

Rocket Talks that Anyone Can Do

Somehow, some way, they found out that you fly rockets. The [choose one: school, science teacher, Scout Leader, Indian Guides Leader, youth leader] wants you to come and talk about them. Hopefully, the following information can help make the experience less painful.

Talks can be as short as 20 minutes or can last up to an hour. Try to always plan time for a question and answer period. If at all possible, plan to go outside and demonstrate 1 to 4 model rocket launches. This is best done last or in the second half of the time allowed.

Subjects

Organize your talk around the following major topics:

Introduction – describe the historical events

Rocket parts – point them out with a model that is large enough to see

Flight profile – explain each phase of a typical flight

Science emphasis – talk about Newton's 3 laws

Motors – explain the coded power rating

Safety – discuss safe flying using the Safety Code

Introduction

If you can start with a short general rocket video, this is a good ice breaker. The DARS *Good Morning America* clip (4 minutes) is an example.

You can start with a history of rockets used in China around AD 1200 through the Space Shuttle. Mention some famous scientists like Robert Goddard, Werner von Braun (Frank Malina for Texans). You might mention that there is a Goddard museum in Roswell, New Mexico, and see if anyone remembers anything else about Roswell.

Ask if anyone has seen *Apollo 13* or *October Sky* (hold up the video/DVD boxes if you have them). Plug *October Sky* (book is *The Rocket Boys*) as a link from model rocketry to space flight (plus it's a great story).

See if anyone can name a well known song that mentions rockets, written by a passenger onboard a British vessel attacking Ft. McHenry in Baltimore harbor during the war of 1812 (Francis Scott Key, *The Star Spangled Banner*). They used Congreve rockets.

The Boy Scout *Space Exploration* Merit Badge booklet has a good section on history of rockets as they pertain to the space program.

Model parts

Using a large model, point out the different parts or ask the audience to name them. Try to use a rocket with a payload section, if possible. Also mention the different types of recovery systems and show them, if available.

This is also a good time to show the parts of the motor. If you have made a fake, upscale of the BP motor components, this will help everyone see it. Repeat, "No, it is not a real motor..." over and over.

Explain that you need three (3) things for something to burn (Scouts should know this) – fuel, oxygen, and heat, and that a typical solid rocket motor has 2 of the 3. Because the oxidizer is mixed into the propellant, the motor would burn in a vacuum or under water (if you could get it lit). Explain that the plug doesn't keep the motor from igniting and one gets blown 10-40 feet away at ignition.

Flight Profile

Explain the phases:

Ignition

Boost

Coast

Apogee

Ejection

Recovery

(you could now mention “repairs” to be funny)

Ask the audience what causes the rocket to slow down and come back down (gravity, you might get drag or air friction). Compare the “coast” phase to peddling a bicycle – it doesn’t stop when you stop peddling.

Science Emphasis

You can get into all kinds of discussions about drag, thrust, stability (CP/C_D), if your audience can handle it. However, stick to basics and mention Newton's (Sir Isaac, not Fig) three laws:

1. an object at rest tends to stay at rest, and an object in motion tends to stay in motion unless acted upon by an outside force.
2. Force = mass times acceleration ($F = ma$)
3. For every action, there is an equal and opposite reaction

Note: "What goes up must come down" is **NOT** one of Newton's laws!

Explain that basic rocket motor operation shows Newton's 3rd Law – the motor burns and blows hot gases out the back end through the nozzle (action). This causes the motor to move in the other direction (reaction), and, hopefully, takes the rest of the rocket with it.

Motors

Explain the letter code on a motor (measure of “power”). The best way is by comparison (don’t even mention newton-seconds). Grab a kid from the audience and call him/her an “A” motor. Now grab two to be the “B” motor. Explain it is twice as powerful, usually resulting in twice the altitude. Grab 4 kids for the “C” motor and compare with the “B” (2 to 1) and “A” (4 to 1). Now, either grab 8 (if you have them) or ask the audience to tell how many kids would be needed for a “D” motor, then an “E” motor (16). This makes the power index go up very fast – a “K” motor would be like stuffing 1024 “A” motors into a rocket.

The average thrust (first number) is also best explained by comparison – a small number means a slower, longer burn, while a higher number is a quicker, harder burn (sledge hammer). For adults and math/science classes, you could explain how this is calculated (average thrust = total impulse/burn time).

The second number, of course, is the “coast time” – the time between motor burnout and ejection charge.

Safety

Mention that rocketry has been a safe hobby since the late 50s. Discuss safe watching distance, electrical ignition, and the audible countdown.

This is a good place to talk about fins and launch rods. Explain that a rocket acts like an arrow – ask them what makes an arrow fly straight (feathers or fletchings). Tell them a rocket works the same way but the rocket must be moving to work.

If possible, show a rocket on a launch rod. Slide the rocket up and down and explain that, at ignition, the rocket can only go up, along the rod. When it reaches the top of the rod, it should be moving fast enough for the fins to start working.

If you have time, talk about some of the various malfunctions that might happen. Include motor failures, separation (core sample), and motor ejection (lawn dart). Exort the group that, though these events may be funny, it is not a safe way to fly, and it is never funny when it is YOUR rocket.

Stability

This topic can fit wherever you explain the purpose of the fins. Ask your audience how well an arrow flies without feathers.

Blow up a balloon and ask the audience if it will go straight. Let it go and then retrieve it after all the commotion dies down.

If you plan ahead and have time, tape some cardboard fins onto a balloon and try again. Or tape a launch lug onto a balloon and let it travel down a length of string. Either of these will help the audience visualize a way to stabilize a rocket.

Example 50 minute session used at Mansfield, TX, “Super Science Saturday”:

- Introduce the presenter and his rocket organization (DARS)
- DARS *Good Morning America* video
- Quickly display *Apollo 13* and *October Sky* video containers
- Show rocket and begin flight profile discussion
- Explain motor ignition, boost and coast.
- Using rocket, demonstrate recovery system deployment
- Explain what the recovery wadding is for
- Talk about fins (compare with an arrow)
- Talk about launch lugs and launch rods
- Explain motor letter designation
- Go outside and fly 2 rockets
- Watch *Texas Tales* video with full scale *Iris* launch
- Wrap up with any additional questions

Props

If you end up doing these again and again (like the DARS Outreach program does), you'll begin to collect and make objects that support your talks.

Some examples:

- rocket books and magazines (*Rocket Boys, Sport Rocketry*)
- videos that depict rocketry/space program: *October Sky* is superb
- a chart showing a typical flight profile
- a medium sized rocket with payload tube and parachute
- a motor display with black powder and composite motors (used)
- an extra large BP motor, igniter, and igniter plug
- balloons
- a small launch pad with a rocket on it

If a VCR and TV are available:

- a 4-5 minute general rocket video (DARS GMA program)
- a model rocket video
- launch videos

Demonstrations

This is the best part, especially after a rocket talk. Even a minimum number of rockets (one or two) will provide the “effect” and also satisfy a bunch of free-wheeling imaginations.

Choose rockets for a “worst case” flight area – low altitude and low power. If possible, have a least one parachute recovery rocket.

For a 45 minute talk and demo, a good number to launch is around 4. Sometimes, you may be asked to launch more, like a lunchtime demo at a camp. The more different types of rockets, the better. Same with motor types. Save the biggest and best for last. Be sure to keep the loaded rocket weight under a pound.

Explain the launch sequence again before the first rocket goes up. Get a teacher or other leader to pick a recovery team. Be sure this group takes turns or pick just one at a time – don’t let them fight over the rockets. If you have time, select some “button pushers”, too. Make sure that they push it when you get to “launch”. Never, never, let go of the safety key – keep it in a pocket.

IMPORTANT: countdown with 5-4-3-2-1-**Launch**, not 5-4-3-2-1-**Fire!**

Make sure that the crowd knows what line(s) to stay behind. Explain that they will not chase the rocket, the recovery team will do that. See if a teacher or leader can handle problems if they occur. If there is a disturbance or problem, just hold up the launch until it is corrected. Not launching is a good deterrent.

Tips

- Try not to emphasize areas of rocketry that the kids cannot experience, like high power, especially if in an urban area. The kids will be very interested but they can only ask about that “O” motor so many times.
- If at all possible, try to demonstrate 2-4 model rockets, at least one with a parachute. This helps the talk “sink in”. Plan for low altitude, low power flights since you may end up in a postage-stamp-sized field or a nice size field with a wicked crosswind across the short dimension.
- Some demo rocket considerations (all on A or ½ A motors):
 - Estes *Intruder* (for very small fields)
 - Quest *Intruder* (airplane shape, coolness factor)
 - Estes *Prime Number Explorer*
 - Estes *Fat Boy*
 - Estes *Rattler* or *Rain Maker*
- Paint the demo rockets bright colors
- Be prepared to explain the “failures” you will undoubtedly get if you fly demos enough – motor CATOs and recovery failures (lawn darts, separations, fouled parachutes).
- Verify that the proper permission has been obtained and that the proper people are notified. Sometimes the fire department will use this as an excuse just to come out and watch!
- Make sure your audience knows that you **ENJOY** this hobby!

Conclusion

Don't be upset if you do back-to-back rocket talks to different groups and they didn't come out the same. You may need to adjust the subject coverage according to the age of the group, time constraints, interest level, and your memory. Too many questions can also get you side-tracked.

Older kids and adults usually get a kick out of you wearing the Pratt Hobbies "As a Matter of Fact, I AM a Rocket Scientist" T-shirt.

Some resources:

- The Boy Scout *Space Exploration* Merit Badge booklet.
- *Estes Educator™, Model Rocketry Manual*
- DARS Outreach Committee (too many to name – most are in therapy)
DARS also has a document on group build sessions – ask for it.

On the web:

<http://www.dars.org>

<http://ourworld.compuserve.com/homepages/CGibke>

<http://www.execpc.com/~culp/space/space.html>