DISR Bibliography
19 July 2006

TI: Fused fiber image guides for planetary exploration
AU: Espitallier-D
SO: Proceedings-of-the-SPIE-The-International-Society-for-Optical-Engineering. 1996; 2611: 14-22
PB: SPIE-Int. Soc. Opt. Eng

TI: Titan: evidence for seasonal change-a comparison of Hubble Space Telescope and Voyager images
AU: Caldwell,-J.; Cunningham,-C.-C.; Anthony,-D.; White,-H.-P.; Groth,-E.-J.; Hasan,-H.; Noll,-K.; Smith,-P.-H.; Tomasko,-M.-G.; Weaver,-H.-A.
SO: Icarus-. May 1992; 97(1): 1-9

TI: "The Descent Imager/Spectral Radiometer (DISR) instrument aboard the Huygens Probe of Titan",
AU:M.G. Tomasko, L.R. Doose, P.H. Smith, C. Fellows, B. Rizk, C. See, M. Bushroe, E. McFarlane, E. Wegryn, E. Frans, R. Clark, M. Prout and S. Clapp, Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ, 85721, USA.
SO: SPIE Proceedings Series, Vol. 2803, p. 64 - 74, 1996.

TI: The Descent Imager/Spectral Radiometer (DISR) aboard Huygens.
AU: M.G. Tomasko, L.R. Doose, P.H. Smith, R.A. West, L.A. Soderblom, M. Combes, B. Bezard, A. Coustenis, C. deBergh, E. Lellouch, J. Rosenqvist, O. Saint-Pe, B. Schmitt, Hu. U. Keller, N. Thomas & F. Gliem. In A. Wilson, editor,
SO: Huygens -- Science, Payload and Mission, volume SP-1177:109-138, 1997.
PB: ESA Publications Division, ESTEC, Noordwijk, The Netherlands, August 1997.

TI: Private life of an integrating sphere: the radiant homogeneity of the Descent Imager-Spectral Radiometer calibration sphere
AU: Rizk,Bashar.
SO: Applied-Optics. 1 May 2001; 40(13): 2095-101
PB: Opt. Soc. America

TI: Inverse radiation modeling of Titan's atmosphere to assimilate solar aureole imager data of the Huygens probe.
AU: Grieger, B.; Lemmon, M.T.; Markiewicz, W.J.; Keller, H.U..
SO: Planetary & Space Science, (Feb 2003), Vol. 51 Issue 2, p147, 12p
PB: Elsevier
Abstract: During the descent of the Huygens probe through Titan's atmosphere in January 2005, the Descent Imager/Spectral Radiometer (DISR) will perform upward and downward looking measurements at various spectral ranges and spatial resolutions. This internal radiation density could be estimated by radiative transfer calculations for Titan's atmosphere. However, to do this, the optical properties (i.e. volume extinction coefficient, single scattering albedo and scattering phase function) have to be prescribed at every altitude, and these are apriori not known. Herein, an inverse approach is investigated, which retrieves the single scattering albedo and the phase function of the aerosols from DISR observations. The method uses data from a DISR subinstrument, the Solar Aureole imager (SA), to estimate the optical properties of the atmospheric layer between two successive observation altitudes. A unique solution for one layer can in principle be calculated directly from a linear system of equations, but due to the sparseness of the data and the unavoidable noise in the measurements, the inverse problem is ill-posed. The problem is stabilized by the regularization method requiring smoothness of the resultant solution. A consistent set of solutions for all layers is obtained by iterating several times downward and upward through the layers. The method is tested in a simulated radiation density scenario for Titan, which is based on a microphysical aerosol model for the haze layer. Within this scenario, the expected coverage of SA data allows a reconstruction of the angular dependence of the scattering phase 90%. [ABSTRACT FROM AUTHOR; Copyright 2003 Elsevier]

TI: The Descent Imager/Spectral Radiometer (DISR) instrument aboard the Huygens Probe of Titan
AU: M. G. Tomasko, D. Buchhauser, M. Bushroe, L. E. Dafoe, L. R. Doose, A. Eibl , C. Fellows,. E. McFarlane, G. M. Prout, M. J. Pringle, B. Rizk, C. See, P. H. Smith and K. Tsetsenekos.
Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ, 85721, USA.
SO: Space Science Reviews. 104 (1-4): 469-551, Annual 2002
PB: 2003 Kluwer Academic Publishers

TI: Simultaneous retrieval of optical depths and scattering phase functions in Titan's atmosphere from Huygens/DISR data.
AU: Grieger, B.; Rodin, A.V.; Salinas, S.V.; Keller, H.U..
SO: Planetary & Space Science, (Dec. 2003), Vol. 51 Issue 14/15, p991, 11p
PB: Elsevier
Abstract: In January 2005, the Huygens probe will descent through Titan's atmosphere and the Descent Imager/Spectral Radiometer (DISR) will perform upward and downward looking observations at various spectral ranges and spatial resolutions. One of the subinstruments, the Upward Looking Visible Spectrometer (ULVS), measures the total downward radiation flux including the direct solar beam and also, with a shadow bar over the Sun, the diffuse downward flux. The intensity of the direct solar beam and thus the optical depth can be calculated from the difference of these two measurements. But <f> 10°</f> wide shadow bar also obscures the Solar Aureole Imager (SA) and therefore removes a considerable fraction of the diffuse downward radiation. This fraction can be estimated taking into account the brightness distribution of the SA which is estimated with the Titan Inverse Radiation Model (TIRM). Input to the model are a first guess of the optical depth in dependence on the altitude calculated directly from ULVS measurements and data from another DISR subinstrument, the Solar Aureole Imager SA imager. By assimilating the sparse SA data, TIRM yields a consistent estimate of the scattering phase function and the complete radiance field in dependence on the altitude. By iteratively correcting the initial optical depth estimation using the resultant radiance field and passing it again to TIRM, the model is used to simultaneously solve for optical depths and scattering phase functions. [ABSTRACT FROM AUTHOR; Copyright 2003 Elsevier]

TI: A spherical model for computing polarized radiation in Titan's atmosphere.
AU: Salinas, Santo V.; Grieger, Björn; Markiewicz, Wojtek J.; Keller, Horst U..
SO: Planetary & Space Science, (Dec 2003), Vol. 51 Issue 14/15, p977, 13p
PB: Elsevier
Abstract: The Huygens descent through Titan's atmosphere in January 2005 will provide invaluable information about Titan's atmospheric composition and aerosol properties. The Descent Imager/Spectral Radiometer (DISR) will perform upward and downward looking radiation observations at various spectral ranges and spatial resolutions. To prepare the DISR data interpretation we have developed a new model for radiation transfer in Titan's atmosphere. The model solves for the full three-dimensional polarized radiation field in spherical geometry. However, the atmosphere itself is assumed to be spherically symmetric. The model is initialized with a fast-to-compute plane–parallel solution based on the doubling and adding algorithm that incorporates a spherical correction for the incoming direct solar beam. The full three-dimensional problem is then solved using the characteristics method combined with the Picard iterative approximation as described in Rozanov et al. (J. Quant. Spectrosc. Radiat. Transfer 69 (2001) 491). Aerosol scattering properties are calculated with a new microphysical model. In this formulation, aerosols are assumed to be fractal aggregates and include methane gas absorption embedded into the extinction coefficient. The resulting radiance of the model atmosphere's internal field is presented for two prescribed DISR wavelengths. [ABSTRACT FROM AUTHOR; Copyright 2003 Elsevier]

TI: "Recovering the Attitude of the Huygens Descent Module Using the DISR Data",
AU: B. Rizk, M.G. Tomasko, M.W. Bushroe, E. A. McFarlane and C. See.
SO: Proc. Int. Workshop 'Planetary Probe Atmospheric Entry and Descent Trajectory Analysis and Science'
PB: ESA SP-544: 183-189, 2004.

TI: SATURN AT LAST!
AU: Lunine, Jonathan I..
SO: Scientific American, (Jun 2004), Vol. 290 Issue 6, p56-63, 8p, 3 diagrams, 1c;
Abstract: Focuses on the journey of the Cassini-Huygens spacecraft to explore the solar system's second-largest planet, Saturn and its giant moon, Titan. Launch of the robotic spacecraft, the Cassini orbiter and the attached Huygens probe, from Cape Canaveral, Florida in 1997; Expectation for the spacecraft to go into orbit around Saturn in July 2004; Background on the mission and what is already known about Saturn and Titan; How the probe will investigate the planet's atmosphere, moons, rings and magnetic field during its four-year orbit; Indication that the Huygens probe will be sent toward Titan in December to study the surface for liquid hydrocarbons; How Cassini gained velocity through gravity assists after its launch; The probe's Descent Imager and Spectral Radiometer to take photos of the methane clouds; Interest in whether complex organic chemicals have evolved on Titan; Question of whether seas exist on Titan.

TI: Image data compressor for Huygens' DISR instrument compared to state of the art compression schemes
AU: Rueffer-P; Michalik-H; Gliem-F; Rabe-F
SO: IGARSS-2004.-2004-IEEE-International-Geoscience-and-Remote-Sensing-IEEE-Cat.-No.04CH37612. 2004: 2518-21 vol.4
PB: IEEE, Piscataway, NJ, USA

TI: Huygens Mission: Score a Big Win For International Effort.
SO:Aviation Week & Space Technology, 1/24/2005, Vol. 162 Issue 4, p58-58, 1/2p
Abstract: The article reports on the success of the European Space Agency (ESA) team in dropping the plucky Huygens probe down on the surface of Titan. It isn't surprising that the French engineers from Alcatel Space, the probe's prime contractor, found the early images from the Descent Imager/Spectral Radiometer strangely familiar. The team rallied when it realized that the initial mission plan wouldn't work because Cassini orbiter of National Aeronautics and Space Administration, would be moving away from the descending probe too fast for an effective radio link. Under the steady leadership of ESA's Jean-Pierre Lebreton, the mission manager and project scientist, the truly international team that put the probe together and made it work has started reaping its rewards.

TI: Shading under Titan's sky.
AU: Grieger, B..
SO: Planetary & Space Science, (Apr 2005), Vol. 53 Issue 5, p577-585, 9p
PB: Elsevier
Abstract: During the descent of the Huygens probe in January 2005, its Descent Imager/Spectral Radiometer (DISR) will take the first close up images of Titan's surface. The shading imposed by the illumination of a planetary surface contains information on its topography. For planetary bodies without an optically thick atmosphere, the light can be assumed to stem from a point source. In this case, methods are available in order to estimate the shape of surface features from shading. The situation is quite different for Titan, as its atmosphere is optically thick at optical wavelengths. The sun is visible from the surface, but the illumination is dominated by diffuse radiance. In order to investigate the characteristics of shading under Titan's sky and to assess methods to retrieve the shape, different digital terrain models (DTMs) are used to simulate images according to different types of illumination. For an idealized DTM, the shape is retrieved from the shading in the simulated images. Deriving the shape from shading under Titan's sky using existing methods is only possible if the topography is relatively flat, i.e. in the absence of steep slopes. [ABSTRACT FROM AUTHOR; Copyright 2005 Elsevier];

TI: Huygens probe entry and descent trajectory analysis and reconstruction techniques.
AU: Atkinson, D.H.; Kazeminejad, B.; Gaborit, V.; Ferri, F.; Lebreton, J.-P..
SO: Planetary & Space Science, (Apr 2005), Vol. 53 Issue 5, p586-593, 8p
PB: Elsevier
Abstract: Cassini/Huygens is a joint National Aeronautics and Space Administration (NASA)/European Space Agency (ESA)/Agenzia Spaziale Italiana (ASI) mission on its way to explore the Saturnian system. The ESA Huygens Probe is scheduled to be released from the Orbiter on 25 December 2004 and enter the atmosphere of Titan on 14 January 2005. Probe delivery to Titan, arbitrarily defined to occur at a reference altitude of 1270km above the surface of Titan, is the responsibility of the NASA Jet Propulsion Laboratory (JPL). ESA is then responsible for safely delivering the probe from the reference altitude to the surface. The task of reconstructing the probe trajectory and attitude from the entry point to the surface has been assigned to the Huygens Descent Trajectory Working Group (DTWG), a subgroup of the Huygens Science Working Team. The DTWG will use data provided by the Huygens Probe engineering subsystems and selected data sets acquired by the scientific payload. To correctly interpret and correlate results from the probe science experiments and to provide a reference set of data for possible 'ground-truthing' Orbiter remote sensing measurements, it is essential that the trajectory reconstruction be performed as early as possible in the post-flight data analysis phase. The reconstruction of the Huygens entry and descent trajectory will be based primarily on the probe entry state vector provided by the Cassini Navigation Team, and measurements of acceleration, pressure, and temperature made by the Huygens Atmospheric Structure Instrument (HASI). Other data sets contributing to the entry and descent trajectory reconstruction include the mean molecular weight of the atmosphere measured by the probe Gas Chromatograph/Mass Spectrometer (GCMS) in the upper atmosphere and the Surface Science Package (SSP) speed of sound measurement in the lower atmosphere, accelerations measured by the Central and Radial Accelerometer Sensor Units (CASU/RASU), and the ... [ABSTRACT FROM AUTHOR; Copyright 2005 Elsevier];

TI: Power and Propulsion for the Cassini Mission.
AU: Johnson, Kevin S.; Cockfield, Robert D..
SO: AIP Conference Proceedings, 2005, Vol. 746 Issue 1, p232-239, 8p
PB: AIP
Abstract: Lockheed Martin contributions to the Cassini mission included power and propulsion for the spacecraft, the Descent Imager / Spectral Radiometer, DISR instrument for the Huygens Probe, as well as the Titan IVB launch vehicle. Cassini is currently in orbit around Saturn performing its primary science mission, investigating Saturn, its many moons, and its complex and beautiful ring system. The Space Power Programs organization in King of Prussia, Pennsylvania, an offsite of Lockheed Martin Space Systems Company, provided the three General Purpose Heat Source - Radioisotope Thermoelectric Generators (GPHS-RTGs) used to provide electric power to the spacecraft during its mission to Saturn and its moons. The RTGs were the same design as those used to power the Galileo spacecraft on its mission to Jupiter and its moons, and the ESA Ulysses spacecraft on its mission to explore the Sun. Three RTGS provided 880 Watts of electrical power to the spacecraft at the beginning of mission, shortly after launch, 50% more than the power available for the Galileo mission. Other papers will describe the extensive science instrumentation made possible by the abundance of continuous, reliable, and long-lived power, unprecedented for a deep space planetary mission. The Cassini Propulsion Module Subsystem is the largest interplanetary propulsion system ever to successfully enter orbit around another planet. The propulsion system was designed to be fully redundant for this critical, 11-year scientific mission to Saturn. The system was designed, assembled and tested at Lockheed Martin’s Space Exploration Systems Company in Littleton, Colorado, before being delivered to the Jet Propulsion Laboratory, JPL in Pasadena California for integration and testing with the spacecraft. The bi-propellant system design holds 3,000 kg of Monomethyl Hydrazine, MMH and Nitrogen Tetroxide, NTO and uses 132 kg of High Purity Grade Hydrazine for 3-axis attitude control and Reaction Wheel...[ABSTRACT FROM AUTHOR];

TI: Topographic Mapping of the Huygens Landing Site on Titan,
AU: Brent A. Archinal, Martin G. Tomasko, Bashar Rizk, Larry A. Soderblom, Randolph L. Kirk, Debbie A. Cook, Elpitha Howington-Kraus, Tammy L. Becker, Mark R. Rosiek, and the DISR Science Team
SO: Asia Oceania Geosciences Society's 2nd Annual Meeting, Singapore, 2005 June 20-24. Abstact only.
PB: Asia Oceania Geosciences Society
Abstract: The Huygens probe successfully accomplished the first descent and landing on Saturn’s moon Titan on 2005 January 14. The onboard Descent Imager-Spectral Radiometer (DISR) experiment1 included three imaging cameras: high resolution (HRI), medium resolution (MRI), and side looking (SLI), which returned the first ever high resolution (~60 m/pixel to a few mm/pixel) images of the surface of Titan. Approximately 596 separate images were returned. Many of these images were taken above ~40 km and showed no surface detail due to haze, or were repeated images of the same scene from the surface. Still, about 40% of the images show surface features of Titan (e.g. Figure 1). Although not possible in some areas due to lost images, we plan to photogrammetrically derive topographic information from these images, from which detailed geologic studies can proceed. As part of this process we expect to recover a history of spacecraft pointing and position, constrained in part by altimetry and Earth-based VLBI tracking, thus providing a trajectory estimate with which other (e.g. atmospheric) data can be associated. Planned products consist of a series of image mosaics, digital elevation models, and orthomosaics, at multiple resolutions and nested within each other as appropriate. We plan to present early versions of such products. Later efforts will also concentrate on analyzing and merging the imaging and topographic information of these images with that of the Cassini RADAR, ISS, and VIMS imaging experiments, to develop a consistent global (horizontal and vertical) reference system for Titan to which these and future data sets can be referred. Reference: [1] M. Tomasko et al. Spc. Sci. Rev. 104, 469-551 (2002). Figure 1: A mosaic of 3 DISR HRI images (http://photojournal.jpl.nasa.gov/catalog/PIA07236)

TI: Observations of Titan’s Surface and Atmosphere from the Descent Imager/Spectral Radiometer (DISR) on the Huygens Probe
AU: L. Soderblom, M. Tomasko, B. Archinal, T. Becker, B. Bézard, M. Bushroe, M. Combes, D. Cook, A. Coustenis, C. de Bergh, L. Dafoe, L. Doose, S. Douté, A. Eibl, S. Engel, F. Gliem, B. Grieger, T. Hare, K. Holso, A. Howington-Kraus, E. Karkoschka, H. Keller, R. Kirk, R. Kramm, M. Küppers, P. Lanagan, E. Lellouch, M. Lemmon, J. Lunine, E. McFarlane, J. Moores, M. Prout, B. Rizk, M. Rosiek, P. Rüffer, S. Schröder, B. Schmitt, C. See, P. Smith, N. Thomas, R. West
SO: AAS Division of Planetary Sciences meeting, 2005 September 4-9, Cambridge, UK. Abstract only. Number 2.06.
PB: AAS
Abstract: DISR characterized atmospheric radiation (350-1600 nm) and returned images and spectra of the surface of Titan. Linear polarization of the aerosol haze extending to the surface is i~50% at visible wavelengths. Monomers making up the aerosol particles are modeled at ~0.1 microns, several 100 monomers making up a haze particle. The extinction optical depth at the surface is ~4.5 at 531 nm, ~2 at 939 nm and ~0.5 at 1500 nm. The near-surface methane mole fraction is ~5% (relative humidity ~50%); methane fog or rain at the landing site is currently unlikely. Below ~8 km the eastward zonal wind dropped to <1m/s and reversed back to the west indicative of a boundary layer. Surface reflectance is ~0.13 at 531 nm, ~0.18 at 830 nm, decreasing to ~0.06 at 1500 nm consistent with dirty water ice. DISR images show brighter, higher terrains with stubby and higher-order drainage systems that border darker, lower-lying plains scoured by flow. Surface images show rounded gravels in a dry river bed. DISR-derived topography for the drainages in the bright terrain show extremely rugged terrain with slopes as high as 30 degrees. This suggests relatively rapid erosion by flows in the river beds resulting in the deeply incised valleys.

TI: Topographic Mapping of the Huygens Landing Site on Titan
AU: Randolph L. Kirk, Brent A. Archinal, Martin G. Tomasko, Bashar Rizk, Larry A.Soderblom, Debbie A. Cook, Elpitha Howington-Kraus, Tammy L. Becker, Mark R. Rosiek, and the DISR Science Team
SO: AAS Division of Planetary Sciences meeting, 2005 September 4-9, Cambridge, UK. Abstract only. Number 46.08.
PB: AAS
Abstract: The Huygens probe successfully accomplished the first descent and landing on Saturn's moon Titan on 2005 January 14. The onboard Descent Imager-Spectral Radiometer (DISR) experiment[1] included three imaging cameras: high resolution (HRI), medium resolution (MRI), and side looking (SLI), which returned the first ever high resolution (~ 60 m/pixel to a few mm/pixel) images of the surface of Titan. Approximately 596 separate images were returned. Many images, taken above ~40 km, showed no surface detail due to haze; others were repeated images of the same scene from the surface. Still, about 40% of the images show surface features of Titan. We are analyzing these images photogrammetrically to derive topographic information for as much of the landing area as possible, from which detailed geologic studies can proceed. As part of this process we expect to recover a history of spacecraft pointing and position, constrained in part by altimetry and Earth-based VLBI tracking, thus providing a trajectory estimate with which other (e.g. atmospheric) data can be associated. Planned products consist of a series of image mosaics, digital elevation models, and orthomosaics, at multiple resolutions and nested within each other as appropriate. The first such products will be shown; they indicate total relief of ~250 m in the higher albedo "highlands" near the landing point, with dark dendritic channels confined to the floors of canyons with side slopes up to 30 deg, indicating extremely active erosion. Later efforts will also concentrate on analyzing and merging the imaging and topographic information of these images with that of the Cassini RADAR, ISS, and VIMS imaging experiments, to develop a consistent global (horizontal and vertical) reference system for Titan to which these and future data sets can be referred. Reference: [1] M. Tomasko et al. Spc. Sci. Rev. 104, 469-551 (2002).

TI: Titan’s Surface as Viewed from the Huygens Probe by the Descent Imager/Spectral Radiometer
AU: L. Soderblom, M. Tomasko, B. Archinal, T. Becker, B. Bézard, M. Bushroe, M. Combes, D. Cook, A. Coustenis, C. de Bergh, L. Dafoe, L. Doose, S. Douté, A. Eibl, S. Engel, F. Gliem, B. Grieger, T. Hare, K. Holso, A. Howington-Kraus, E. Karkoschka, H. Keller, R. Kirk, R. Kramm, M. Küppers, P. Lanagan, E. Lellouch, M. Lemmon, J. Lunine, E. McFarlane, J. Moores, M. Prout, B. Rizk, M. Rosiek, P. Rüffer, S. Schröder, B. Schmitt, C. See, P. Smith, N. Thomas, R. West
SO: Geological Society of America, 2005 October 16-19, Salt Lake City, UT. Abstract only. Number 102-9.
PB: Geological Society of America
Abstract: The Descent Imager/Spectral Radiometer (DISR) aboard the Huygens Probe characterized atmospheric radiation (350-1600 nm) and returned images and spectra of Titan's surface. The near-surface methane mole fraction is ~5% (relative humidity ~50%); making methane fog or rain at the landing site unlikely at present. Below ~8 km the eastward zonal wind dropped to <1m/s and reversed back to the west indicative of a boundary layer. Surface reflectance is ~0.08 at 531 nm, ~0.13 at 830 nm, decreasing to ~0.1 at 1500 nm consistent with dirty water ice. DISR images show brighter, higher terrains with stubby and higher-order drainage systems that border darker, lower-lying plains scoured by flow. Surface images show rounded cobbles in a dry river bed. DISR-derived topography for the drainages in the bright terrain show extremely rugged terrain with slopes as high as 30 degrees. This suggests relatively rapid erosion by flows in the river beds resulting in the deeply incised valleys.

TI: Rain, winds and haze during the Huygens probe's descent to Titan's surface.
AU: Tomasko-MG; Archinal-B; Becker-T; Bezard-B; Bushroe-M; Combes-M; Cook-D; Coustenis-A; de-Bergh-C; Dafoe-LE; Doose-L; Doute-S; Eibl-A; Engel-S; Gliem-F; Grieger-B; Holso-K; Howington-Kraus-E; Karkoschka-E; Keller-HU; Kirk-R; Kramm-R; Kuppers-M; Lanagan-P; Lellouch-E; Lemmon-M; Lunine-J; McFarlane-E; Moores-J; Prout-GM; Rizk-B; Rosiek-M; Rueffer-P; Schroder-SE; Schmitt-B; See-C; Smith-P; Soderblom-L; Thomas-N; West-R
SO: Nature, (8 Dec. 2005), Vol. 438 Issue 7069, p765-778, 14p, 13 graphs, 3c, 6bw
PB: Nature Publishing Group
Abstract: The irreversible conversion of methane into higher hydrocarbons in Titan's stratosphere implies a surface or subsurface methane reservoir. Recent measurements from the cameras aboard the Cassini orbiter fail to see a global reservoir, but the methane and smog in Titan's atmosphere impedes the search for hydrocarbons on the surface. Here we report spectra and high-resolution images obtained by the Huygens Probe Descent Imager/Spectral Radiometer instrument in Titan's atmosphere. Although these images do not show liquid hydrocarbon pools on the surface, they do reveal the traces of once flowing liquid. Surprisingly like Earth, the brighter highland regions show complex systems draining into flat, dark lowlands. Images taken after landing are of a dry riverbed. The infrared reflectance spectrum measured for the surface is unlike any other in the Solar System; there is a red slope in the optical range that is consistent with an organic material such as tholins, and absorption from water ice is seen. However, a blue slope in the near-infrared suggests another, unknown constituent. The number density of haze particles increases by a factor of just a few from an altitude of 150 km to the surface, with no clear space below the tropopause. The methane relative humidity near the surface is 50 per cent. [ABSTRACT FROM AUTHOR];

TI: The Character of the Surface of Titan as viewed from the Cassini Orbiter and the Huygens Probe
AU: Soderblom, L. A.
SO: AGU, Fall Meeting 2005, abstract #U23A-04,12/2005
PB: American Geophysical Union [2005AGUFM.U23A..04S]
Abstract: Images of the surface of Titan continue to be acquired by three instruments aboard the NASA Cassini Orbiter (ISS or Imaging Science Subsystem, the Cassini RADAR, and VIMS or Visible and Infrared Mapping Spectrometer) and were acquired by one instrument (DISR or Descent Imager/Spectral Radiometer) aboard the ESA Huygens Probe during its descent to the surface in January 2005. ISS can image the surface globally and temporally down to about 1 km resolution. RADAR, unhampered by the atmosphere, acquires synthetic aperture images down to about 300 m but will cover only about 0.2 of the surface during the nominal mission. VIMS acquires spectral images the surface to about 1 km resolution through several atmospheric windows but with limited coverage at the highest resolution. The ISS, RADAR, and VIMS images reveal a surface rich in geological diversity. The images show ample evidence for volcanic, fluvial, lacustrine, eolian, and tectonic processes. DISR results reveal that the near-surface methane relative humidity is about 0.5, making methane fog or rain at the landing site unlikely at present. Below about 8 km the eastward zonal wind dropped to <1m/s and reversed back to the west indicative of a boundary layer. Visible and near-infrared surface reflectance is consistent with dirty water ice. DISR images show brighter, higher terrains with stubby and higher-order drainage systems that border darker, lower-lying plains scoured by flow. Surface images show rounded gravels in a dry river bed. DISR-derived topography for the drainages in the bright terrain show extremely rugged terrain with slopes as high as 30 degrees. This suggests relatively rapid erosion by flows in the river beds resulting in the deeply incised valleys.

TI: Topographic Mapping of the Huygens Landing Site on Titan: New Results and Error Analyses
AU: B. A. Archinal, M. G. Tomasko, B. Rizk, L. A. Soderblom, R. L. Kirk, E. Howington-Kraus, D. A. Cook, T. L. Becker, M. R. Rosiek, D. Galuszka, B. L. Redding, T. L. Hare, and the DISR Science Team
SO: Proceedings of the 37th Lunar and Planetary Science Conference, 2006 March 13-17, Houston, Texas), abstract no. 2089.
PB: Lunar and Planetary Science Institute, Houston, TX.
Abstract Summary: A new DTM of the hills near the Huygens landing site on Titan is presented, as generated from 5 DISR images. We describe our investigation of possible error sources, such as from the merging of DTMs from stereo pairs and from camera calibration.

TI: Recent Results on Titan’s Surface from the Cassini Orbiter and Huygens Probe
AU: Soderblom, L.
SO: EGU 3rd General Assembly, April 02-07, Vienna, EGU06-A-01683, 2006
PB: European Geosciences Union, Geophysical Research Abstracts, Vol. 8, 01683
Abstract: Spectra and images of the surface of Titan continue to be acquired by the Cassini Radar and Cassini VIMS (Visible and Infrared Mapping Spectrometer) aboard the NASA Cassini Orbiter. Images and spectra were also acquired by DISR (Descent Imager/Spectral Radiometer) aboard the ESA Huygens Probe during its descent to thes urface in January 2005. Radar, unhampered by the atmosphere, acquires synthetic aperture images down to about 300 m and will cover about 0.2 of the surface during the nominal mission. VIMS acquires spectral images from 0.35 to 5.1 microns and can see clearly to the surface through several atmospheric windows in the near IR with a best resolution of 1-to-2 km. The RADAR and VIMS images reveal a surface rich in geological diversity: including evidence for volcanic, fluvial, lacustrine, eolian, and tectonic processes. The Radar images reveal vast regions pervaded by radar-dark longitudinal sand dunes. Correlation of the Radar and DISR images reveal the landing site to be about 40 km south of a region laced by these long, dark, longitudinal dunes; they are seen in both Radar and DISR SLI (side-looking) images. DISR images of regions near the landing site show brighter, higher terrains with stubby and higher order drainage systems that border darker, lower-lying plains scoured by flow. Surface images show rounded gravels in a dry river bed. Six new photogrammetric models using DISR stereo pairs reveal extremely rugged topography for the drainages in the bright terrain with slopes as high as 30 degrees. This suggests relatively rapid erosion by flows in the river beds resulting in the deeply incised valleys.

TI: By the Light of a Coppery Moon.
SO: Science, (19 May 2006), Vol. 312 Issue 5776, p977-977, 1/4p;
Abstract: The article reports that the U.S. National Aeronautics and Space Administration, the European Space Agency and the University of Arizona have released two videos showing the space satellite Huygens probing onto the surface of planet Saturn's moon Titan. The videos captured the landing, condensed several hours of data taken by the spacecraft's Descent Imager/Spectral Radiometer. One of the videos discloses a readout of the craft's trajectory and other data.

TI: Titan Zonal Wind Corroboration via the Huygens DISR Solar Zenith Angle Measurement
AU: Michael Allison, David H. Atkinson, Michael K. Bird, Martin G. Tomasko
SO: ESA SP-544, pp. 125-130
PB: ESA Publications Division, ESTEC. Noordwijk, The Netherlands