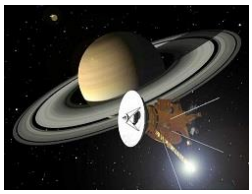
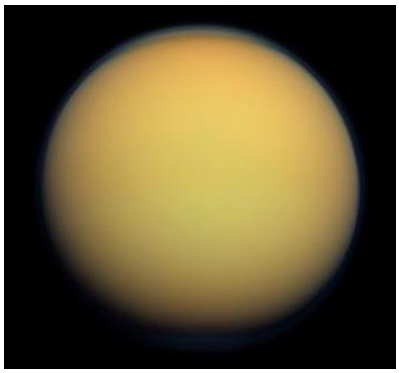


Cassini: Mission Planning Exercise

Atmospheres

There are lots of reasons why atmospheres are extremely important subjects to study. Whilst a lot of time is spent understand the atmosphere of the Earth, there are features seen on other moons and planets that we don't have on Earth. In addition, we have begun to identify large numbers of planets outside our solar system. These extra-solar planets could potentially host life and by studying their atmospheres we could perhaps identify the existence of life. The Cassini spacecraft is interested in the atmosphere of Titan. The conditions of the moon are believed to similar to that of the Earth shortly after it was formed. This means that by observing the atmosphere there is a lot to be learned about the history of the Earth.



Instruments

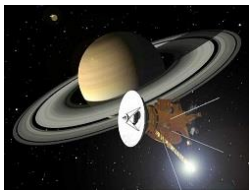
The RADAR (radio detection and ranging) instrument uses radio waves to investigate the surfaces of the many different moons of Saturn.

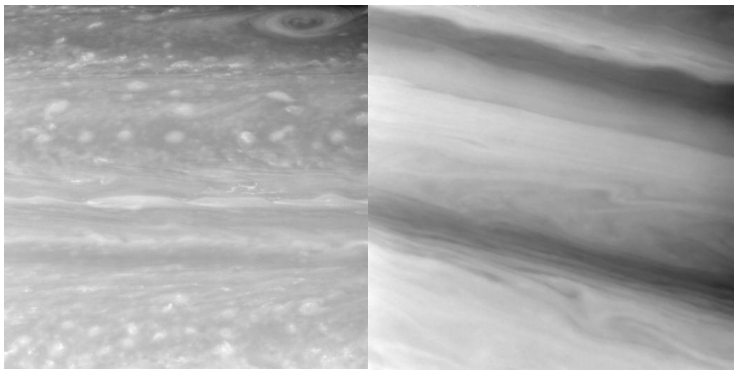
RADAR is an extremely flexible instrument and can be used for multiple purposes. In some cases normal pictures or a 3D map is created by bouncing pulses of energy off the surface from different angles. However, this cuts through the atmosphere and shows the surface. Instead, to find out more about the atmosphere, the RADAR instrument can be set up to measure the energy that is being emitted naturally by the surface. This gives important information about the moisture in the atmosphere.

The microwaves emitted by the instrument are at a frequency of 13.78 GHz. The frequency can be converted to to a wavelength using the following equation:

$$\lambda = \frac{c}{f}$$
$$\Rightarrow f = \frac{c}{\lambda}$$

As an alternative to RADAR, the Imaging system can be used. This will give clear evidence of what is happening in the atmosphere as storms, waves, jet streams and vortices can be studied.

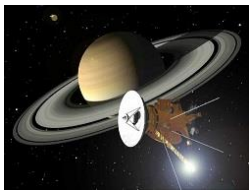




One further instrument that can be used is the Magnetometer. This instrument is essentially a magnetic compass and directly measures a magnetic field. The instrument is extremely sensitive to electric currents and metal components, so it is placed on an 11m boom made of non-metallic material. The boom 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.

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?



Cassini: Mission Planning Exercise

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
Telemetry Downlink	*T*

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
Telemetry Downlink	*T*	*-100*

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…