

Teacher Task Cards



VOYAGE TO MARS



TEACHER TASK CARDS

INTRODUCTION

The year is 2076. A permanent base has been established in the Chryse Planitia region of Mars, just northeast of Valles Marineris.

The Alpha Crew is wrapping up 24 months of exploration, the period required for the orbits of Mars and Earth to cycle back into a position favorable for their return to Earth. The Beta crew has nearly completed their six-month journey to Mars. It is now time to exchange crews at Chryse Station.



As classroom teacher, your job is to train the crew to work together as a team, find solutions to problems, make responsible decisions, and communicate with each other clearly and effectively.

These task cards will guide you through the process of crew preparation by outlining mission events,

directing you to relevant classroom activities, and suggesting topics for further discussion and exploration.



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CLASSROOM PRE-MISSION PREPARATION CHECKLIST

Several weeks prior to your mission:

- Review Voyage to Mars mission objectives (pg. 5) with crew
- Review team descriptions with crew
- Choose resources and activities that
 - fit the standards you need to teach in your classroom
 - promote teamwork, problem solving, communications, and decision making
- Distribute [Job Applications](#)
- Complete [Crew Manifest](#)
- Distribute and collect [Consent and Release Forms](#)
- Distribute and collect [Gift Shop Forms](#), including exact payment





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MISSION OBJECTIVES

- Land BETA Crew Safely at Chryse Station
- Conduct Geologic Study of Martian Surface
- Deploy ARES Plane into Martian Atmosphere
- Conduct Geographic Study of Martian Surface
- Deploy Probe to Phobos & Deimos
- Maintain the Health and Safety of the Crew

CRITICAL SKILLS

- Work Together as a Team
- Solve Problems
- Make Responsible Decisions
- Communicate Clearly and Effectively





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CHALLENGER MISSION TEAMS

The crew is organized into teams consisting of members of both the Mars Lander and Mars Control crews, all of whom are working toward the same goals. Together they will complete their tasks by sharing, coordinating, and cooperating.

The Life Support team on your mission, for example, may include as many as six people – three working in the Mars Lander, and three working in Mars Control. While the LS team members aboard the Mars Lander are busy testing the pH of onboard water supplies, their teammates in Mars Control may be scouring recently received data describing the lander's artificial environment for signs of danger.

In the event of an emergency, teams solve problems together by sharing information, conducting research, supplying procedures, and carrying out a solution.





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MISSION TEAM RESPONSIBILITIES

Navigation (NAV)

The **Navigation Team (NAV)** is responsible for knowing where the Mars Lander is and where it is going.

They begin by calculating the distance of the sun, Earth, and Mars from the Mars Lander. This pinpoints the location of the Mars Lander in the Solar System.

Next they need to determine the correct angle for the engines to fire in order to achieve a counter clockwise orbit around Mars. Their next assignment is to survey the surface of mars to determine the safest landing path.

Before lifting off for the return trip to Earth, the Nav team must use an Astro telescope and a Laser Meter to make sure that there are no unidentified objects passing close to Mars that would jeopardize the liftoff.

Finally the Nav team will collaborate with other teams to decide how long the return trip to Earth will take.



Navigation

Space Weather (SW)

The **Space Weather Team (SW)** is responsible for assessing potential hazards posed by powerful solar events.

Using a combination of recent satellite imagery and up-to-date research, SW team members will study current sun spot patterns and track Coronal Mass Ejections that could endanger the crew, orbiting satellites, earth-based power grids, and citizens of Earth.

The SW Team will use hand-held models to aid in visualizing the structure of Earth's protective magnetic field.



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Probe (PROBE)

The **Probe Team (PROBE)** is responsible for assembling, testing, repairing, and deploying the scientific probes employed in the mission. They will do research to get information about the function of each of the instruments that will be installed on probe. They will also research Phobos and Deimos, the moons of Mars.

The Probe team will begin by massing each instrument before it is installed on the probe motherboard. If there is too much total mass, the Probe team will need to evaluate each instrument for possible exclusion.

After the probe is assembled, it will be deployed to do a flyby of the Martian moons Deimos and Phobos.



Probe

Isolation (ISO)

The **Isolation Team (ISO)** is responsible for monitoring radioactive samples, micrometeoroid impact panels, and hazardous chemicals stored on board the Mars Lander. Articulated-arm robots are employed to handle the materials, which are stored in an airtight isolation chamber.

The **ISO 1** Team monitors:

- chemical samples for evidence of leakage or potential explosion;

The **ISO 2** Team monitors:

- condition of externally-mounted micrometeoroid impact panels for evidence of heavy bombardment;

The **ISO 3** Team monitors:

- air filters for evidence radioactive contamination.

The Isolation Team will also be looking at contour maps of Mars. They will plot a path for a rover to travel from the base of Olympus Mons to its caldera.



Isolation

Remote (REM)



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The **Remote Team (REM)** is responsible for the program of Martian geological science conducted during the mission. They will study and compare Earth and Mars rock and mineral samples. They will also track the position of the Mars Rover and the Field Geologists that are collecting rock and mineral samples from the surface of Mars.

The Remote Team is looking for minerals on Mars that can be used as building materials or medicines. They are also looking for clues to the history of water on or under the surface of Mars.

Martian rock and soil samples will be examined. Samples of Mars "Blueberries" from Eagle Crater are compared to earth hematite. Other samples from the Martian surface and Earth are compared and contrasted. Characteristics such as color, luster and magnetism are recorded.

Dust storms often occur on Mars. If a dust storm is approaching, the Remote Team will be responsible for tracking it in order to keep their teammates informed.



Remote

Life Support (LS)

The **Life Support Team (LS)** is responsible for the systems which make life aboard the Mars Lander and in Mars Control possible. They are also responsible for overseeing the food supply to ensure that the crew is receiving proper nutrition.

The LS Team monitors:

- the quality of the artificial atmosphere, including temperature, humidity, and atmospheric pressure;
- the onboard oxygen supply, as well as the solar panel system that generates all electrical power aboard the Mars Lander; and
- the onboard water supply, testing for pH levels, and levels of total dissolved solids (TDS).



Life Support

To avoid information congestion, all messages are sent through one of two teams - COM or DATA. Many of the data and communication messages essential to the mission are embedded in the manuals and task cards. Crewmembers should use these examples to fashion any other messages that become necessary.



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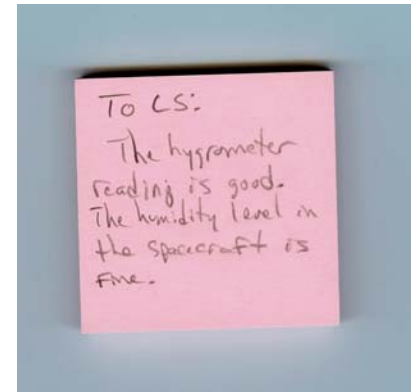
TEACHER TASK CARDS

All messages are to be written on the paper provided, beginning with the name of the receiving team, followed by the message, written as clearly and concisely as possible. Complex messages, or messages containing numbers, are brought to the DATA Team for transmission. All other messages go through the COM Team.

Communications (COM)

The **Communications Team (COM)** manages the flow of spoken messages between the Mars Lander and Mars Control. COM transmits messages via radio, which is quick and easy.

Radio transmissions are subject to dropout and interference, however, so COM officers use a *protocol* when transmitting that ensures messages are heard in their entirety. COM officers defer complex messages, and messages containing numbers, to the DATA Team.



Correct format of Data/Communication message

Data (DATA)

The **Data Team (DATA)** manages the flow of electronic messages and images between the Mars Lander and Mars Control.

Because electronic messages can be reread and referenced later, complex messages, and messages containing numbers, are transmitted between DATA officers in Mars Control and the Mars Lander. The Data officers then prioritize and transmit the messages at one end, and receive, print, and distribute them to appropriate crewmembers at the other end.



Communications



Data



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TEACHER TASK CARDS

Engineering Design Lessons from the McAuliffe Center

- [Who Will Go To Mars](#)
- [Spacesuit Design](#)
- [Is There Life on Mars](#)
- [Investigating Ore Deposits on Mars](#)





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TEACHER RESOURCES ONLINE

McAuliffe Center Articles

- [About Mars](#)
- [Mars/Earth Comparison](#)
- [Mars Timeline](#)

General

- The [McAuliffe Center's Website](#)
- [NASA Explores](#) is a NASA website offering lessons and online resources for teachers
- [Mars Links](#) assembled by SEDS (Students for the Exploration and Development of Space)
- [NASA website](#) for students at all grade levels
- [Mars Exploration Rovers](#)
- [Mars Phoenix Lander](#)
- NASA Lunar and Planetary Science [Mars Page](#)



www.christa.org, the
McAuliffe Center's website



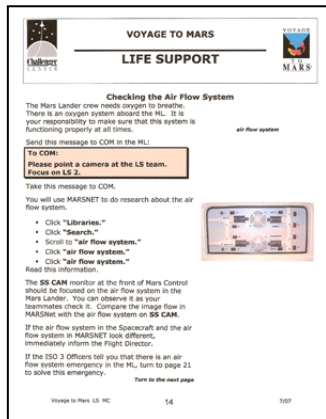
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MARS CONTROL MANUAL

Crewmembers in Mars Control direct and assist the Mars Lander crew throughout a series of tasks. All instructions necessary for the completion of these tasks are found in their Mars Control Manuals.



Sample Mars Control Manual Page



Mars Control Manual



Challenger Mars Control



Mars Control

The purpose of the manuals is to empower the crew to take a proactive, rather than reactive, approach to the mission. It guides them step-by-step through an otherwise unfamiliar process, encouraging teamwork over conflict, problem solving over guesswork, responsible decision making over uncertainty, and clear and effective communication over information overload.

Data generated by the Mars Lander crew is recorded by Mars Control crewmembers in Data Logs. Each team's Data Log is formatted to accommodate the unique data they will process.

Once recorded, the data is analyzed per instructions provided in the manual.

RETURN TO THE MOON		LIFE SUPPORT DATA LOG		RETURN TO THE MOON	
Hygrometer Reading					
HYGROMETER READING	ACCEPTABLE LEVEL?	ACTION TAKEN			
%	Yes / No				
Humidity Research:					
1. Fill in the missing numbers: An acceptable humidity reading in the Spacecraft will be somewhere between _____ and _____ percent.					
2. What is humidity?					
Barometer Readings					
AIR PRESSURE TODAY	AIR PRESSURE YESTERDAY	DIFFERENCE	ACCEPTABLE LEVELS?		
_____ inches	_____ inches		Yes / No		
AIR PRESSURE RESEARCH:					
Fill in the missing number: The difference between yesterday's air pressure and today's air pressure should be no more than _____ inches.					
What does a barometer measure?					

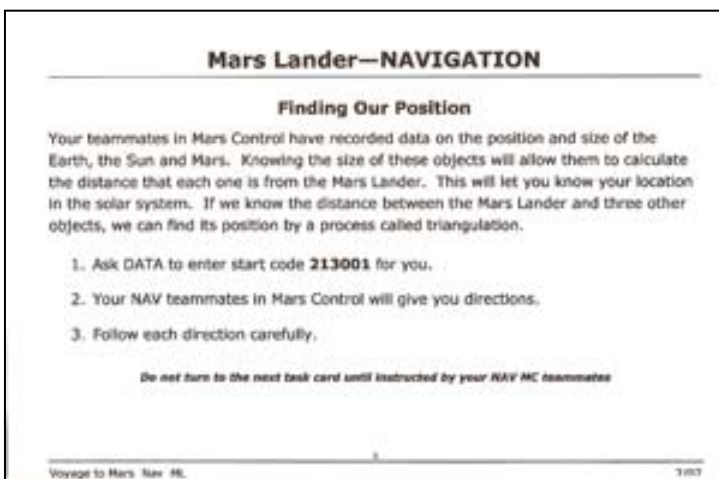
Sample Data Log Page

MARS LANDER TASK CARDS

Crewmembers in the Mars Lander are guided through the mission by a set of Task Cards.



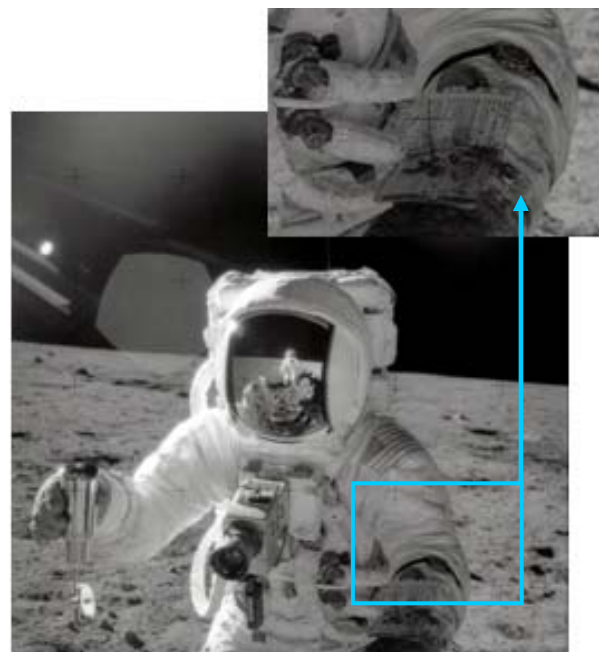
Mars Lander Task Cards



Sample Mars Lander Task Card Page

The Mars Lander Task Cards provide the same step-by-step guidance to crewmembers as the Mars Control Manual, although in a compact and concise form more suitable to a Mars Lander environment.

An important difference is the inclusion of Start Codes. All Mars Lander teams, except for COM and DATA, enter these six-digit numbers into their console computers as indicated by the Task Cards. The Start Codes trigger the appearance of short descriptions of the team's current task on the Mission Status Monitor, one of the four large monitors prominently located in both Mars Control and the Mars Lander. These messages allow Mars Control and Mars Lander teams to synchronize their efforts and work more effectively together.



The Apollo Astronauts used task cards to keep them on track during their extra-vehicular activities on the Moon's surface.



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CLASSROOM POST-MISSION DEBRIEFING CHECKLIST

In the days following your mission:

- Hold [Press Conference](#)
- Discuss [Future Mars Mission Objectives](#)

