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APOGEE PEAK OF FLIGHT NEWSLETTER

The Story of the 501st Missile Wing

INSIDE:

- A Unique Perspective on the Tomahawk Cruise Missile
- Tip : Quick fix for Broken Balsa
- Web Site of the Week
- Rocketry's Astounding Achievers

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A UNIQUE PERSPECTIVE ON THE TOMAHAWK MISSILE

by Richard Debler

Photo 1

Have You Seen My Rocket?

Imagine receiving your brand new launch system and rocket via air mail *(see photo 1)*. Then, taking your new pad and rocket with its new paint scheme of gray and white out to the launch site, you set up your launch rod to clear any obstacles to allow for a launch. *(see photo 2)*. Giving a countdown, the launch button is pushed for ignition.

Seeing it leave the launch pad in perfect flight, we watch *(see photo 3)* as it goes up to Apogee where it will transition to *(see photo 4)* recovery mode. During our recovery mode it just keeps going out of site, another rocket lost because I'm not running after that one. So, we pack up, go home, and rebuild a new one. However, this one I will keep just for display only *(see photo 5)*. This display model is serial number 097 hanging at the USAF Museum at Dayton, Ohio.

Photo 2

Photo 3

The 501st Missile Wing

This is the story of the 501st missile wing located at RAF Greenham Common in Newbury, England. *(see photo 6)* It was outfitted with British and American Airman who had upwards of a year of specialized training in 1982 before arriving on base. In 1983 after many weeks of hard work and inspections the base made IOC (initial operation capability) - worlds first GLCM (Ground Launched Cruise Missile) system. The 501st team of professionals worked feverishly and wrote many procedures to get there; a great feat indeed.

Photo 4

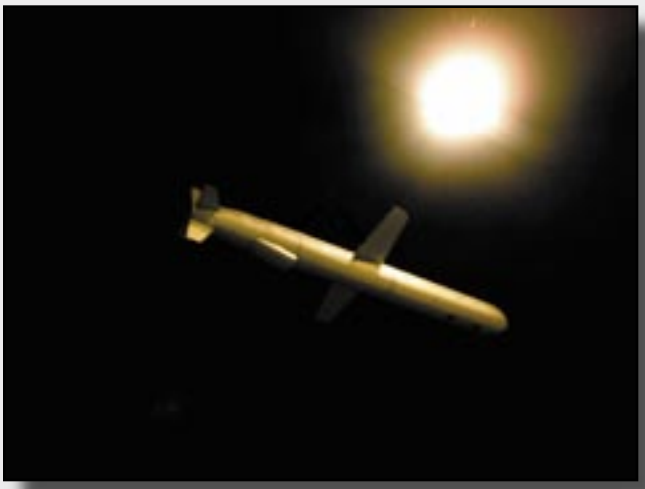


Photo 5

This system went from conception to operation in 7 years, when most systems take 15-20 years. The GLCM system is a mobile launched missile system

continued on page 4

About this Newsletter

You can subscribe "FREE" to receive this e-zine at the Apogee Components web site (www.ApogeeRockets.com), or by sending an e-mail to: ezine@apogeerockets.com with "SUBSCRIBE" as the subject line of the message.

Astounding Achievements in Rocketry

At Apogee Components, we like to give special recognition to our customers that have worked extra hard to make astounding achievements. Recently, these individuals made significant rocketry accomplishments, and we'd like to recognize them:

	Accomplishment	State
Kevin Heritage	level 1	Georga
George Shaiffer	level 1	Colorado
Vic Kovacs	level 1	Michigan
Tim Reidy	level 1	Texas
David Utterson	level 1	Iowa
Chad Nagel	level 1	Iowa
Rich Thorne	level 1	Montana
Vic Kovacs	level 1	Michigan
Chuck Walden	level 2	Georga
John Gordon	level 2	Georga
John Yuseth	level 2	Oklahoma
Vic Kovacs	level 2	Michigan
Juan Bazan	level 2	Texas
Steven Sanders	level 2	Oklahoma
L. Ray Sunderlin	level 2	Utah

Congratulations go out to all of these individuals!

Great work to all of you. We know it took a lot of effort, grit, and determination. For those reasons we celebrate your accomplishments! If you see a name in the above list that you know, why not send them a note of congratulations.

We'd also like to say a big "Thank You" to the people behind the scenes that helped these individuals achieve their rocketry goals. It is very rare that someone works alone without receiving encouragement, insight or knowledge from others. Keep up the good work!

If you would like to see your name mentioned here, or if you know of a rocketeer deserving of special recognition, please let us know. We'd like to give credit where it is due. Here are some of the attainments we'd like to honor and celebrate: High power certification (Level 1, 2, 3), NARTREK Awards, New altitude records, Science fair awards, 4-H Ribbons, Senior student research projects, Starting a new rocketry club, Grand champion at a NAR competition, Awarded a grant to teach rocketry, Rocketry inventions, Having your rockets featured in museum displays, or Feature articles about your rocketry activities in national newspapers or magazines. Email the "Astounding Achievements" to John Manfredo at johnm@apogeerockets.com.

Please limit the achievements to those that occurred in the last two months.

All summer long Dynastar Mid-Power Rockets had the opportunity to have the Orion Transport model (http://www.apogeerockets.com/orion.asp) on display at the "Zero Gravity" exhibit in the Sangre de Cristo Arts Center in Pueblo, CO. Our model (the white one in the photo) was one of many that were there for the public to see at a show that had a futuristic theme. It doesn't get more futuristic-looking than the Orion! This model rocket is like a luxury aircraft, but built for space travel. It's powered by C - F motors and comes back to land gently on a 32" plastic parachute! In the photo at the right, I had an opportunity to go by and view the exhibit which included artwork by Doug Chiang, who is known for his work in movies such as *Terminator 2, Forrest Gump, Jumanji, and The Mask*. You also might remember little projects that he had a hand in as Design Director like *Star Wars Episode I: The Phantom Menace and Episode II: Attack of the Clones*.

Photo 6

Continued from page 2

that is deployed to the field in flights *(see photo 7).* Each flight has 4 TEL (Transport Erector Launcher), each carrying 4 missiles, giving us 16 per flight (96 total). Also, 2 LCC (Launch Control Centers – 1 backup) including a hidden armed force to protect it. All these vehicles were connected by fiber cable to make it quick and easy (not like 407L). There where 6 flights at Greenham and more flights in Italy, Germany, and later, a little more in England. *(see photo 8)*

Thus, being a nuclear system it was not well liked and soon it was on the chopping block at a salt treaty agreement. So, in 1985 the system was to disband quickly but surely to zero. This is the first and only system ever to be eliminated by treaty. Shown here is the heavy harden bunkers where the flights were stored until needed. (*see photo 9)*

Photo 7

Photo 8

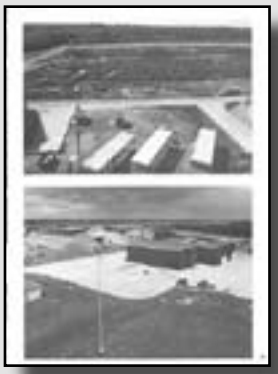


Photo 9

It was our hard work, money spent, desire to win, and desire to balance the strategy of weapons that helped to bring the cold war to a end. This, in turn, helped to bring down the wall and helped mankind to live at ease a little from years of being on edge. This was all due to the men and woman of the 501st, *(see photo 10)* who are all heros. Each and everyone who ever had anything to do with this system; they all know the truth and have been unsung heroes for our country.

How it flies

The missile is 6.25 meters long and 5.56 meters without the solid booster rocket. It has a 2.62 meter wingspan and has a 51.8cm diameter. The missile fits into AUR (all up around tubes), which they slide into and launch out from *(see photo 11).* These tomahawk systems on based on the initial design for fitting in torpedo tubes.

Photo 10

continued on page 5

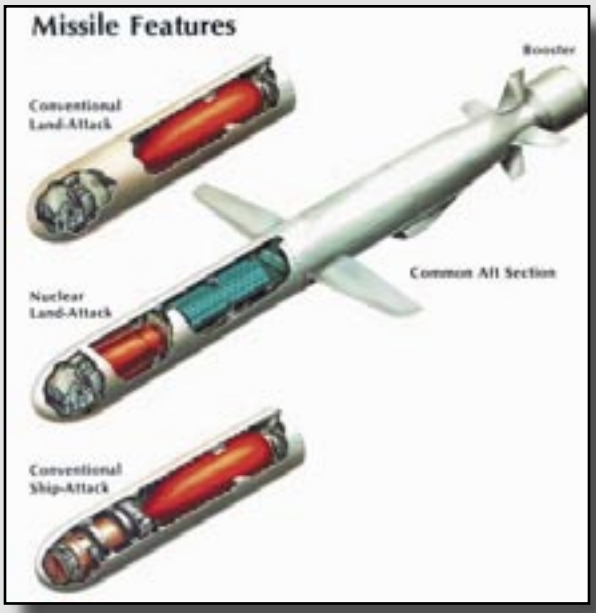


Photo 11

It is launched using a 26.7 KN solid rocket engine with a trust time of 12 seconds. It carries thermonuclear warheads as payloads.

After launch, as it leaves the AUR, blowing thru the end cap, the lower, smaller four fins unfold from their hinges. The forward wings are servoed out from within the airframe of the missile to a locked, flying position. At the apogee of thrust of the solid engine, the missile heads back down air starting the 2.7KN turbo jet, which has folded out into position as well. The tomahawk has a range of 1350 nm (published data) and speed of 550 mph (published data). It guides itself to target because it knows where it is, not so it knows where to go. It really compares stored digital maps in memory to on - the - fly maps made to orientate it to target. All this while flying just barely off the ground *(see photo 12),* making it one tuff baby to find (terrain following guidance).

If you would like to sample a bit of the missile that the author talked about, please visit http://www.apogeerockets.com/quest_tomahawk.asp and purchase one today!

Photo 12

About the Author

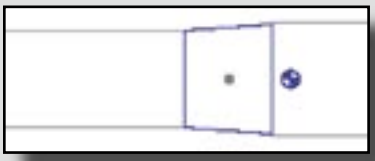
SSGT Debler, 501 TMW, Nar Section 500 Smash member lives out in the countryside with the Amish just down the road, and has own model rocket range. He loves to ride his motorbike. His wife Kathy and daughter Emily work for the American Red Cross. He belongs to the the NAR club SMASH (Who are putting on Naram49) and has a large Scale BGM-109 Missile started. He watches lots of sci-fi and NASA TV. He was with the Air Force for 8 total years and also was in 602 DASC, Germany, and 83TCF, Tucson, AZ. He's been involved with rocketry since seeing the 1967 Estes catalog and mail-ordering a Alpha and Little Joe II Kit.

QUESTION AND ANSWER CORNER

Our question for this issue comes from Jonathan Henry who writes, *"I've designed a two stage rocket in RockSim v8. There is a boat tail at the end of the sustainer and a reducing transition at the top of the booster. Is there anyway to create the transition so it is in the proper location as part of the booster?"*

Well, Jonathan, you are not alone with this question as many Rocksim users have posed it to us before. For some reason many people don't understand that the same "transition" button can be used to create both shoulders and reducers. You need to understand that the given reducer and boattail will be placed to the right side of the part that is highlighted. Once you insert it, size the forward and rear diameters to match the different tubes *(see picture 1)* that are being joined. Then you can move on to the boattail and perform the same procedure with that component. In the end, the final product will appear as the design at the bottom. *(see picture 2)*

If you have a rocketry question that you are looking for the answer to, write to me at johnm@apogeerockets.com and I will do my best to answer it either by e-mail or in this newsletter.



Picture 1 Forward and rear diameter matched

Picture 2 RockSim design with transition and boattail

TIP OF THE FIN

Photo 1

The tip for this issue comes from Ian Cinnamon who provides us with a quick but very effective way to repair damaged balsa wood. He says, "I have figured out a great way to repair damaged fins, and I want to share it!

Photo 2

When I was building the "Heli-roc" Apogee kit (the kit is fantastic, by the way), one of the long, 1/16" thick balsa propellers cracked. I was sanding it to try to create the perfect airfoil. When the fin broke *(see photo 1),* I thought the kit was ruined. I tried fixing it with wood glue *(see photo 2),* but it was taking all day to dry.

Photo 3

My fast and easy solution was to apply a drop of thin CyA glue and put the fin together *(see photo 3).* Once this dried (it took about 30 seconds), I used my finger to rub wood glue into the remaining crevice where the crack was *(see photo 4).* Because I needed so little glue, it dried in minutes. The fin was as good as new *(see photo 5)!*

Photo 4

Photo 5

Well Ian, Because we used your tip, you will be recieving a 58" Dynastar Ripstop Nylon Parachute!

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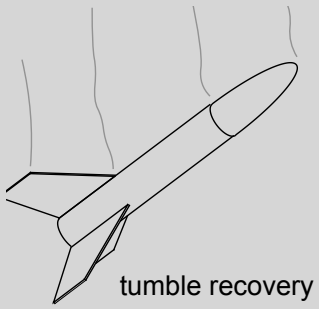
Here is what I Tell all my friends about Apogee:

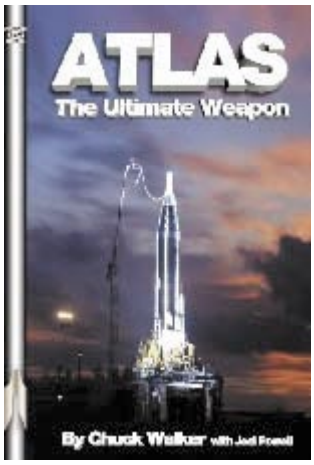
"As a BAR (Born Again Rocketeer) I have found that the products and services at Apogee Rockets are first rate. They offer everything I need to build (or rebuild) my dream kits. I have made extensive use of their fix-it clay epoxy and have fell in love with its look and versatility. The service at Apogee Rockets is top notch. I can't say enough about this site. Great Products and Great people who understand the needs of the Hobby Rocketeer. Thanks For Everything!" -- Clinard "Cj" Kendrick

DEFINING MOMENTS

Tumble or Featherweight Recovery is accomplished by small, low-mass rockets. They often tumble or flutter to the ground. If the speed of the rocket is slow enough during its fall, it may not need any other type of recovery device.This is termed *tumble recovery*. The tumbling action is achieved by changing the relationship of the center-of-pressure (CP) and the center-of-gravity (CG) of the model. When the CP is forward of the CG, the rocket becomes unstable and begins to tumble end over end. Typically, tumble recovery is applicable only for small and short rockets that are built to withstand the forces of a hard landing on the ground. An important use of tumble recovery is for recovering the lower stages of multi-stage rockets like the Dynastar Rip-Roar (http://www.apogeerockets.com/Rip-Roar.asp). Sometimes this type of recovery is also called featherweight recovery. In this variation, the engine is ejected entirely from the rocket and the model still descends in a stable manner. Because the model has such a very low mass in relation to its drag, its terminal velocity is limited and it falls very slowly. It can be related to the slow stable flight of a badminton shuttlecock.



Tumble Illustration from Model Rocket Design and Construction www.apogeerockets.com



If you want to build REALLY big rockets try these two great books from Apogee Space Books

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WEB SITES WORTH VISITING

The website worth visiting for this week is that of the Utah Rocketry Club at http://www.uroc.org/index.php You can find a lot of information here. They have the usual launch photo and video section, but the collection they have are really nice ones! A "news" section is revealed on the home page, which sports the latest real world news about rocketry, club news, and rocketry in general. Going to the archive of articles, you'll discover many different categories to choose from. Located in the "FAQ" section are how-to articles on a variety of subjects including centering rings, LEUPs, tube marking, and ejection charges, to name a few.

They launch a lot of large projects at their site at the Bonneville Salt Flats, where their big launch, "Hell-fire", is held each July. The normal site is at the Pony Express Test Range, which is southwest of Salt Lake City, where they have the "Sport Launch". *The group in the middle photo is comprised of University of Utah students. The large rocket behind them has a hybrid motor that took it to 10,000 feet.*Go in and take a look, I think you'll like what you see! If you are ever in the area during one of their launches, take the opportunity to stop by, watch, launch, and greet the club!