OPERATION

LEAPFROG FLIGHT MANUAL

TEACHER PACKET

PREPARATION FOR A FULL EXPEDITION TO THE MOON AND MARS

HMNS Expedition Center Program

This packet is pre-visit material for a **Full Expedition Center Flight** at the **Houston Museum of Natural Science**.

TO TEACHERS

Dear Teachers,

Thank you for planning a field trip to the Expedition Center at the Houston Museum of Natural Science. The Expedition Center Program is the most innovative way for students to engage in STEM objectives, and the Expedition Center at HMNS has 30 years of experience doing so. This packet will help you prepare for a field trip that your students will not soon forget.

Please use the enclosed material to help prepare your students for their flight. This packet is divided into three sections: "**Must Do**" contains the minimum preparation necessary, "**Recommended**" are the activities that will help teachers and students understand and increase the learning potential of the space expedition, and "**Fun Stuff**" are activities that can get your students more excited about the field trip. The Center uses space flight to make many fields of science exciting and introduce scientific career options. As astronauts they will become electrical engineers, chemists, biologists, geologists, environmental scientists, and more. During the expedition we will focus on the teamwork, communication and problem solving skills needed to successfully accomplish goals.

To help teachers prepare for your field trip, the Expedition Center is open for you to visit. We recommend that any teachers who have not previously brought a group come to see the Center and meet with a staff member. To arrange a visit, call 713-639-4727 or email expedition@hmns.org

We enjoy working with a broad range of students with different abilities. If you have students with learning or physical disabilities, or do not read or speak English, it is helpful if you let us know at the start of each expedition so that we can give them the attention they need.

We are here to help make your field trip the best it can be. If you have any questions, call 713-639-4727 or email expedition@hmns.org

We look forward to your visit!
The Expedition Center Staff

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CONTENTS

MUST DO

Preparation that must be done before each expedition.

Expedition Overview
An outline of your day at the Expedition Center.

Multiple Expeditions in One Day
If your school is doing more than one expedition in a day, this chart will help you get the students divided properly.

Team Assignments
This chart will show which teams should be used for your group size. If a student is absent on the day of your field trip, use it to shift the team assignments before your mission.

Team Descriptions
This is a list of job description and skill sets for each position. Review these with your students and choose who is best for each job. Each team has a different job using different abilities and is based on a career on Earth. There is a Job Application activity in the “Recommended” activity section that you can use to help decide assignments.

Crew Manifest
Use this to assign students to their teams. One Crew Manifest is needed for each expedition. Write the names of your students in the team slots. If you have trouble deciding how to assign jobs, do not hesitate to call the Expedition Center for help. Bring the Crew Manifest to the Expedition Center and give it to the staff as soon as you arrive.

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CONTENTS

RECOMMENDED

These activities will help your students function more efficiently and understand the expedition better.

Terms and Astronaut Lingo
Learn the terms commonly used in the Expedition Center and the language of the astronauts and Mission Control.

Sample Pages
It may be helpful for students to see the layout of the instructions they will be following before their expedition.

Job Interview
- Team Application
- Performance Review

To help enhance the career aspect of the expedition, students can apply for the team they want using the Team Application. This will also help teachers decide who to assign to what teams. After the mission, the Performance Review will help summarize the activity.

Extending the Expedition
These notes describe the skills that will be emphasized during the expedition. Teachers should familiarize themselves with this information to know what to watch for during the Mission. Also, each team job is linked to a real-world career. Teachers are encouraged to discuss the use of skills and the careers associated with each team in the days following the visit to the Expedition Center. This information is very helpful in conjunction with the Job Interview activity.

FUN STUFF

Activities that can be added to your expedition.

Crew Patch
Your students can design a crew patch for your mission. Select one patch that represents your group and bring it with you.

Certificate
Make a copy for each student to reward them after their mission.

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EXPEDITION OVERVIEW

When you arrive at HMNS, line your kids up in front of the museum doors. Your lead teacher must check in at the Box Office. Your group should receive bright green ID tags for each chaperone and bright blue tags for each teacher. If your school is scheduled to arrive early in the morning a staff member from the Expedition Center will meet you at the entrance to the Museum to help you get organized. For expeditions during the day, your group should go to the Expedition Center (located on the lower level near Chemistry exhibits) about 10 minutes before your expedition is scheduled to start. To facilitate starting the activity, please make sure each student knows their team name and if they are on the Alpha Crew or Bravo Crew before the start time. At the beginning of the expedition, please give the Crew Manifest to the staff and **tell them if your students are scheduled for a Giant Screen Theater or Planetarium show immediately after the mission** so that we can be sure to finish a few minutes early. Also, it is helpful if we know of any students that have special needs that may require extra attention. The Expedition Center is completely wheelchair accessible.

Two staff members will work with your group. To start the expedition, one of the staff will give a “Mission Briefing” in which the scenario, goals, and team responsibilities will be reviewed. Then the students will be given specific instructions on how to do their jobs. The Expedition Center Program at HMNS has developed a unique mission scenario that incorporates activities on both the Moon and Mars. We call it *Operation: LEAPFROG Lunar Exchange And Preparation For Research On-Going*. As the expedition starts, the students acting as Flight Control are stationed on the Moon at New Tranquility Base in the year 2076. The astronauts will leave Earth orbit and travel to the Moon to take over New Tranquility Base. Along the way they must conduct several experiments and work to complete the first half of the flight. Once they arrive on the Moon, the astronauts and flight controllers will trade places. The crew that has been on the Moon will continue the work as they travel to Mars. Through the journey, there may be problems or emergencies that the crews will have to work through such as high radiation, explosive gases, power blackouts, air system malfunctions and more. The expedition ends with the landing on Mars, and finally with a debriefing to discuss what the students learned.

During the expedition, we will ask that 2 or 3 teachers or chaperones go into the flight simulator with the astronaut group. Other adults will stay at the rear of Mission Control. The involvement of chaperones will be limited during the expedition unless there are students that require special attention. If a discipline problem should arise, we will ask that a teacher step in, and if it continues the student will be removed from the program. You are welcome to take as many pictures as you like.

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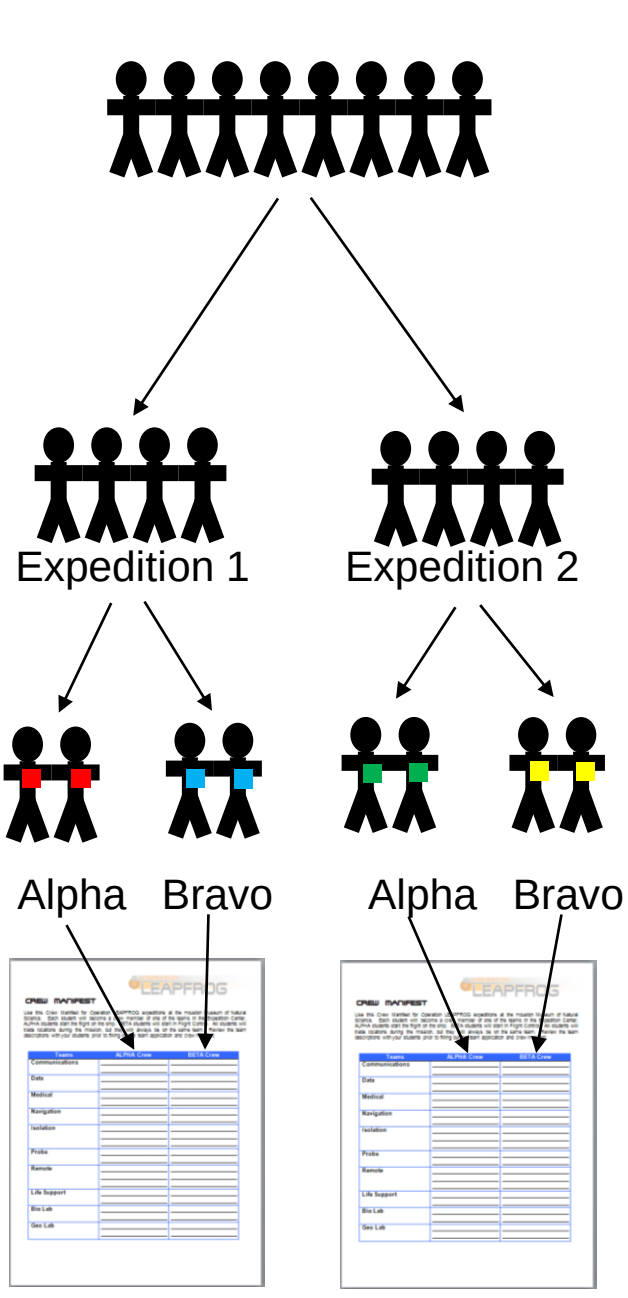
MULTIPLE EXPEDITIONS IN ONE DAY

If you are only doing one expedition in a day, your students simply need to have teams assigned with Alpha Crew and Bravo Crew. Doing more than one expedition calls for more dividing and organizing. Follow the instructions below for organizing more than one expedition in a day.

Each expedition can have up to 44 students. To do two expeditions in one day, you should be bringing between 50 and 88 students. We'll use a group of 80 as an example.



= 10 students

Divide the entire group in half so that there are 40 students for each expedition. Because of differing class sizes, Expedition 1 and Expedition 2 do not need to be exactly the same number.

Expedition 1 will be on one Crew Manifest, Expedition 2 will be on another.

Each expedition group will be split in half. The "Alpha Crew" and "Bravo Crew" must have equal number of students. The "Alpha Crew" will start their flight on the ship, "Bravo Crew" will start in Mission Control.

Write the students' names on the Crew Manifest. It is helpful to identify the crews by using different colors.

OPERATION LEAPFROG

TEAM ASSIGNMENTS

Use this chart to make the best team assignments for your number of students.

# of Students	Assignments to Each Team
18	2 Comm, 2 Data, 2 Nav, 2 Med, 4 Probe, 2 Iso, 4 LS
19	2 Comm, 2 Data, 2 Nav, 3 Med, 4 Probe, 2 Iso, 4 LS
20	2 Comm, 2 Data, 4 Nav, 2 Med, 4 Probe, 2 Iso, 4 LS
21	2 Comm, 2 Data, 4 Nav, 3 Med, 4 Probe, 2 Iso, 4 LS
22	2 Comm, 2 Data, 4 Nav, 2 Med, 4 Probe, 4 Iso, 4 LS
23	2 Comm, 2 Data, 4 Nav, 3 Med, 4 Probe, 4 Iso, 4 LS
24	2 Comm, 2 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS
25	2 Comm, 3 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS
26	2 Comm, 2 Data, 4 Nav, 2 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem
27	2 Comm, 2 Data, 4 Nav, 3 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem
28	2 Comm, 2 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem
29	2 Comm, 3 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem
30	2 Comm, 4 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem
31	3 Comm, 4 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem
32	4 Comm, 4 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem
33	2 Comm, 3 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem, 4 Geo
34	2 Comm, 4 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem, 4 Geo
35	3 Comm, 4 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem, 4 Geo
36	4 Comm, 4 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem, 4 Geo
37	2 Comm, 3 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem, 4 Geo, 4 Bio
38	2 Comm, 4 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem, 4 Geo, 4 Bio
39	3 Comm, 4 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem, 4 Geo, 4 Bio
40	4 Comm, 4 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 4 Rem, 4 Geo, 4 Bio
41	4 Comm, 4 Data, 4 Nav, 4 Med, 4 Probe, 4 Iso, 4 LS, 5 Rem, 4 Geo, 4 Bio
42	4 Comm, 4 Data, 4 Nav, 4 Med, 4 Probe, 6 Iso, 4 LS, 4 Rem, 4 Geo, 4 Bio
43	4 Comm, 4 Data, 4 Nav, 4 Med, 4 Probe, 6 Iso, 4 LS, 5 Rem, 4 Geo, 4 Bio
44	4 Comm, 4 Data, 4 Nav, 4 Med, 4 Probe, 6 Iso, 4 LS, 6 Rem, 4 Geo, 4 Bio

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TEAM DESCRIPTIONS

COMMUNICATIONS TEAM: As a member of the Communications Team, the students will be responsible for all verbal messages between Mission Control and the ship. These students should be responsible and cool under pressure. **Skills**: reading and oral communications, work in high stress situations, ability to prioritize.
DATA TEAM: The Data Team is responsible for all written information exchanged between Mission Control and the ship. **Skills**: computer keyboard operation, good communication, ability to organize.
MEDICAL TEAM: As members of the Medical Team, the students will study the effects of space flight on the human body and are responsible for the health of the astronauts. **Skills**: good interpersonal skills, simple math, and keyboarding.
NAVIGATION TEAM: The navigators will identify constellations, take measurements and make calculations to get the ship into orbit and land on the Moon and Mars. **Skills**: math, geography, and an interest in astronomy.
ISOLATION TEAM: The Isolation Team will use robot arms to conduct chemistry experiments and analyze test results. **Skills**: using joystick controls, observation skills, patience.
PROBE TEAM: As members of the Probe Team the students are responsible for the assembly, deployment, and monitoring of a satellite. **Skills**: strong mechanical skills, analytical problem solving, deduction skills.
REMOTE TEAM: The Remote Team will operate a simulation rover/ jet on the Moon and Mars. **Skills**: using joystick controls, observation skills, patience.
LIFE SUPPORT TEAM: Students on the Life Support Team are responsible for the environmental conditions on the ship that are required to live. They will monitor the air filtering system, water recycling, and electricity. **Skills**: strong problem solving skills, interest in environmental and biological sciences.
BIOLOGY LAB TEAM: The biologists will evaluate living animals, analyze the growth of plants in greenhouse systems, and study crop and seed samples. **Skills**: interest in biology, observation, measurement.
GEOLOGY LAB TEAM: The Geology Team will study and compare rocks and surface features of the Earth, Moon, and Mars. **Skills**: interest in geology, observation, measurement.

OPERATION LEAPFROG

CREW MANIFEST

Use this Crew Manifest for Operation LEAPFROG expeditions at the Houston Museum of Natural Science. Each student will become a crew member of one of the teams in the Expedition Center. ALPHA students start the flight on the ship. BRAVO students will start in Mission Control. All students will trade locations during the mission, but they will always be on the same team. Review the team descriptions with your students prior to filling out the team application and crew manifest.

Teams	ALPHA Crew	BRAVO Crew
Communications		
Data		
Medical		
Navigation		
Isolation		
Probe		
Remote		
Life Support		
Bio Lab		
Geo Lab		

TERMS AND ASTRONAUT LINGO

It may be helpful to review some of these terms with your students.

EXPEDITION CENTER – Formerly known as the Challenger Center. The Houston Museum of Natural Science has been operating flight simulations for students since 1988.

EXPEDITION – A long journey taken for scientific purposes. The word “expedition” is what NASA uses to identify the crews of the International Space Station. The Expedition Center staff will use the term to describe the entire simulation, but generally will not use the term within the activity.

SIMULATION – An activity that replicates a real life experience as closely as possible. NASA has been using simulations to train the astronauts since the beginning of manned space flight.

OPERATION LEAPFROG – The name of the expedition going to the Moon and then on to Mars. It stands for Lunar Exchange And Preparation For Research On-Going.

MISSION CONTROL –The Mission Controllers handle the information part of the job for each team.

SS LEGACY – The name of the space ship. It was named in honor of the seven astronauts of the 51-L Crew who died on board the Space Shuttle Challenger.

TASK CARDS – The instructions the astronauts will follow on the ship.

AFFIRMATIVE – Yes

NEGATIVE – No

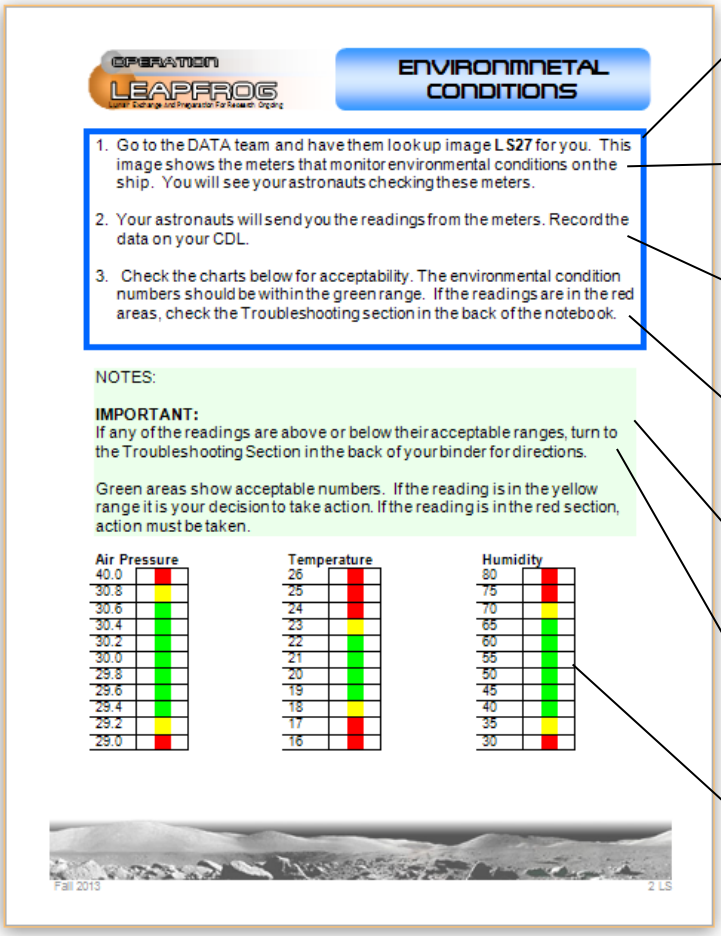
I COPY – I understand, I got your message

ROGER THAT – I understand and I am doing it, or starting it right now.

OVER – Said at the end of a spoken message. It means “I’m finished talking and I’m ready for you to reply.”

SAMPLE PAGES

Flight Control Instructions



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ENVIRONMNETAL CONDITIONS

1. Go to the DATA team and have them look up image **LS27** for you. This image shows the meters that monitor environmental conditions on the ship. You will see your astronauts checking these meters.
2. Your astronauts will send you the readings from the meters. Record the data on your CDL.
3. Check the charts below for acceptability. The environmental condition numbers should be within the green range. If the readings are in the red areas, check the Troubleshooting section in the back of the notebook.

NOTES:

IMPORTANT:
If any of the readings are above or below their acceptable ranges, turn to the Troubleshooting Section in the back of your binder for directions.

Green areas show acceptable numbers. If the reading is in the yellow range it is your decision to take action. If the reading is in the red section, action must be taken.

Air Pressure	Temperature	Humidity
40.0	26	80
30.8	25	75
30.6	24	70
30.4	23	65
30.2	22	60
30.0	21	55
29.8	20	50
29.6	19	45
29.4	18	40
29.2	17	35
29.0	16	30

Fall 2013 2 LS

The instruction steps the mission controllers follow are outlined in blue. It is important that each step is read and completed carefully.

Many teams will need the help of other teams to get the information they need, so Mission Control stays very active.

Astronauts send the test results to the mission controllers. A CDL is the worksheet where all information is written down.

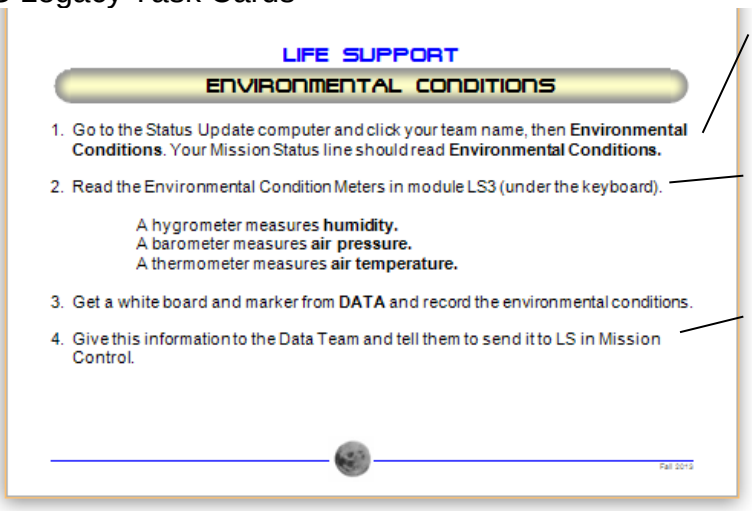
One of the main tasks of the mission controllers is to make sure the tests are being done and the ship is functioning properly.

Mission controllers have notes that give them extra information.

If any of the ship's functions are outside normal range, the mission controllers will need to troubleshoot and correct the problem.

Much of the information the mission controllers need is in charts or graphs.

SS Legacy Task Cards



LIFE SUPPORT

ENVIRONMENTAL CONDITIONS

1. Go to the Status Update computer and click your team name, then **Environmental Conditions**. Your Mission Status line should read **Environmental Conditions.**
2. Read the Environmental Condition Meters in module LS3 (under the keyboard).

   A hygrometer measures **humidity.**
   A barometer measures **air pressure.**
   A thermometer measures **air temperature.**
3. Get a white board and marker from **DATA** and record the environmental conditions.
4. Give this information to the Data Team and tell them to send it to LS in Mission Control.

Fall 2013

Astronauts must keep their progress updated so mission controllers know what they are working on.

The main task of the astronauts is to collect information and conduct experiments.

Astronauts will pass all information and test results to Mission Control through the Data team.

OPERATION LEAPFROG

JOB INTERVIEW

TEAM APPLICATION

Key Concepts
The students will gain real-world job hunting experience by applying for the teams they are interested in as though they were applying for a real job. The goal is for the teacher to help students reflect on their strengths, as they prepare to apply for a job on the upcoming flight in the HMNS Expedition Center Program. The strong workplace readiness component will help to prepare students as they learn about skills for future careers.

The Scenario
Because each person brings a different mix of skills to the workplace, it is important to identify and take advantage of their unique characteristics when finding the right position. Be aware of the teams that will be available by checking the Assignments Chart page and only allow students to apply for these teams.

Procedures
1. Copy and pass out the Team Applications.
2. Make a list of available jobs on the chalkboard and discuss the jobs using the Team Description page of this packet.
3. Students complete the applications.
4. Teacher assigns jobs for the upcoming Expedition Center flight.

PERFORMANCE REVIEW

Key Concepts
After the flight in the Expedition Center, students will follow up the pre-expedition Job Interview with a performance review. They will reflect on their objectives and evaluate their own performance.

Procedures
1. Copy and pass out the Performance Review.
2. Students complete the review.
3. Discuss the students' answers.

TEAM APPLICATION

OPERATION LEAPFROG

Name _____
Date _____ Period _____ Grade _____
School _____ Teacher _____

Career Objectives:

I am applying for a position on these teams:
Number your first, second, and third choices.

- ❑ Communications
- ❑ Data
- ❑ Life Support
- ❑ Navigation
- ❑ Probe
- ❑ Isolation
- ❑ Remote
- ❑ Medical
- ❑ Geology
- ❑ Biology

What qualities do you have for these positions?

_____
_____
_____
_____
_____
_____

What experience do you have for these positions?

_____
_____
_____
_____
_____
_____

References

Name _____
Relationship _____

Name _____
Relationship _____

OPERATION LEAPFROG

PERFORMANCE REVIEW

Name _____
Date _____ Period _____Grade _____
School _____ Teacher _____

State the responsibilities that you had as part of your mission team.

_____
_____
_____
_____

What problems did you encounter in meeting your objectives during the mission?

_____
_____
_____
_____

What might you do differently or better if you had the job to do again?

_____
_____
_____
_____

From your observations, what other mission work team interested you and why?

_____
_____
_____
_____

Are you more interested in going into science because of having a role on this mission?

_____
_____
_____
_____

Extending the Mission

Things to look for and discuss after an HMNS Expedition Center Program.

At the end of the flight, the Expedition Center staff will discuss some of these ideas, but there will not be enough time to cover all of them or go into much detail. Teachers are encouraged to discuss these ideas with their students after returning to school.

Skills

Teachers should watch for these skills, and after the flight discuss with students how they could use the skills to achieve their goals in school.

Reading
Listening
Being responsible
Prioritizing
Working on a team
Communicating
Problem Solving

In the Expedition Center Program, students will have to use many different skills to complete a successful expedition. These skills are an important part to getting the job done. Everyone will have jobs to do during the flight as astronauts and mission controllers, but they also have real life jobs – being students. By developing skills in this simulated activity, we can promote using the same skills to be a successful student. At the beginning of the expedition, in the "Mission Briefing", three goals are set: 1) Land on the Moon, 2) Land on Mars, and 3) Complete assigned work. Each student also has goals at school – improved grades, achieve all A's, pass standardized tests, etc. The same skills used to meet the flight goals will also help students meet their goals at school. The following explanation of skills compares the importance of each in the Expedition Center and at school. Teachers should watch for these skills being used during the flight. After your day in the Expedition Center, the field trip can be used to remind students of the importance of using these skills to achieve their goals.

Reading – The level of success of each team relies on how well they read the instructions. Every team will follow step-by-step instructions that tell them exactly how to do their jobs. If the students are reading carefully they will work quickly, get quality work done and understand what they are doing. Flight goal number three, complete assigned work, depends on quality reading by each team. At school, students must read their assignment instructions carefully. If students read carefully, they will understand the assignment better, get better quality work done, and get better grades.

Listening – In order to complete their goals, students must listen to instructions from the Expedition Center staff carefully and also listen to the messages flowing between the ship and Mission Control. Without this information, students will not understand the tools they will have available or what is going on around them. Also, a team that is not paying attention can potentially slow down the work of other teams that must wait on them. In the classroom,

students must listen to lessons and instructions so that they understand their assignments and what is happening with the rest of the class.

Being Responsible – In the expedition, each team is responsible for a different job and everyone on the team has a part; mission controllers must handle the information required for their team and astronauts must complete the hands-on work. Just as astronauts and mission controllers must get their assigned work completed, students must be responsible for their own schoolwork. A student cannot be successful in school without getting his or her work done and getting it turned in on time.

Prioritizing – At times during the flight things can happen that will need attention before the scheduled work, and students may encounter emergencies that need to be solved. They will need to decide which messages to send first and what can wait. There will be times when a team will need to take priority over other teams. A good student will set priorities. For example, when a student wants to go outside with friends or has a favorite TV show coming on, but has a big test the next day, studying should come first.

Working on a Team – Each team has two sides, astronauts and mission controllers, who must work together. Astronauts cannot complete their experiments without the information from their mission controllers, and flight controllers cannot do anything without the test results of the astronauts. Each half of the team must stay on task for the other side to complete their work. If students cooperate and share the work they will be able to work more efficiently. At school, students may work on group projects or on sports teams. Working together can help an entire class learn more; however, sometimes teamwork is not allowed, like on a test!

Communicating – Astronauts and mission controllers will be able to communicate with each other by verbal and text messages sent through the Communications and Data Teams. Good communications is two-sided; it requires a clearly spoken message or good handwriting, and someone listening or reading carefully on the other end. Also, to be able to get a message students must be able to hear it. Listening is an individual task – each person is responsible for his own ears. Hearing is a group task – the noise volume of a group must be low enough for the message to be heard. Students will quickly find that if they are unable to communicate with each other they will not be able to complete their work. Midway through the flight, during the “crew exchange”, we will pause and evaluate the first half. Comments from students usually focus on the need to improve a breakdown in communications. Very often the students will point out that they cannot hear messages, cannot read handwriting, or the teams are not organizing the message to be sent. In the second half of the flight, students should be able to see that their work is much easier when they have clean, clear communications. In the classroom, students that can ask questions clearly, listen carefully, have good handwriting, and can hear information will find it easier to get their schoolwork done.

Problem Solving – An Expedition Center flight is full of problems; some small, some "life threatening", but all have a solution. Students may need to think through what to do when a part isn't fitting right, or when the crew is about to fail the expedition. Sometimes they will just need to put their heads together to do some critical thinking, or they may take top priority in sending messages to ask for help. In school students will need to solve problems, some small and some big. Many times they will need to ask for help in solving the problem, just as astronauts will have to ask their mission controllers for help. In both space travel and school, giving up is not an option.

Throughout the flight, students should improve at these skills and the efficiency of their work should increase. At the beginning, students will not know much more than the basics- read your instructions and listen carefully. During the first half of the flight, students will be learning how to do their work. In the second half of the flight they should be able to work smarter and more efficiently, so the work should be easier for them. Also, in the second half the astronauts have the experience of knowing how Mission Control works, and mission controllers know what to expect from the astronauts.

Careers

The teams in the Expedition Center all match careers that will be in high demand in the future. (The career of an astronaut is not one of them.) The HMNS Expedition Center Program promotes the science, technology, engineering and math careers that are attainable by anyone that sets their mind to it. An astronaut's job is so specialized and so unique that we don't promote it as a career.

People will never pursue a career that they have never experienced – someone will not become a chemist that has never been shown what chemistry is, and no one grows up to become an engineer without first learning what engineering is. The experience of an Expedition Center flight is also a sample of the careers that match each team.

Engineering is the science of designing and building things. An engineer produced everything man-made, from cardboard boxes to rockets. The Probe Team models electrical engineering and the Isolation Team uses robotic engineering. Engineering can be paired with all sorts of other interests: someone that likes the outdoors could become an environmental engineer and someone that likes the city could be a civil engineer. The United States is not producing enough engineers to meet future demand; therefore, the job outlook of those going into the engineering fields is excellent.

Many teams emulate fields of research science. Life Support demonstrates environmental science. The astronauts are testing the air and water quality on board the ship. Back on Earth scientist must track our air and water pollution, especially in a large city like Houston. The Biology Team studies the living animals and plants on the ship. Healthy ecosystems are

important to the health of the human population on Earth. Because of the energy industry, geology is one of the most important sciences for the city of Houston. Geologists that locate fossil fuels have a good job outlook with the energy companies. The Isolation Team must conduct laboratory experiments under strict sterile conditions with great safety precautions. Many fields of science from cancer research to studying moon rocks use these same techniques.

In the entire expedition scenario, the Navigation Team is the only one using astronomy. Houston is Space City, USA. There are many programs within NASA that look at space from Earth, or Earth from space. Whether it's sending a probe through the solar system or planning a future Moon colony, we will need to know where we're going.

The Medical Team is also part of the heart of Houston. Our Medical Center is home to some of the best hospitals in the world, and because of the aging US population the medical field will be expanding in the future.

In the Expedition Center flight, there are two teams that handle information: Communications and Data. The Communications Team does all the talking and handles information being spread to other people, just like a Public Relations department. The Data Team is the Information Technology department of the flight. The Data Team must keep information flowing smoothly, just like an IT department that keeps email systems and data transfer running smoothly and securely.

Teachers are encouraged to describe the career models in the Expedition Center to their students. It may just be the spark needed to help a student find a rewarding and valuable career.

This certifies that

_____

has successfully completed

Operation: LEAPFROG

LUNAR EXCHANGE AND RESEARCH ON-GOING

HMNS
Expedition Center
Program

_____

Teacher signature

_____

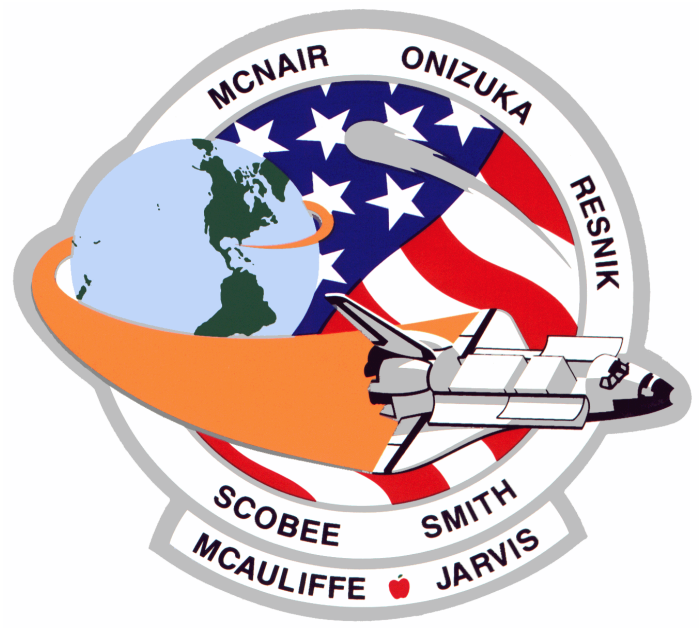
Date

CREW PATCH

Your students can design a crew patch for their flight. Bring one patch to the Expedition Center to be added to our Crew Patch Database.

Patch Specifications:

- Patch should be on 8 ½" x 11" paper.
- Design should include the name of the school and the year.
- Designs should be colorful and represent the school or the class.
- One patch per flight. Students can design the patch together, or students can each design a patch then the group votes for one to represent them.



51-L Mission Patch
This patch symbolizes the mission to fly, to explore, to teach. The shuttle, being launched from the United States of America, encircles the planet to signify its U.S. presence in space to explore new frontiers. The shuttle in flight with open cargo doors represents the 51-L mission to launch a communications satellite to collect data from Comet Halley and to conduct scientific experiments. The apple next to the teacher's name signifies the educational mission of the crew to touch the future through the lessons taught in space. The scene is encircled by the surnames of the crew members. They were astronauts Francis R. (Dick) Scobee, Commander; Michael J. Smith, pilot; Ron McNair, Ellison Onizuka and Judy Resnik, all mission specialists; Greg Jarvis, payload specialist; and Christa McAuliffe, teacher.