National 4-H Curriculum
BU-06845

Aerospace Adventures

Pilot in Command

Stage 4

Aerospace Activity Guide

Name _____

County _____

REVIEWED & RECOMMENDED
National 4-H Curriculum

Note to the Project Helper

Congratulations, you have an exciting and challenging role as the helper of a young person interested in exploring the activities in Pilot in Command. Not only will you be providing encouragement and recognition, you will also be the key person with whom the young person shares each of the experiences outlined in each of the Aerospace Adventures activity guide.

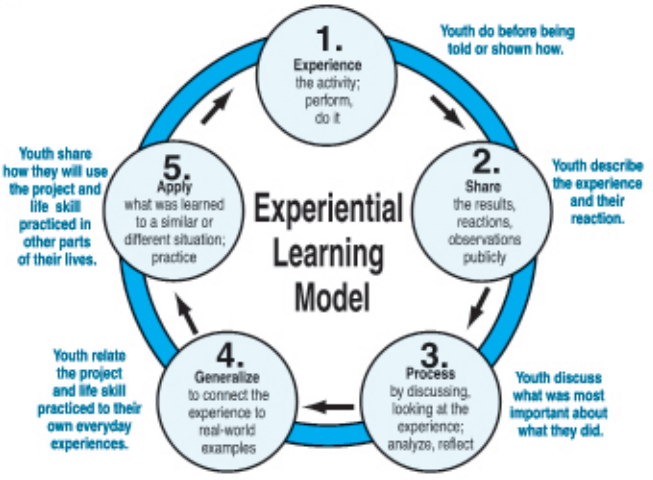
By encouraging young people to set goals and work to complete them, there will be many opportunities to help them develop important life skills they will use each day. These skills include creative thinking, decision making, problem solving, accepting responsibility, managing time and participating as a member of a team. How you are involved will often determine how successful the youth is in developing these critical skills.

The *Aerospace Adventures* Series

A total of five pieces are included in this series. The first four activity guides, *Pre-Flight, Lift-Off, Reaching New Heights* and *Pilot in Command* have been designed to be developmentally appropriate for grades 1-2, 3-5, 6-8 and 9-12 respectively but my be used by youth in any grade based on their project skills and expertise. The fifth piece Flight Crew has been designed to provide group activities that can be organized very quickly and conducted with a group of usually three to fifteen youth.

The Experiential Learning Model

The experiential learning model is used throughout this series to maximize the opportunities for both youth development and aerospace related outcomes. A complete description of the model is shown in the Flight Crew Helper's Guide.



Pfeiffer, J.W., & Jones, J.E., "Reference Guide to Handbooks and Annuals" © 1983 John Wiley & Sons, Inc. Reprinted with permission of John Wiley & Sons, Inc.

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Launch Pad

Stage 4 Pilot in Command








Introduction

The Activities

Glossary and Resources

For more on Aerospace, look for these other guides in this set.

Stage 1 Pre-Flight

5...4...3...2...1...
Wonderful Wings
What Do You Do?
Space Buggy

Stage 2 Lift-Off

Rockets Away!
Gnome of Your Own
I Want to Be…
Airfoil Magic
From Here to There!
Follow That Shadow
Can I Fly Today?
Which Way Is Up?
Angle of Attack!
Up, Up and Away
Round and Round
Charlie Oscar Delta Echo
From Nose to Tail

Stage 3 Reaching New Heights

Rippin' Rockets
Fly'n Show
Let's Go Launching
Attitudes, Altitudes and Airspeed
Rudder Away
Follow That Shadow
Flying My Way
Star Gazing
Powerful Payload
Flying Fighters
Mustangs to Zeros
Copters and Robbers
Just Blowing Through

Stage 4 Pilot in Command

Versatile Viking
Altitude Advisors
Future Pilot
Ace Instructor
Cross Country
Knowledgeable Navigators
Astronaut Aerobics
Brouhaha Box Kite
Care in the Air
Elevator Magic
Circle of Power
My Personal Qualities

Flight Crew Helper's Guide

Aerospace Quiz Bowl
Aircraft Fire Rescue
Afterburner
Top Gun
Far Out!
Community Airport Field Day
Flight 777
Aerospace Experts
Traffic Cop in the Sky
Space Station Skillathon
Aerospace Alphabets Games
Touring An Airport
Full of Hot Air

Getting Started

If you have completed the first three levels of this series or can do most of the activities you are ready for a new challenge. Pilot in Command and the Pilot in Command Achievement Program include many challenging activities to increase your enthusiasm about aerospace. As a recognized expert in many aspects of aerospace you are becoming a role model for many youth who also enjoy the excitement of aerospace. This is your opportunity to share what you have learned and develop your leadership skills as well as other important workforce preparation skills.

Stage 4 Pilot in Command

Guidelines

1. Complete your Flight Plan and record your progress
2. Complete at least seven activities in your Pilot in Command achievement Program each year and at least 20 activities in three years.
3. Discuss each experience with your project helper.
4. Share your aerospace knowledge and skills with others
5. Have fun discovering the romance of flying and the excitement of space exploration

Developing Your Skills

This is your own guide to exploring aerospace and developing important skills that will help you throughout your life. As you do the activities you'll be practicing the types of skills employers consider essential to success. These include communication skills, creative thinking, decision making, problem solving, accepting responsibility, managing time, money and human resources, working with diversity, teaching others and participating as a member of a team. Do you know how skilled you are at each of these? The activities will help you build your skill level in each of these important areas.

Your Project Helper

Your project helper is an important part of your overall experience in the aerospace project. The choice of an helper is yours. This person may be your project leader, troop leader, teacher, family member, neighbor, friend or anyone who has the interest to work with you to complete the Pilot in Command Achievement Program. Involve your helper as you set your goals, discuss the Debriefing questions found in each activity and sometimes work together on an activity.

Write the name and phone number of your helper here:

Helper's name: _____

Phone number: _____

Flight Plan

Stage 4 Pilot in Command

Destination Log

Name _____

My most important aerospace project goals:

_____
Year

_____
Year

_____
Year

Learning Experiences

Do a minimum of five each year.
Record the date you complete each one.

Year	Year	Year	Activity
			Build and launch a rocket
			Build and fly a model airplane
			Ride in a hot air balloon
			Interview a pilot
			Give an aerospace presentation
			Exhibit at a fair
			Conduct an aerospace skillathon
			Help judge aerospace exhibits at a fair
			Help organize an aerospace club or group

Aerospace Activity Log

Date and list exciting things you do and learn in the aerospace project.

A photo of me and my project here.

Achievement Program

Stage 4 Pilot in Command

To Complete:

1. Do a minimum of seven required and/or optional activities each year
2. Complete at least 20 total activities to pass the Pilot in Command Achievement Program
3. Have your project helper date and initial each activity when completed

Required Activities

Complete at least 10 of the 12 activities

The Versatile Viking
Date_____Initial_____

Altitude Advisors
Date_____Initial_____

Future Pilot
Date_____Initial_____

Ace Instructor
Date_____Initial_____

Cross Country
Date_____Initial_____

Knowledgeable Navigators
Date_____Initial_____

Astronaut Aerobics
Date_____Initial_____

Brouhaha Box Kite
Date_____Initial_____

Care in the Air
Date_____Initial_____

Elevator Magic
Date_____Initial_____

Circle of Power
Date_____Initial_____

My Personal Qualities
Date_____Initial_____

Optional Activities

Select and do any of the Solo Flight activities in this guide.

Page	#	Date Completed	Helper's Initials

Write your own activity

1.

Date_____Initial_____

2.

Date_____Initial_____

3.

Date_____Initial_____

Pilot in Command

Completion Certificate

I certify that

_____

has completed all requirements of the
Pilot in Command Achievement Program
in the Aerospace Adventures Series.

Helper's signature_____

Date _____

A picture of me and
my project.

The Versatile Viking™

The word versatile means that something has many uses or applications. The fins of the Viking™ are very versatile because they can be positioned on the rocket in many ways. So, let's get versatile and go rocketing!

Activity: Build a Viking™
Aerospace Skill: Exploring rockets, flight paths, and configurations
Science Skills: Building models, comparing variables, experimenting

Materials: One Viking™ rocket kit for each participant; carpenter's glue; scissors; hobby knife

Blast Off

1. Find 3 or more friends that enjoy rocket making or are interested in learning how to make a rocket.
2. Follow the instructions provided with the Versatile Viking™ and each friend, including yourself, make a rocket.
3. When you and your friends begin the fin construction, follow these directions:
   - One person make a 'control rocket', which means to make a rocket just like the rocket in the picture in the manufacturer's directions.
   - Another make one with 3 fins; another with 4 fins; and so on.
4. Discuss and predict which rocket you and your friends believe will fly the highest. Record your results on the chart.
5. Launch the 'control rocket' on an A8-3 engine. Record on the Flight Observation Chart.
6. Launch the Viking™ rockets with the different number of fins on A8-3 engines. Launch each rocket one at a time and record after each launching record results on the Flight Observation Chart.

Rocket configuration predicted to fly the highest _____

Rocket Flight Observation Chart

	Flight Descriptions			
	Stability	**Duration**	**Altitude**	**Overall Performance**
Control Rocket (3 fins)				
1. _____Rocket				
2. _____Rocket				
3. _____Rocket				
4. _____Rocket				
5. _____Rocket				

Debriefing

Ground to Ground (Share)

- How did you and your friends make your rockets?
- What challenges did you face in gathering or making parts for your rockets?

Climb Out (Process)

- How did you stabilize your rockets?
- What changes made the most difference?

Level Off (Generalize)

- Describe another time you experimented to find the best solution.

Cross Country (Apply)

- What are some challenges you will face in the next week? Month? Year? How are you planning now to meet these challenges?

Rocket Fins

- Fins are the stabilizing and guiding part of a model rocket. Fins help the rocket fly in a straight path.
- Fins of a rocket provide the best stability, by being symmetrical and in numbers of three or four.

1. Conduct a class rocket launch.

2. Build a Star Dart™ or Sizzler™ model rocket. How is this rocket similar to the Viking™? Different?

Altitude Advisors

You are a NASA tracking specialist. All eyes are on the Space Shuttle. The launch window is very tight. Tracking the flight path of the launch is critical for calculating necessary flight adjustments. The banks of computers hum as they ready for the onslaught of *telemetry* data. 3…2…1… the shuttle launches. The International Space Station Crew is counting on your course corrections and adjustments!

Activity: Construct and use an altitude tracker

Aerospace Skill: Constructing an *altitude tracker*

Life Skill: Following directions

Science Skill: Measuring, experimenting, building models

Materials: Large soda straw; 20 cm long string; protractor; eraser; cellophane or masking tape

Blast Off

1. First – make an altitude tracker. Tape the straw to the straight side of the protractor and attach the string to the straw so that it is fixed at the center point of the straight edge. Hold the protractor with the straw on top to site the apex of the rocket flight, with the string and eraser hanging down. Your altitude tracker is now ready for use.

2. To track the altitude of a rocket: Study the NAR safety guidelines for your launch site. The NAR guidelines can be found in either the Let's Go Launching, Stage 3 (page 10) or included in your rocket package. Measure the tracking station site at a distance of 1,000 feet from the launch pad and mark. Have a partner launch a rocket from the launch pad.

3. Stand at the tracking station site and hold the altitude tracker straw up to your eye. You should focus on the rocket as it is being launched. Move the altitude-tracking device up as the rocket ascends. When you see the streamer or parachute on the rocket, you know the rocket has reached apogee. At this exact moment, hold the string with your finger exactly where it is on the protractor. Read the number (angle) and record it on Altitude Chart.

4. Refer to the diagram: rocket is launched at C; Tracking site is A; B is apogee; determine the angle at A by tracking rocket as traveled from C to B; Subtract the apogee number (number read on protractor from string) from 90-degrees for the angular difference.

5. The altitude of the rocket is determined by using this formula:

Height = Tangent of angular distance x Base line

Example: Angular Distance = 40 degrees

Tangent of Angular Distance = 0.84

Baseline = 1,000 feet

Height = 840 feet (0.84 x 1,000)

6. Record and calculate each rocket launch. Let's go launch!

Altitude Chart

	Angle	Angular Distance	Tangent of Angular Distance	Altitude
Launch 1				
Launch 2				
Launch 3				
Launch 4				

Debriefing

Ground to Ground (Share)

- How did it feel to be a tracking supervisor?
- How did you construct your altitude tracker?

Climb Out (Process)

- How might you test your altitude tracker's accuracy?
- How can you be certain that the height you calculated for the rocket was accurate?
- What are some improvements that you could suggest to someone who is just beginning to construct an altitude tracker?

Level Off (Generalize)

- What other occupations require a person to make calculated decisions?
- Where/when else might you have to make a calculated decision based on limited information?

Cross Country (Apply)

- What did you learn from this activity that you can use in your life?

AEROSPACE Facts

Tracking Systems

- Tracking systems for the space shuttle include many back up systems so that if one tracking system fails several others are in place to make the measurements. Scientists use radio signals, radar and optical devices for extremely accurate tracking of the space shuttle and other rockets. Tracking involves more than just altitude. It also measures the location (***longitude*** and ***latitude***), velocity, and ***spatial orientation*** of the rocket. Thousands of bits of information are fed into the tracking computers each second during a launch.
- **Global Positioning Systems** (GPS) are a form of tracking mechanisms that are now used routinely in even small aircraft, giving the pilot instant information including longitude, latitude and altitude.

Table of Tangents

Angle	Tan.	Angle	Tan.	Angle	Tan.	Angle	Tan.
1°	0.02	21°	0.38	41°	0.87	61°	1.80
2	0.03	22	0.40	42	0.90	62	1.88
3	0.05	23	0.42	43	0.93	63	1.96
4	0.07	24	0.45	44	0.97	64	2.05
5	0.09	25	0.47	45	1.00	65	2.14
6	0.11	26	0.49	46	1.04	66	2.25
7	0.12	27	0.51	47	1.07	67	2.36
8	0.14	28	0.53	48	1.11	68	2.48
9	0.16	29	0.55	49	1.15	69	2.61
10	0.18	30	0.58	50	1.19	70	2.75
11	0.19	31	0.60	51	1.23	71	2.90
12	0.21	32	0.62	52	1.28	72	3.08
13	0.23	33	0.65	53	1.33	73	3.27
14	0.25	34	0.67	54	1.38	74	3.49
15	0.27	35	0.70	55	1.43	75	3.73
16	0.29	36	0.73	56	1.48	76	4.01
17	0.31	37	0.75	57	1.54	77	4.33
18	0.32	38	0.78	58	1.60	78	4.70
19	0.34	39	0.81	59	1.6	79	5.14
20	0.36	40	0.84	60	1.73	80	5.67

Future Pilot

Have you thought about someday getting a pilot's certificate? Having your own airplane? Becoming a commercial pilot? Each year thousands of young people 17 years of age and older do just that. In this activity you will explore what you need to do and learn to get a pilot's certificate.

Activity: Research how to qualify for a pilot's certificate

Aerospace Skill: Exploring pilot certification requirements

Life Skill: Learning to learn—acquiring information

Materials: Pencil or pen

Blast Off

Most of the information you will need to complete this activity and discover the requirements for obtaining a pilot's certificate is available from any local airport with a flight school. Other sources of information include pilots, bookstores, the Federal Aviation Rules Part. 61 and 91 available at flight schools. Use the Pre-Solo Questionnaire to conduct your interview. With the information you collect complete the Questionnaire.

Pre-Solo Questionnaire

Future pilot's name _____

Medical requirements _____

Flight hours required to solo _____

Flight hours required for Private Pilot Certificate _____

Ground school topics required (list 8 to 10)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Examinations required _____

_____

_____

Total cost to get Private Pilot Certificate _____

Aircraft rental _____ Instructor fee _____

Miscellaneous supplies, books, etc. _____

Flight school options (where to attend)_____

_____

Why I would like to fly _____

_____

_____

_____

_____

_____

Debriefing

Ground to Ground (Share)

- Where did you find the resources to complete the questionnaire?
- Why are you interested in becoming a pilot?

Climb Out (Process)

- What are the requirements to become a pilot?
- What did you learn from your research?
- What do you think would be the most difficult part of earning a pilot's certificate for you? The easiest?

Level Off (Generalize)

- How would earning a pilot's certificate help you in a career you are interested in?

Cross Country (Apply)

- How can you apply what you learned about acquiring information in this activity to other areas of your life?

Aerospace Facts

Pilot Certificates

Private pilot regulations: You must be 17 years old, pass the written ground school exam, pass a medical exam given by a FAA designated physician and fly only with an instructor or with an instructor's written approval.

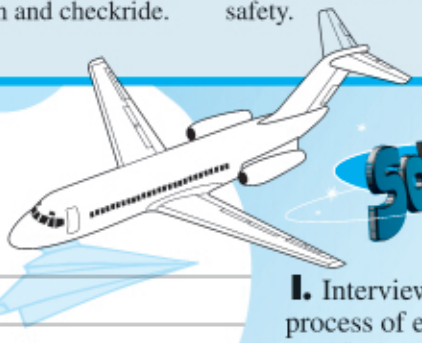
Instrument rating regulations: An instrument rating allows you to fly when visibility is poor and fly in the clouds. You must have a minimum of 125 hours' pilot experience, at least 40 hours' instrument instruction and pass a written examination and a FAA checkride.

Commercial pilot regulations: "Fly-for-hire" pilots must have an instrument rating, be at least 18 years old, hold a Class II medical certificate, have a minimum of 250 hours of flight time and pass a written FAA exam and checkride.

Airline transport pilot: Must have a commercial certificate, pass a Class I medical exam within the last six months, have a minimum of 1,500 flight hours, pass a FAA written examination and a checkride.

VFR Pilots (Visual Flight Rules) navigate by keeping visual contact with objects on the surface.

IFR Pilots (Instrument Flight Rules) can fly by instruments during poor visibility conditions or by visual flight rules. An IFR pilot still has requirements and minimums such as being required to file a flight plan, receive air traffic control clearance and follow IFR cruising altitude or flight levels. Communication and information are key to an IFR pilot's safety.



Solo Flight

1. Interview someone who is in the process of earning a private pilot certificate and share what you learn with a friend with similar interests.

2. Research and explain to your helper the different 'types' of pilot ratings available such as for multi-engine, seaplane, hot air ballooning, helicopter, glider. What are the requirements for each? Why are there different requirements for each category?