



## Cassini: Mission Planning Exercise

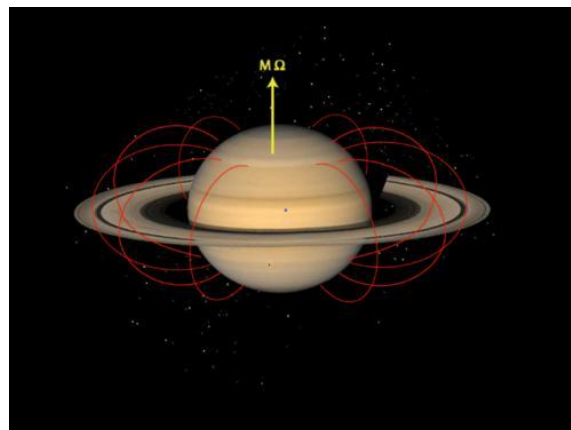
### Fields and Particles

Both electric and magnetic fields are of interest. They originate from the Sun and planets. The particles being referred to are Hydrogen (protons and electrons) and atmospheric atoms (ions) from Saturn and its moons. This is a difficult subject because the particles aren't visible. In some cases, planets or moons can lose their atmospheres to space. For example, it is thought that Mars used to have an atmosphere but it was lost somehow. By studying the atmosphere of Titan an explanation could be found.

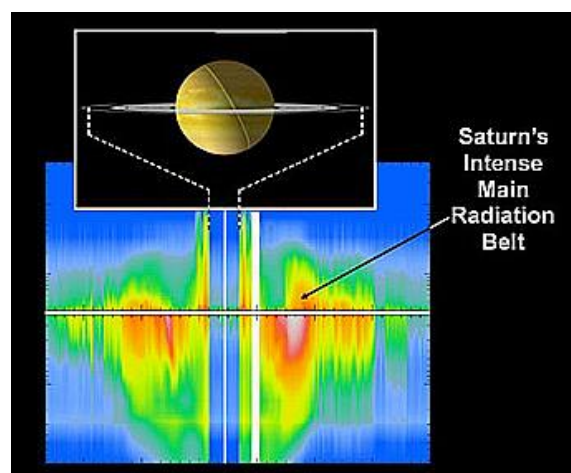
### Instruments

One important instrument that can be used is the Magnetometer. This instrument is essentially a magnetic compass and directly measures a magnetic field. The instrument is extremely sensitive to electric currents and metal components, so it is placed on an 11m boom made of non-metallic material. The boom remained folded during launch and was only deployed two years after launch. It can help identify the rate at which the planet or moon rotates. This has consequences for weather in the atmosphere.

This is the type of data that is recorded, the image below shows the magnetic field lines around Saturn:



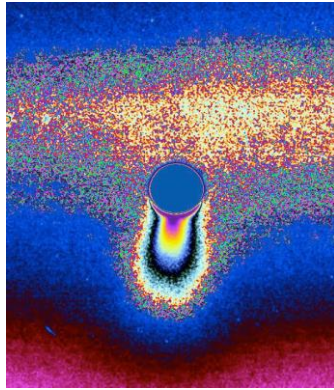
Other important observations includes the radiation of the rings of Saturn:





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It's not just Saturn that is of interest. Features of the moons can be identified by study the fields and particles. Enceladus is shown in the image below and it can be clearly seen that jets of material are being thrown off the moon. These powerful geysers were first seen with the magnetometer and it was only later that the imaging system was used to take a picture. This was an important discovery because it is thought that this material is responsible for creating or increasing the dust and ice in Saturn's E ring.



### Getting Started

- Do you get close to any moons? If so, which ones and when?
- When do you get closest to the planet?
- When do you cross the ring plane?
- Which of the four instruments do you want to use to make your observations?
- When do you want to make those observations?



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### Spreadsheet Instructions

When you have decided what targets you want to go for and the instruments you want to use, you are ready to fill in the spreadsheet.

There are only two different columns that you can put data into:

1. Column C: target. Type in the name of the object you want to focus on, eg Titan.
2. Column D: instrument. Next to the name of the object put in the code for the instrument you want to use.

Key for instruments:

Instrument	Symbol
Imaging	I
Magnetometer	M
Dust detector	D
Radar	R
(asleep)	Z
<i>Telemetry Downlink</i>	<i>T</i>

Importantly, each instrument takes up data in the memory. There is a maximum amount that can be used up in each time period. Once the memory is full, the data must be sent back to Earth. This then means new observations can be made. However, whilst the data is downloaded the spacecraft can't be used for anything else.

		Data Rate
Instrument	Symbol	(Mb per hour)
Imaging	I	200
Magnetometer	M	70
Dust detector	D	100
Radar	R	400
(asleep)	Z	0
<i>Telemetry Downlink</i>	<i>T</i>	<i>-100</i>

Once you have filled in all the slots where you want to make some observations (you don't have to fill in the whole spreadsheet!) you should ensure that the group knows the scientific reasons for making that observation as you may have to negotiate with other groups to get what you want...