ketchup first invented ?  
a) Cincinnati, OH   b) Boston, MA   c) Jamestown, NY   d) Pittsburgh, PA
3. What planetary system was Gem from (in the Star Trek episode "The Empath") ? (my favorite !)  
a) Argus X   b) Ardana   c) Gamma 7A   d) Menara
4. What is the state bird of California ?  
a) Western Meadowlark   b) Ruffed Grouse   c) Mountain Bluebird   d) Valley Quail

—> ANSWERS in next months issue of the Science Newsletter ! <—

\*\* ANSWERS to September's Superfluous Questions: 1. b) Omyakon   2. b) 1977   3. d) California   4. c) Omicron Ceti 3