CASSINI FACT SHEET 3/93

Solar System Exploration Division

* MISSION SUMMARY *

The giant outer planets - Jupiter, Saturn, Uranus, and Neptune - contain 99 percent of the planetary mass in the solar system. Far from the vaporizing effects of the Sun, much of this mass remains largely unchanged since its formation. It is thus among the outer planets and their moons that we seek insight into the origins and evolution of the early solar system. Cassini, a joint U.S.-European mission to Saturn and its moon Titan, will be launched in October 1997. Cassini is the second Orbiter-Probe type mission to an outer planet, after the 1989 Galileo launch to Jupiter. Cassini's scientific mission is dual: to complete an orbital surveillance of the planet, following up the questions raised by the Voyager flyby encounters of the 1980s; and to unveil the Saturnian moon Titan, the second largest moon in the solar system, by dropping an instrumented probe - provided by the European Space Agency (ESA) - through Titan's dense and intriguingly Earth-like atmosphere. Elements of several of Cassini's science instruments are being provided by the Italian Space Agency, as is the Orbiter's high-gain antenna.

Saturn is best known for its complex ring system. Study of these rings - along with Saturn's moons - will help us to understand the composition and evolution of the preplanetary masses from which planets form. Saturn also offers for study a complex, banded atmosphere, with equatorial winds in excess of 500 meters/sec. The Cassini data will be a major contribution to our scientific modeling of planetary atmospheres, crucial to our understanding of the evolution of Earth's own atmosphere. The Cassini Orbiter's multiple close flybys of Saturn's icy satellites will also provide insight into the nature of the population of small planet-like bodies that may have once been prevalent in the outer solar system.

Titan is a moon the size of a small planet. Its chemically complex atmosphere is primarily nitrogen and is rich in hydrocarbons, resembling the early atmosphere of Earth. The study of Titan's atmosphere and local surface, carried out by ESA's Huygens Probe, will not only provide insight into the status and formation of this unique body, but will also give us a glimpse into the early history of our own planet. During subsequent close flybys of Titan, Orbiter instruments will make remote observations of the surface and in situ measurements of its ionosphere and upper atmosphere.

The Cassini mission will employ a Venus-Venus-Earth-Jupiter gravity assist trajectory on its way to a June 2004 injection into Saturn orbit. Late in 2004, the Orbiter will release the Huygens Probe for its 2-1/2 hour descent through the atmosphere of Titan. The Orbiter, during its 4-year tour of the Saturn system, will perform approximately 60 orbits around Saturn, measuring the planet's magnetosphere, atmosphere, and rings, and observing Titan and some of the icy satellites during close flybys. The Cassini project is managed by NASA's Jet Propulsion Laboratory (JPL), Pasadena, California.

* SATURN *

DIAMETER AT EQUATOR:	120,536 km

MASS:	5.688 x 1026 kg
MEAN DENSITY:	0.69 g/cm3
EQUATORIAL GRAVITY AT ATMOSPHERE SURFACE:	10.45 m/s2
TYPICAL WIND VELOCITY:	400-500 m/s
TEMPERATURE AT CLOUD TOP:	94 K (-179 C)
ROTATIONAL PERIOD (A SATURN DAY):	10.656 hrs
MEAN DISTANCE FROM SUN:	1,429.4 million km
MEAN ORBITAL VELOCITY:	9.64 km/s
SIDEREAL PERIOD (A SATURN YEAR):	29.458 years
COMPOSITION OF ATMOSPHERE:	Hydrogen, Helium

* TITAN *

DIAMETER AT EQUATOR:	5,150 km
MASS:	1.35 x 1023 kg
MEAN DENSITY:	1.88 g/cm3
MEAN DISTANCE FROM SUN:	1.222 million km
COMPOSITION OF ATMOSPHERE:	Nitrogen, Argon, Methane, and Other Hydrocarbons

* MAJOR MISSION CHARACTERISTICS *

LAUNCH PERIOD:	October 6 - 30, 1997
LAUNCH VEHICLE:	Titan IV/Centaur
TRAJECTORY:	VVEJGA (Venus-Venus-Earth-Jupiter Gravity Assist)
SATURN ORBIT INSERTION:	June 2004
HUYGENS PROBE RELEASE:	Early November 2004 (3 weeks to Titan)
PROBE DESCENT:	2-1/2 hrs. via Parachute and Drogue Chute
ORBITER PRIMARY MISSION:	4 years (~60 orbits)
END OF NOMINAL MISSION:	June 2008

* MISSION OBJECTIVES *

o Conduct detailed, multispectral studies of Saturn's atmosphere, rings, and magnetosphere during 4-year orbital surveillance.

o Conduct close-up, multispectral observations of Saturn's icy satellites.

o Characterize Titan's atmosphere and local surface through Huygens Probe science, and map the satellite's surface via Orbiter radar.

* KEY SPACECRAFT CHARACTERISTICS *

* ORBITER *

MASS: 5634 kg (includes Probe, 335 kg of science instruments, and 3132 kg of propellant)

POWER: 3 radioisotope thermoelectric generators (RTGs) for 628 Watts power at end-of mission

PROPULSION: Hydrazine for attitude control thrusters; MMH and N2O4 for two 490-N engines

MEMORY CAPACITIES: 3.6 Gb Solid State Recorders
AACS memory: 512 KW RAM; 8 KW PROM
CDS memory: 512 KW RAM; 8 KW PROM

DATA RATES: Selectable to 249 kbps

BASIC DESIGN: Three-axis stabilized

SIZE: 7 meters high

ANTENNA DIAMETER: 4 meters

MAGNETOMETER BOOM LENGTH: 10.5 meters

* HUYGENS PROBE *

MASS: 52 kg (includes 43kg of science instruments and 46 kg of support equipment on Orbiter)

POWER: LiSO2 batteries

PROPULSION: None

MEMORY CAPACITIES:
CDMU: 64 KW RAM; 64 KW PROM
PSA: 64 KW RAM; 32 KW PROM

DATA RATES: 8 kbps

BASIC DESIGN: Ballistic probe

SIZE: 2.7 meters diameter

* MISSION MANAGEMENT *

NASA/HQ Program Manager: Howard T. Wright
NASA/HQ Program Scientist: Henry C. Brinton

JPL Project Manager: Richard J. Spehalski
JPL Project Scientist: Dennis L. Matson
ESA Huygens Project Manager: Hamid Hassan
ESA Huygens Project Scientist: Jean-Pierre Lebreton

SCIENCE INVESTIGATIONS

ORBITER INVESTIGATIONS:
PRINCIPAL INVESTIGATOR:
PURPOSE:

CASSINI PLASMA SPECTROMETER (CAPS)
Dr. David T. Young, Southwest Research Institute
In-situ study of plasma within and near Saturn's magnetic field

COSMIC DUST ANALYZER (CDA)
Prof. Dr. Eberhard Grun,Max-Planck-Institut fur Kernphysik
In-situ study of ice and dust grains in the Saturn system

COMPOSITE INFRARED SPECTROMETER (CIRS)
Mr. Virgil G. Kunde,NASA/Goddard Space Flight Center
Spectral mapping to study temperature and composition of surfaces/ atmospheres/rings within the Saturn system

ION AND NEUTRAL MASS SPECTROMETER (INMS)
Dr. J. Hunter Waite, Southwest Research Institute (Team Leader)
In situ compositions of neutral and charged particles within the Saturn magnetosphere

IMAGING SCIENCE SUBSYSTEM (ISS)
Dr. Carolyn C. Porco, University of Arizona (Team Leader)
Multispectral imaging of Saturn, Titan, rings, and the icy satellites to observe their properties

DUAL TECHNIQUE MAGNETOMETER (MAG)
Dr. David J. Southwood, Imperial College of London
Study of Saturn's magnetic field and its interaction with the solar wind

MAGNETOSPHERIC IMAGING INSTRUMENT (MIMI)
Dr. Stamatios M. Krimigis, Johns Hopkins University
Global magnetospheric imaging and in situ measurements of Saturn's magnetosphere/solar wind interactions

CASSINI RADAR (RADAR)
Dr. Charles Elachi, Jet Propulsion Laboratory (Team Leader)
Radar imaging, altimetry, and radiometry of Titan's surface

RADIO AND PLASMA WAVE SCIENCE (RPWS)
Dr. Donald A. Gurnett, University of Iowa
Study of plasma waves, radio emissions, and dust in the Saturn system

RADIO SCIENCE SUBSYSTEM (RSS)
Dr. Arvydas J. Kliore, Jet Propulsion Laboratory (Team Leader)
Study atmospheres and ionospheres of Saturn and Titan, and the rings

and gravity fields of Saturn and its satellites (also search for gravitational waves during cruise)

ULTRAVIOLET IMAGING SPECTROGRAPH (UVIS)
Dr. Larry W. Esposito, University of Colorado
Spectra and low-resolution imaging of atmospheres and rings for structure, chemistry and composition

VISUAL AND INFRARED MAPPING SPECTROMETER (VIMS)
Dr. Robert H. Brown, Jet Propulsion Laboratory (Team Leader)
Spectral mapping to study composition and structure of surfaces, atmospheres, and rings

PROBE INVESTIGATIONS:
PRINCIPAL INVESTIGATOR:
PURPOSE:

AEROSOL COLLECTOR PYROLYSER (ACP)
Dr. Guy M. Israel, Service d'Aeronomie du
In-situ study of clouds and aerosols in the Titan atmosphere

DESCENT IMAGER/SPECTRAL RADIOMETER (DISR)
Dr. Martin G. Tomasko, University of Arizona
Measure temperatures and collect images of atmospheric aerosols and the surface of Titan

DOPPLER WIND EXPERIMENT (DWE)
Dr. Michael K. Bird, Universitat Bonn
Study of winds from their effect on the probe during its descent.

GAS CHROMATOGRAPH/MASS SPECTROMETER (GCMS)
Dr. Hasso B. Niemann, NASA/Goddard Space Flight Center
In-situ measurement of composition of gases and aerosols in Titan's atmosphere

HUYGENS ATMOSPHERE STRUCTURE INSTRUMENT (HASI)
Prof. Marcello Fulchignoni, Univerita di Roma
In-situ study of physical and electrical properties of Titan's atmosphere

SURFACE SCIENCE PACKAGE (SSP)
Dr. John C. Zarnecki, University of Kent
Measurement of the physical properties of Titan's surface

INTERDISCIPLINARY INVESTIGATIONS:
INTERDISCIPLINARY SCIENTIST:
PURPOSE:

AERONOMY AND SOLAR WIND INTERACTIONS
Dr. Darrell F. Strobel, Johns Hopkins University
Study of aeronomy in the atmospheres of Saturn and Titan

ATMOSPHERES
Dr. Tobias C. Owen, University of Hawaii

Study the atmospheres of Saturn and Titan

MAGNETOSPHERE AND PLASMA
Dr. Michel Blanc, Observatoire Midi-Pyrenees
Dr. Tamas I. Gambosi, University of Michigan
Study of plasma circulation and magnetosphere/ionosphere re-coupling; study of the plasma environment in Saturn's atmosphere.

ORIGIN AND EVOLUTION
Dr. James B. Pollack, NASA/Ames Research Center
Study of the origin and evolution of the Saturn system.

RINGS AND DUST
Dr. Jeffrey N. Cuzzi, NASA/Ames Research Center
Study of rings and dust within the Saturn system

SATELLITES
Dr. Laurence A. Soderblom, U.S. Geological Survey
Study of the satellites of Saturn

TITAN AERONOMY
Dr. Daniel Gautier, Observatoire de Paris-Meudon
Study of the aeronomy of Titan's atmosphere

TITAN ATMOSPHERE/SURFACE INTERACTIONS
Dr. Jonathan I. Lunine, University of Arizona
Study of atmosphere/surface interactions on Titan

TITAN CHEMISTRY EXOBIOLOGY
Prof. Francois Raulin, Universite de Paris-Val de Marne
Study of Titan's chemistry and exobiology