

Rocket Nose Cone



Protects your spacecraft during launch. **Required for all missions!**

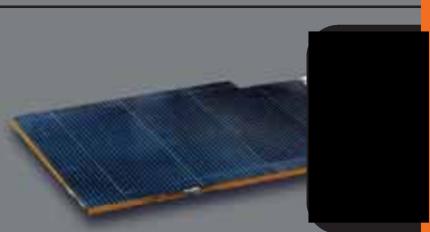
✓ PROS:

- Low cost.
- No power needed.

✗ CONS:

- Medium mass.

Low-Power Solar Panel



Gives your mission electricity.

✓ PROS:

- Low cost, low mass.
- Lasts a few years.

✗ CONS:

- Must have sunlight. Only works during daylight.
- Only works near the equator.
- Requires on-board battery (card #10)

Medium-Power Solar Panel



Gives your mission electricity.

✓ PROS:

- Low cost, medium mass.
- Lasts a few years.

✗ CONS:

- Must have sunlight. Only works during daylight.
- Only works near the equator.
- Requires on-board battery (card #10)

High-Power Solar Panel



Gives your mission electricity.

✓ PROS:

- Medium cost, medium mass.
- Lasts a few years.

✗ CONS:

- Must have sunlight. Only works during daylight.
- Only works near the equator.
- Requires on-board battery (card #10)

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On-board Battery



A battery is required for all solar-powered missions.

✓ PROS:

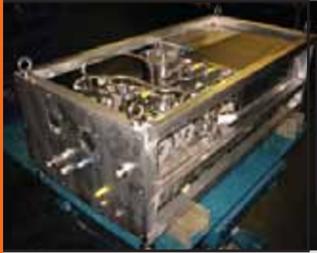
- Stores power collected by solar panels so your mission can survive when the sun is not visible.

✗ CONS:

- Increases the cost, mass and power points for your mission.

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Fuel Cell



Gives your mission electricity.

✓ PROS:

- Does not need the sun or a battery.
- Provides more power than solar panels.
- Works everywhere.

✗ CONS:

- Lasts a few months.
- Costs more than solar panels.

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Radioisotope Power System



Gives your mission electricity.

✓ PROS:

- Does not need the sun or a battery.
- Provides the most power of all.
- Works everywhere.
- Lasts over a decade.

✗ CONS:

- Costs the most.
- Has the most mass.

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Low-Resolution Camera



Makes discoveries about the environment on Mars.

✓ PROS:

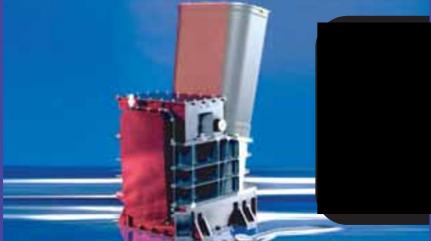
- Sees a very wide area of Mars.
- Low cost, low mass.
- Does not use much power.

✗ CONS:

- Can't see small details on Mars.

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Medium-Resolution Camera



Makes discoveries about the environment on Mars.

✓ PROS:

- Sees twice as much detail as the Low-Resolution Camera.
- Low mass and low power usage.

✗ CONS:

- Medium cost.
- Sees a smaller area on Mars than the Low-Resolution Camera.

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High-Resolution Camera



Makes discoveries about the environment on Mars.

✓ PROS:

- Sees the most detail of all.

✗ CONS:

- See only a tiny area of Mars.
- Costs the most.
- Has more mass and uses more power than other cameras.

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Infrared Camera



Makes discoveries about the environment on Mars.

✓ PROS:

- Gives basic information about minerals and grain size of the soil on Mars.
- Low mass and low power usage.

✗ CONS:

- Medium cost.

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Infrared Spectrometer



Helps discover if Mars was ever a habitat for microbial life.

✓ PROS:

- Detects minerals in detail, including those that formed in water, which is essential to life.
- Low mass and low power usage.

✗ CONS:

- High cost.

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High-Energy Spectrometer



Helps discover if Mars was ever a habitat for microbial life.

✓ PROS:

- Helps show where on Mars has water, which is essential to life.
- Low mass and low power usage.

✗ CONS:

- High cost.

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Radiation Sensor



Helps discover if Mars could be a habitat for humans someday.

✓ PROS:

- Shows healthier places for people where radiation is lower.
- Low cost, mass and power usage.

✗ CONS:

- Data may not be used for a long time to support human missions.

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Life Sciences Laboratory



Helps discover signs of past or present microbial life on Mars.

✓ PROS:

- Helps find out if Earth is the only place that supports life.

✗ CONS:

- Highest cost, most mass and uses the most power.
- Requires sample collection device (card #25).

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Laser Topography Mapper



Makes discoveries about the environment on Mars.

✓ PROS:

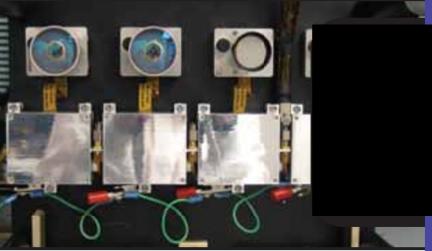
- Measures the high and low points of the Martian terrain, including mountains and craters.
- Low mass and low power usage.

✗ CONS:

- High cost.

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Color Stereo Camera



Makes discoveries about the environment on Mars.

✓ PROS:

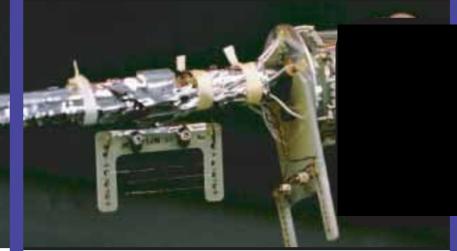
- Provides a 3D experience of Mars by combining images taken by a set of cameras.
- Low mass and low power usage.

✗ CONS:

- Medium cost.

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Atmosphere/Wind Sensors



Makes discoveries about the environment on Mars.

✓ PROS:

- Collects detailed data about wind speeds and chemicals in the atmosphere.
- Very low cost, low mass and low power usage.

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Magnetometer



Helps discover areas that might protect microbial or human life.

✓ PROS:

- Measures where Mars has a magnetic field, which can protect life from radiation.
- Very low cost, low mass and low power usage.

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Sample Collection Device



Required for Life Sciences Laboratory.

✓ PROS:

- Collects air, rocks or soil samples for study by the Life Sciences Laboratory.

✗ CONS:

- Adds minor costs, mass and power usage to your mission.

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Wheels



Either wheels or tracks are required for rover missions.

✓ PROS:

- Wheels carry rovers to discoveries beyond their landing sites.
- Medium speed and work on rocky terrain.

✗ CONS:

- Have a little more mass, and use a little more power than tracks.

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Tracks



Either wheels or tracks are required for rover missions.

✓ PROS:

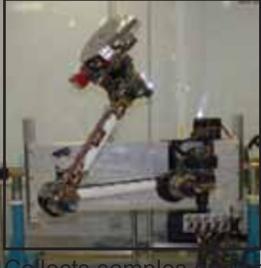
- Have less mass and use less power than wheels.

✗ CONS:

- Can make it harder to climb over some obstacles.
- Less precise steering.

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Robotic Arm



Collects samples and carries a number of science instruments.

✓ PROS:

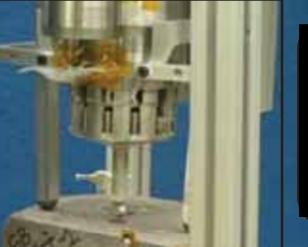
- Doesn't use much power.
- Low cost.
- Provides an added science point.

✗ CONS:

- Medium mass.

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Rock Drill



Collects samples by drilling into rocks.

✓ PROS:

- Low cost, low mass.
- Provides an added science point.

✗ CONS:

- Medium power.

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Rotating Instrument Mount



Provides flexible structure for multiple science instruments.

✓ PROS:

- Holds science instruments so they can collect data in a circle without moving the spacecraft.

✗ CONS:

- Adds minor costs, mass and power usage to your mission.

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Heat Shield



Required to protect all landers and rovers traveling through the atmosphere to the surface.

✓ PROS:

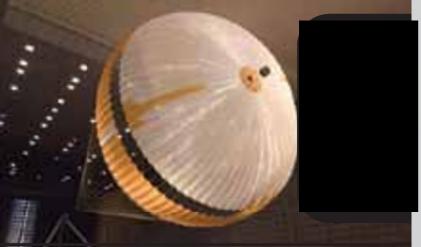
- Very low cost.
- Does not use power.

✗ CONS:

- Medium mass.

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Hypersonic Parachute



Required for all Mars landers and rovers.

✓ PROS:

- Slows the spacecraft down prior to using airbags or retro rockets.
- Low cost.
- Does not use power.

✗ CONS:

- Medium mass.

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Retro Rockets



Either airbags or retro rockets are required for Mars landers and rovers.

✓ PROS:

- Slows the spacecraft down for a controlled landing.
- Lower cost and mass than airbags.

✗ CONS:

- Spacecraft can be damaged by landing in rocky terrain.

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Airbags



Either airbags or retro rockets are required for Mars landers and rovers.

✓ PROS:

- Protects spacecraft from impacts on rocks and slopes.

✗ CONS:

- Higher cost and mass than rockets.
- Precise landings are difficult because the airbags bounce.

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Impact Probe



Probes can be added to enhance discoveries.

✓ PROS:

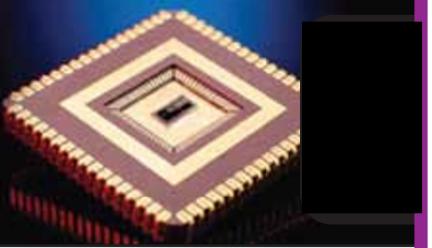
- Penetrates the Martian surface at high speeds to collect data from below the surface
- Does not use power.

✗ CONS:

- Adds cost and mass to your mission.

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Standard Microprocessor



At least one microprocessor is required for all Mars missions.

✓ PROS:

- Provides mission "brainpower."
- Low cost, mass and power usage.

✗ CONS:

- Provides only basic functions needed to receive commands and send data.

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Advanced Microprocessor



At least one microprocessor is required for all Mars missions.

✓ PROS:

- More "brainpower" lets the space-craft make simple choices without commands from Earth.

✗ CONS:

- Costs more and uses more power than the standard microprocessor.

Main Bus



Connects science tools with the onboard computer so they work. **Required for all missions!**

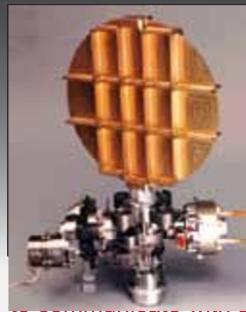
✓ PROS:

- Low power usage.
- Allows you to make discoveries with your science tools.

✗ CONS:

- Medium cost and mass.

High-Gain Antenna



At least one antenna is required to communicate with Earth.

✓ PROS:

- Sends large amounts of data at one time.

✗ CONS:

- Costs more and uses more power than the Low-Gain Antenna.

Low-Gain Antenna



At least one antenna is required to communicate with Earth.

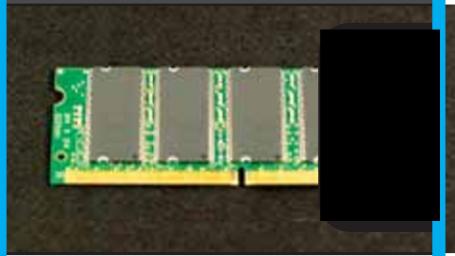
✓ PROS:

- Low cost and power.
- Can be used as a backup for the High-Gain Antenna.

✗ CONS:

- Cannot send much information at one time.

Main Memory Card



Stores all Mars data until it can be sent back to Earth. **Required for all missions!**

✓ PROS:

- Low cost, mass and power usage.

✗ CONS:

- None! Your mission does not have a continuous link with Earth, so you need a way to store your data.



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