Igniting Passion:
A Detailed Journey Through Rocketry Course Activities

Kevin Park, Josi Maness, Krish Patel, Josh Gage, Mufeng, Hannah Caycedo
Fort Hays State University College of Education Department, Dr. Paul Adams

FORT HAYS STATE UNIVERSITY

Abstract

This course is a semester-long adventure in rocketry, led by Dr. Paul Adams. It covers everything about building and flying rockets, starting from the basics to more advanced rocketry. Students learn how to build rockets and use equipment used I payload systems like and altimeter and a GPS. We also learned about the importance of safety involved with building and launching rockets.

Objectives

In this comprehensive Rocketry course, students delved into the fundamentals of rocket construction, propulsion, and launch dynamics. There were many things we got to learn in this course.

Learning Objectives:

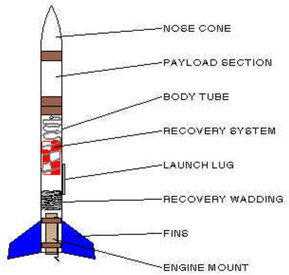
- Learn the physics behind rocket building
- Rocket construction
- Parts of rockets
- Safety of rocket launching
- Practical experience in rocket building and launching

Additionally, Dr. Paul Adams' lectures broadened perspectives with insights into overall knowledge about rockets. Students were encouraged to actively engage in all aspects of the course, collaborate effectively in teams, and rigorously adhere to all safety guidelines for a profound and engaging learning experience.

Building Process

Before any rocket can be built, we need to read about the basic building of a model and high-powered rocket. Each high-powered rocket usually have the same common elements.

- nose cone
- payload section
- airframe or the body tube
- launch system
- motor mounts
- motor tube
- fins
- recovery system



The building process begins with rough sanding the outside of the body tube, nose cone and fins as well as and fine-tuning certain parts to fit before glueing them together. Once the o-rings used for connecting the motor mount to the body tube are sanded you can attach them to the motor tube with proper spacing. Then the eyebolt can be attached to one of the o-rings and finally the motor tube can be glued to the inside of the body tube above the fin slots. Now we apply our adhesive to the bottom of the fins and push the fins all the way into the fin's slots and apply fillets

Now that our main body has been built, we will build the upper section of the rocket. The upper section of the rocket includes the nose cone, the payload section, and the other half of the recovery system, which is the parachute and fire blanket to protect the parachute during ejection. We tie this to the shock cord where the body tube ends. The payload section has some type of eye-bolt that ties to the other end of the shock cord, connecting both halves of the rocket. Then the nose cone is fitted at the top of the rocket above the payload section. Next add a hole to relieve the pressure in the rocket to equalize with that of the air pressure outside.

The last thing that is needed to do it to tie the parachute to the end of the shock cord that was tied to the eye-bolt coupler. Now we can prime, paint, and finish the rocket and do minor adjustments to make sure the rocket is prepared to fly, such as making sure that the spot where the coupler and body tube connect is very smooth.

Successes and Failures

When learning something new there will always be successes and failures. We had many successes including building model rockets and launching them with A-C motors to see how that affected the rocket. Another success we had was launching a slightly bigger rocket with a payload bay and successfully recovered the rocket using a GPS. The next success was our high powered rocket which was launched with a G motor and we got to use an altimeter to record different aspects of our launch including speed, height, thrust time and more.

Hi-Tech Rocket Altimeter Data From Flight 1 (H Motor):

- Top Speed, 287mph
- Top Height, 1,570
- Descent Rate, 20mph
- Thrust Time, 1.52s
- Acceleration, 10.3 g's
- Coast Time, 9.3s
- Ejection, .10s

We were also successful in learning new concepts.

Items Learned:

- How to assemble and build varying sizes of Model Rockets
- Troubleshooting mistakes in the building process
- Safety guidelines to ensure an injury-free launch and recovery
- How to use websites like RockSim to predict flight paths
- How to successfully launch a rocket using launch lugs or rail buttons.
- How to use tracking devices to locate Rockets after they land

We did have one main failure including not using the correct glue for one of our rockets which made it come apart

Results

Students built a total of three rockets, two individually and one as a group. There were a few unsuccessful recoveries, of the first rockets, but the Hi-Tech's in general flew well with successful both launch and recovery.

Pictured below are our rockets after being flown and painted. Also pictured, a rocket that had used a weak cord and landed roughly, breaking the fin.






Sources

"A Typical Model Rocket." *Washington.edu*, 2021, courses.washington.edu/engr100/All_Sections/Rocket/HTML%20Handouts/01a_hnd_Typical_model_rocket.htm.

Canepa, Mark. "Modern High-Power Rocketry 2." Trafford, 2005

Milligan, Van., S, Timothy. "Model Rocket Design and Construction." Apogee, 2008