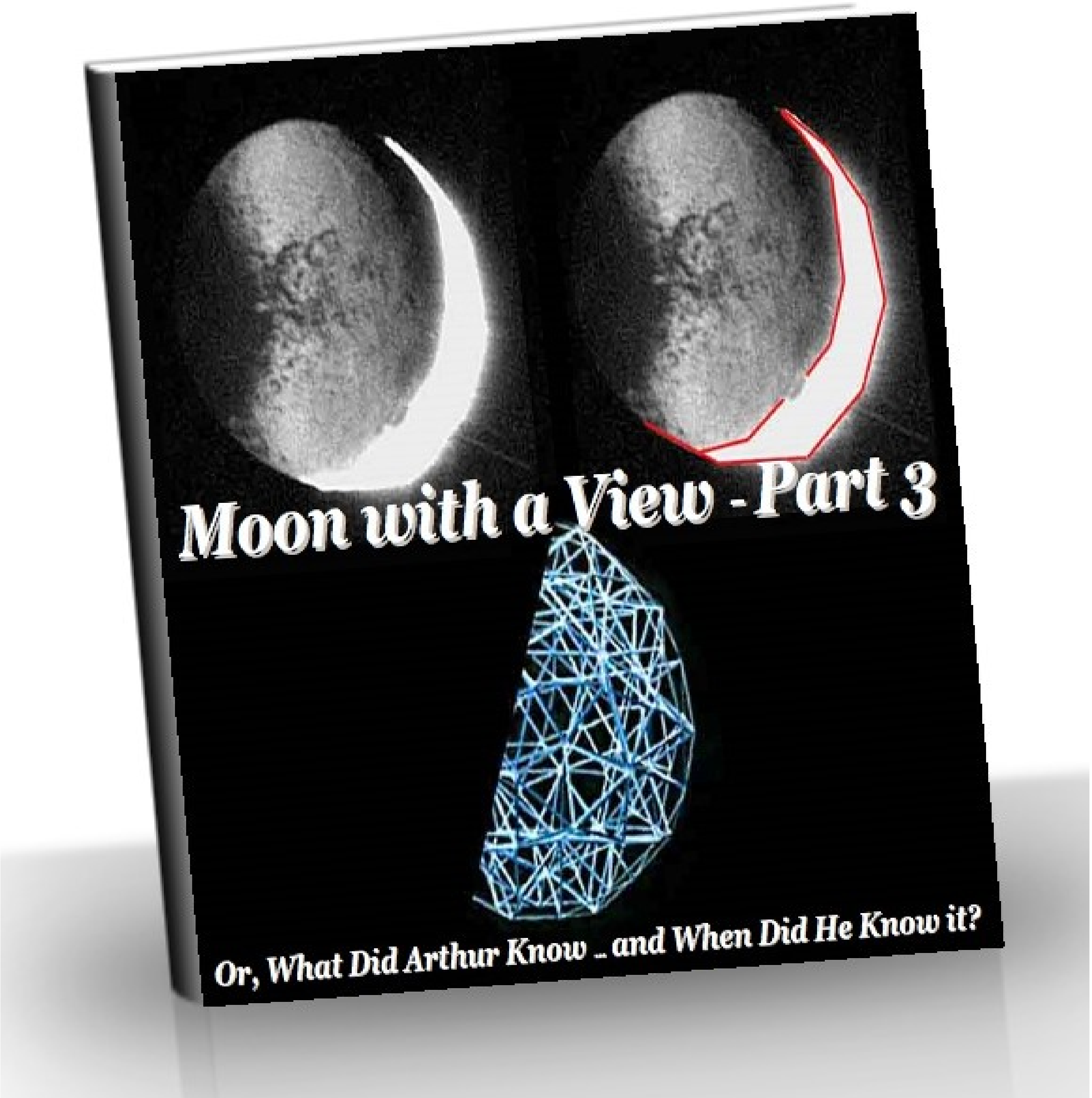
Moon with a View – Part 3



Or, What Did Arthur Know … and When Did He Know it?

By Richard C. Hoagland

"The only way of discovering the limits of the possible is to venture a little way past them ... into the impossible."

-- Clarke's Second Law

So, apropos of this "impossible image" (above) ... what have we got?

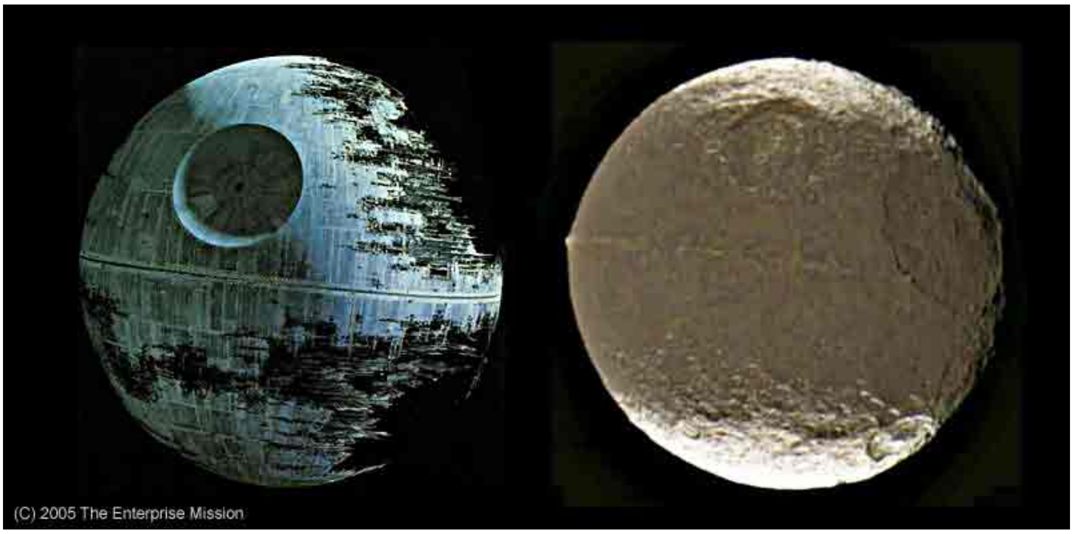
What we've "got" is a unique, extraordinary object orbiting Saturn ... again, the singularly most important object (I would argue -- the "Face on Mars" now notwithstanding) that NASA has found in its almost half a century of looking!

The "Holy Grail" of all our Hopes and Dreams ... the culmination of centuries of planetary observation/expectations ....

A "moon" -- but a moon like no other known, one which has intrigued and mystified Earthbound astronomers for centuries ... which now, it turns out, is quite possibly a very ancient spaceship ... placed in orbit around Saturn for "some reason" ... a long, long time ago.

When it was new, it may have even looked a bit like this (below) -- complete with "equatorial ring."

(Which means, of course, we now have to add George Lucas to our growing list – and ask where he got such an extraordinary concept ....)



But what's most amazing about all this is that none of the extraordinary information or analysis supporting this tentative conclusion has come to you via "an official NASA press release" -- despite this data having been on Earth for months!

If we are right in this "Iapetus Proposal," the most staggering discovery of NASA's last 30 or so years is coming to you (once again ...) via a group of independent scientists. And now that we have brought world-wide attention to this extraordinary find ... whether we even get to see the more extraordinary details of the next Cassini fly-by of Iapetus (which is supposed to be ~100 times closer than last December's!) is quite debatable ....

For, it's hard to believe that we're the first to recognize what we are seeing! Or, that we're the only investigators – either inside or outside NASA -- to comprehend the incredible implications of such a potentially overwhelming find—

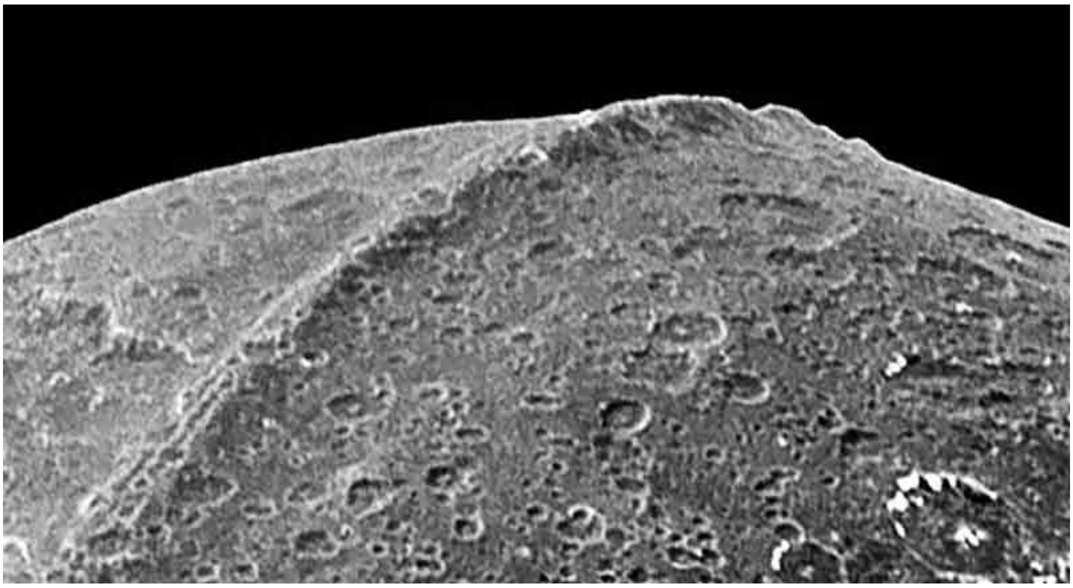
An entire spaceship world ... trapped in orbit ... around Saturn.

But, because of the deafening silence coming out of NASA on what it already knows but won't release (let alone suspects!), about the glaring anomalies we've now identified about this "moon" ... we are left with only one sad but inevitable conclusion:

NASA, again, has decided to "tough it out" ... to officially say nothing -- like it has treated all its other discoveries of "extraterrestrial ruins" in the solar system ... over the last 30 or so years ....

Such a policy, of course, is directly due to "Brookings" -- the official NASA report of almost 50 years ago (1959) -- which warned the U. S. Government that any scientific evidence of extraterrestrial intelligence "could be destabilizing to terrestrial governmental institutions ... if not the future of civilization ...."

The Space Agency, therefore, obviously plans to pretend (certainly, in public ...) -- in full consonance with "Brookings" -- that what exists in these extraordinary Iapetus photographs ... simply isn't there.



(And then some folks wonder why I've been saying for a long, long time ... we need new leadership at NASA ....)

But, suppose that we as taxpayers (who are actually paying for this Mission ...) could determine "what comes next?" What should we insist occur now?

The true test of any scientific hypothesis is successful "prediction." The well-known astrophysicist, the late Sir Fred Hoyle, once said: "I don't see the logic of rejecting data just because they seem incredible." Later (in Part 4), we will make a number of highly specific predictions regarding our "incredible" hypothesis: that Iapetus is, in fact, an artificial "moon."

Such an idea -- while perhaps outrageous to some -- is scientifically confirmable, and with this spacecraft ... but only if we now go back to Iapetus and acquire key new data, to test the predictable aspects of this amazing possibility.

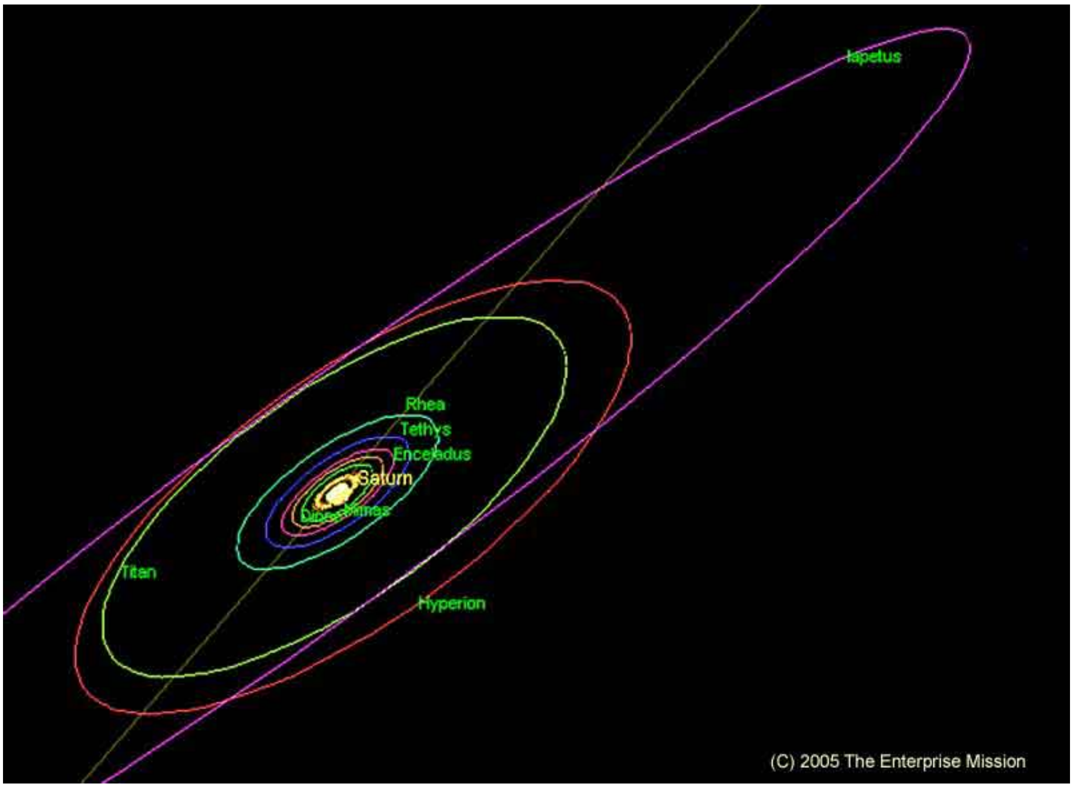
Now, when should we do this? Well, that's obvious--

As soon as possible -- while Cassini's still a working spacecraft!

The Cassini/Huygens spacecraft is as big as a small school bus (note the size relative to the technicians - below), measuring over 22 feet long, 13 feet wide -- and weighing more than 6 tons (with fuel). It is equipped with a complement of 12 state-of-the-art scientific instruments, many with multiple functions – making it uniquely qualified now to return to Iapetus ... and carry out the first thorough scientific investigation of a high probability extraterrestrial "artifact" ... an entire artificial "moon!"

But, getting back to Iapetus will not be as easy as it sounds – both for technical and political reasons.

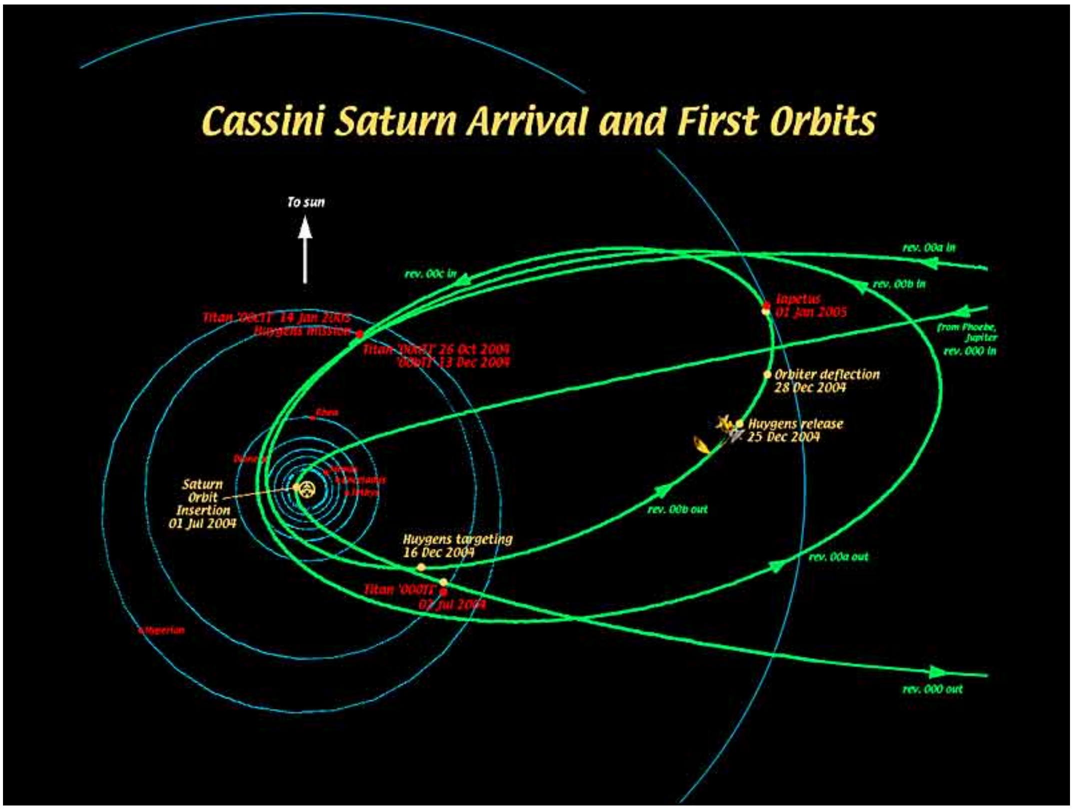
Of all the moons of Saturn (except for tiny, distant Phoebe), Iapetus has the most inclined orbit. All the other major moons lie essentially in the plane of Saturn's equator and its rings, and are relatively close to Saturn. Iapetus' orbit is tilted 15 degrees to these other orbits ... and lies more than 2 million miles away (below) ....



This makes Iapetus very difficult to get to.

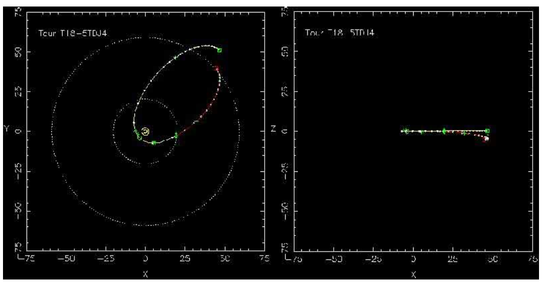
After entering orbit on July 1, 2004, the original plan was for Cassini to observe Iapetus mainly from a distance … as the spacecraft was enroute to observing the bewildering but scientifically rich cornucopia of other phenomena in the Saturn system. This was how the recent, even more spectacular images and data of Iapetus than originally planned, were -- almost as an "afterthought" -- acquired on December 31, 2004: because the initially designed spacecraft trajectory was significantly altered a few years ago … to allow for the so-called "Doppler problem" discovered on-board Cassini after launch. Without this major orbit alteration – which coincidentally allowed Cassini to come within 80,000 miles of Iapetus (as opposed to the original ~400,000 on the recent fly-by) -- the subsequent encounter geometry at Titan would have prevented clear data transmissions to Cassini during the critical Huygens' Titan landing (polar orbital view - below).

Thus, our best look at Iapetus to date was actually due to a series of "beneficial accidents!"

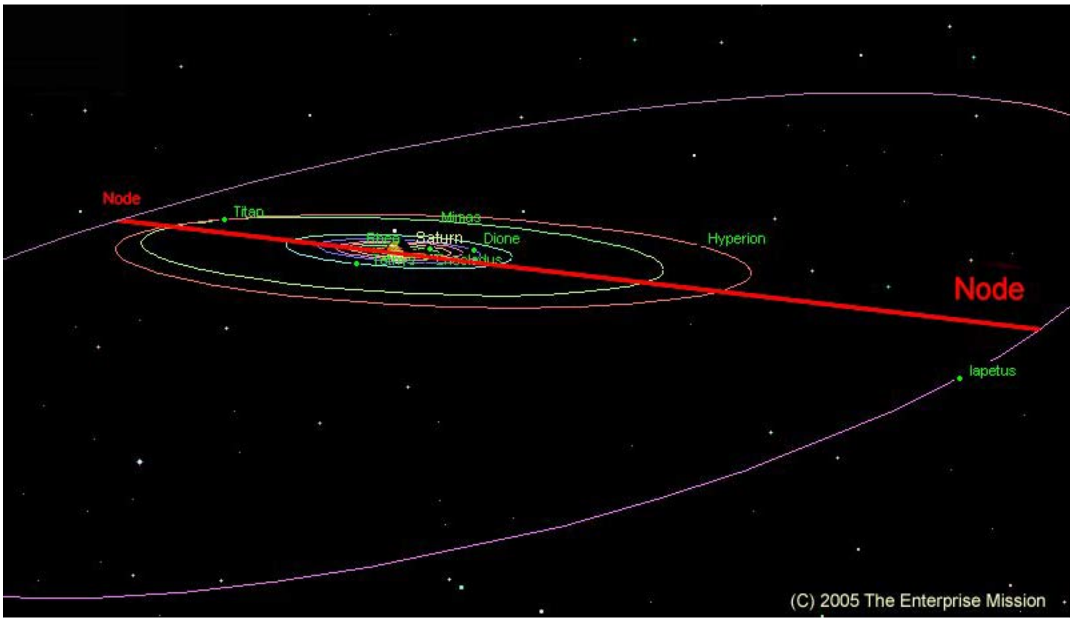


Because of this great difficulty in reaching Iapetus' orbit directly, in <u>the nominal Cassini Plan</u> the intent was (and still is!) to carry out the next (extremely close) fly-by of Ipateus (~600 miles) only once in the entire four-year Mission – on September 10, 2007 (below) – as the base-line Cassini science mission is winding down.

The outer circle (below-left) depicts Iapetus ~2 million-mile orbit as seen from above Saturn's north pole; the next inner ring is Titan's orbit. The second view (below-right) depicts the Saturn system edge-on – showing the major orbital plane change required to reach Iapetus. And, orbital plane changes are VERY expensive (in terms of on-board fuel) … which is why (ostensibly) there is only one "targeted" close fly-by of Iapetus in Cassini's first four years ….

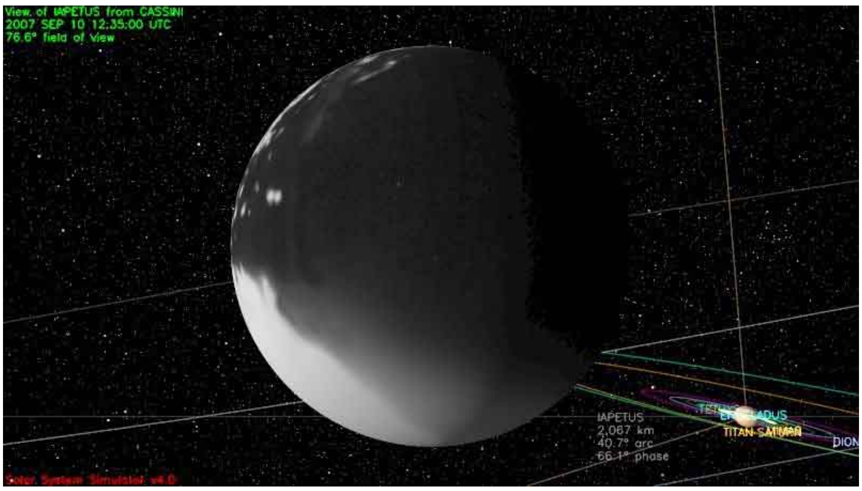


This restriction only applies, however, if Iapetus is not near one of its two nodes -- two opposing points (see red line - below) along its orbit, where it must cross the plane of all the other satellites, twice every 79 days; if you time a spacecraft rendezvous for there … then there's no "expensive" plane change involved at all! And, the number of times you can visit Iapetus (within Cassini's current fuel margin) opens up enormously.



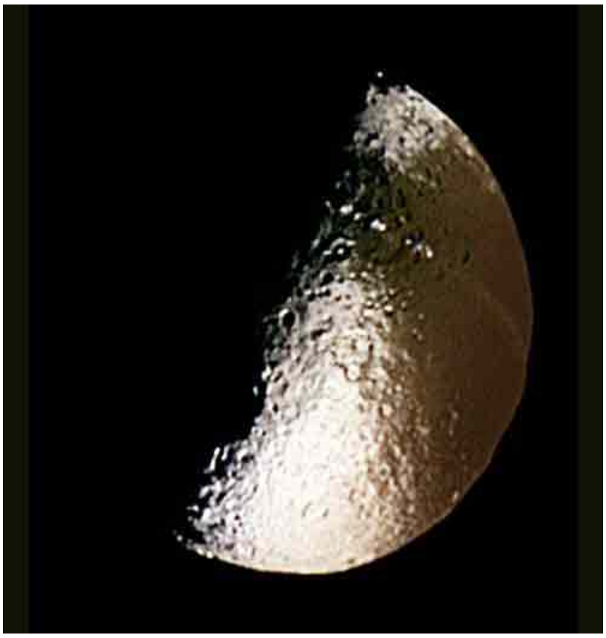
This, in fact, is how the December 31, 2004 "coincidental far encounter" was accomplished; Iapetus was near the node on the left (above), when Cassini (because of the forced change in the celestial mechanics previously described for Titan) swung out to within 80,000 miles of Iapetus' 2 million mile orbit -- on its way back in toward Titan and the Huygen's landing, January 14th.

Courtesy of <u>JPL's "Solar System Simulator</u>" (below), this will be the view from Cassini as the spacecraft nears this one specially-planned close-encounter with Iapetus – on September 10, 2007.

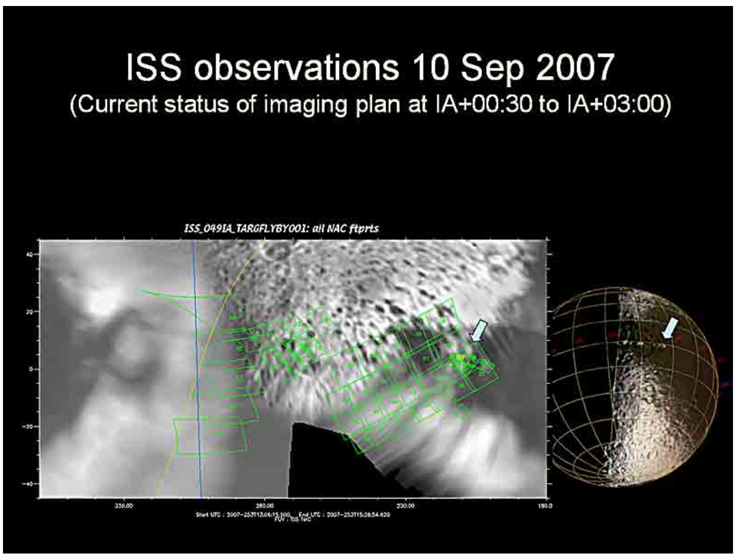


As can be seen, the timing is impeccable for imaging in unprecedented detail (and at a perfect lighting angle) not only the western end of "The Great Wall of Iapetus" … stretching across the dark expanse of "the Ellipse" … but one end of The Wall's apparent "beginnings" – over the second "ring-basin" (below), two thirds of the way around Iapetus. On the JPL simulation (above), one can even see the line of "12-mile-high-mountains" … which seem to mark the western boundary of The Wall.

The 2007 Cassini fly-by should send us close-ups of these extraordinary features that are literally 1000 times better than this image (below) ….



Courtesy of Tilmann Denk (one of the Cassini Imaging Team members), these (below) are the currently planned, actual 2007 narrow angle camera imaging sequences -- designed to gain additional insights into "The Great Iapetus Wall" ….



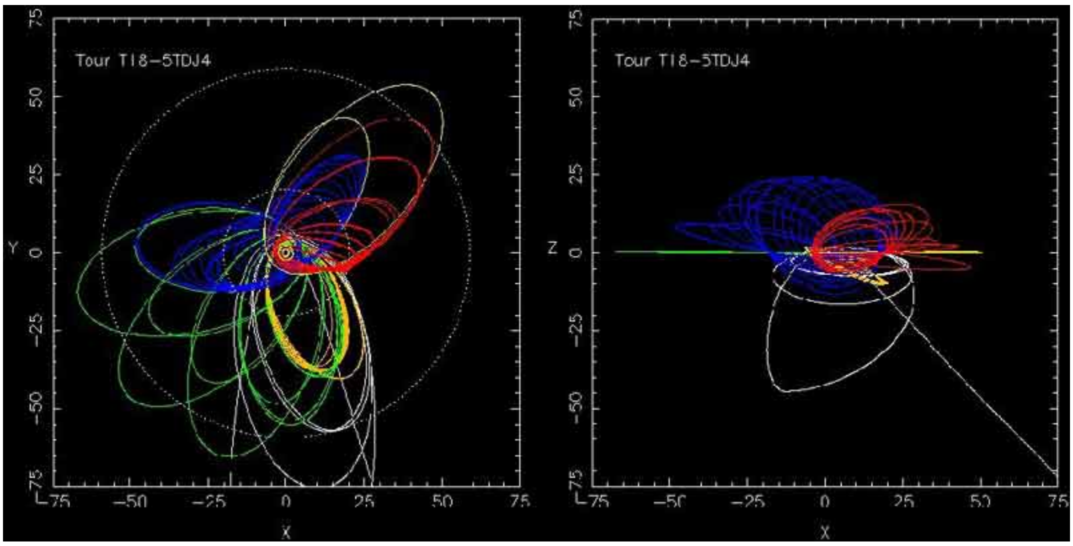
But all this won't occur for almost two more years ….

In the meantime, Cassini will be maneuvered into a variety of other orbits around Saturn -- via those repeated "slingshot maneuvers" utilizing the gravity field of Titan – all designed to bring it breathtakingly close to several of the inner moons, the rings, and to place it in position to examine extended regions of Saturn's far-flung magnetosphere (below).

And, of course, Cassini will relentlessly pursue its planned 44 close observations of Titan itself, on each repeated close approach … on every "slingshot."

During all this time, however, as we wait patiently for two more years – particularly, as Cassini repeatedly approaches the dangerous rings themselves – anything could happen to the spacecraft … and we could without warning lose a priceless opportunity to fully explore and resolve the now immense scientific and cultural "SETI opportunity" presented by the deepening mysteries of Iapetus ….

That must not be allowed to happen.



So, if we could sweepingly redefine the priorities of the Cassini Mission (based on the startling information presented here, and its non-trivial scientific and social implications …), what vital information could we learn from even one or two more dedicated fly-bys of Iapetus … and much sooner than two years?

Let's start with the "moon's" overall geometry.

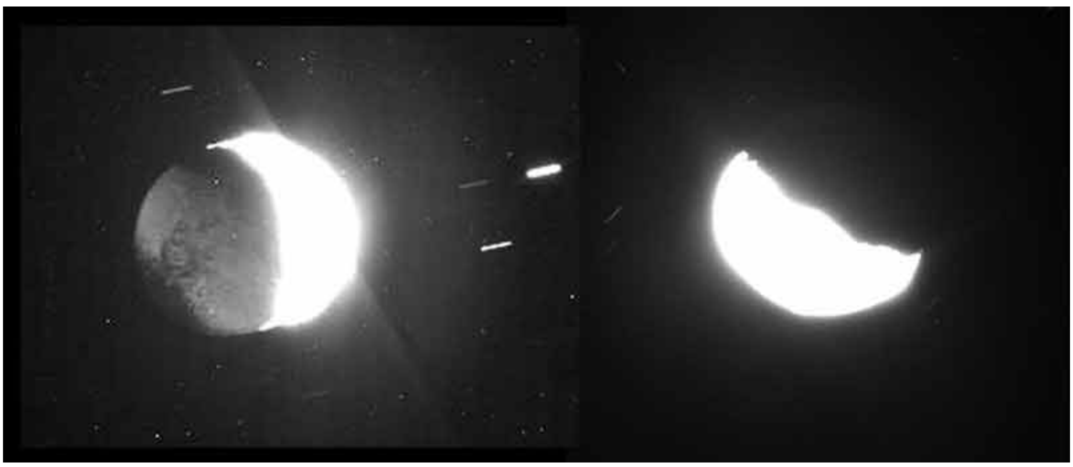
The most obvious, most blatant evidence of artificiality for Iapetus comes from its overall, totally bizarre geometric form (below).

Even in a recent paper (2000), whose authors included some Cassini team members, it was admitted:

> *... limb fitting of Voyager data shows that the shape of Iapetus can be described by an ellipsoid with half-axes 750 km X 715 km .... However, note that Iapetus' shape is irregular rather than ellipsoidal ... measured radii vary between 700 km and 780 km. An irregularly shaped, Iapetus-sized body is something quite unusual in the solar system [emphasis added] ....*

As these measurements were conducted on "conventional" Voyager images, and did not utilize the long-exposure "Saturn shine" Cassini techniques described in Part 2, they are in fact serious underestimates for how truly "unusual" and geometric Iapetus' limb turns out to be (though, they seem to have been one of the key incentives for the long-exposure Cassini observations which confirmed this extraordinary information ...).

What's needed now is an extended series of similar, over-exposed "silhouette views" of the rest of the sunlit limb of Iapetus ... all the way around ... taken from many different angles and points along its orbit -- which can then be combined into a 3-D computer model to derive the actual "non-spherical" geometry of this bizarre "moon."



Fortunately, this does not require particularly close fly-bys to accomplish, merely the targeting of multiple, distant narrow-angle images of Iapetus with different exposure settings … as Cassini is simultaneously pursuing other studies of the Saturn system ….

What does require a series of close encounters to truly be effective, is a comprehensive surface survey of the composition of Iapetus – particularly, the "dark ellipse."

*Here (below) is <u>some of the early composition data</u> NASA's published, acquired by Cassini's **Visual and Infrared Mapping Spectrometer** (VIMS) during the December 31 Iapetus encounter. As can be seen, the results are very preliminary – mainly at this stage identifying the "light stuff" around the brightly reflective north polar regions as "water ice" … and the "dark ellipse stuff" as being composed of "a mixture of organics …." But, "organic" what?!*

Iapetus surface composition (Credit: NASA/JPL/University of Arizona)

12 January 2005
This colour composite image of Saturn's moon Iapetus from NASA/ESA/ASI Cassini spacecraft was obtained on 31 December 2004, an hour and a half before the New Year.

It was taken with Cassini's Visual and Infrared Mapping Spectrometer (VIMS) at a distance of 121 000 kilometres, with a spatial resolution of about 60 kilometres.

The three colours used in the mosaic correspond to 1.01, 3.21, and 3.80 microns. The different colours represent vastly different surface compositions. The upper bright blue region is rich in water ice, while the lower, dark brown region is composed mainly of a substance rich in organic material.

The yellow region consists of a mixture of ice and organics, suggesting a gradual change in composition on the surface. This pattern suggests Iapetus swept up the dark material, which may have come from debris created from meteoritic impacts onto the small, outer satellites of Saturn.

The Cassini-Huygens mission is a co-operative project of NASA, ESA and ASI, the Italian space agency.

Before Cassini, another paper -- addressing this same several-hundred-year-old problem -- <u>was published in 2001</u>:

> *We present new [Earth based] spectra of the leading and trailing hemispheres of Iapetus from 2.4 to 3.8 m. We have combined the leading hemisphere spectra with previous observations by others to construct a composite spectrum of the dark side (leading) hemisphere from 0.3 to 3.8 m. We review attempts to deduce the composition of the dark material from previously available [ground-based] spectrophotometry. None of them (numbering more than 20 million!) leads to a synthetic spectrum that matches the new data. An intimate mixture of water ice, amorphous carbon, and a nitrogen-rich organic compound (modeled here as Triton tholin) can fit the entire composite dark side spectrum. Observations in this spectral region have not revealed this mix of material on any other object observed thus far [emphasis added] ....*

This potentially key relationship of the Iapetus "dark stuff" to the other significant anomalies we have presented will be discussed in greater detail later.

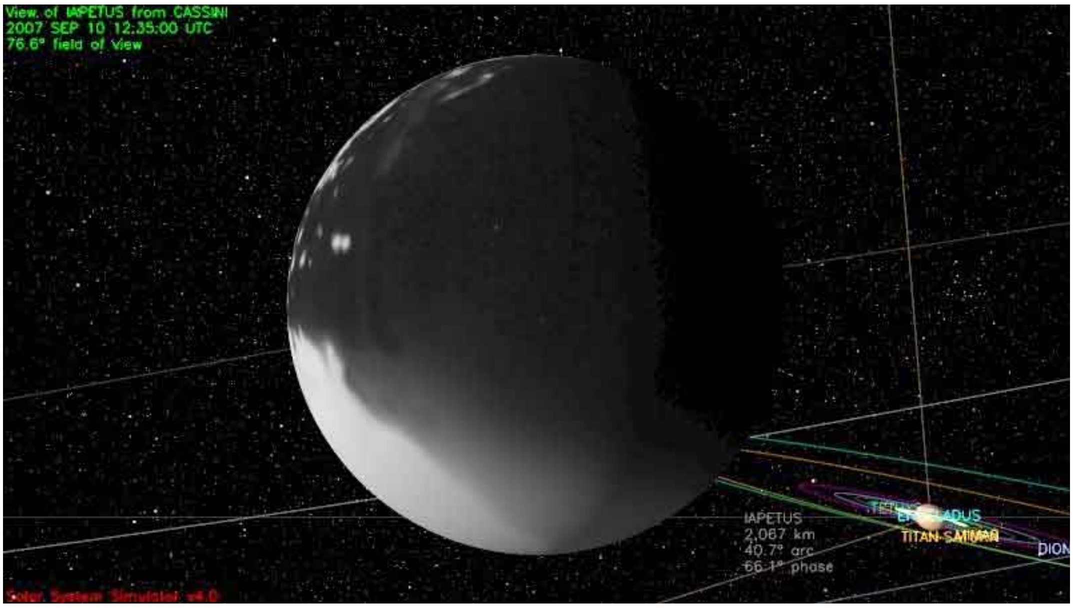
To ultimately understand where these mysterious surface materials have come from – whether the "dark stuff" is internal, and has (for some reason) welled up from Iapetus only on one side, or if it is external ... and has rained down over time on the "front" of Iapetus as it orbits Saturn (to say nothing of the question: "Which came first? Is the dark stuff on top of the light stuff? ... or, is the light stuff draped over the dark stuff ?") – will ultimately be determined only by the details of much higher-resolution VIMS composition maps.

And that (if you look at the size of the ~ 40-mile pixels in the VIMS multi-spectral image - above) will require getting a lot closer ....

In fact, it will require optical-scale resolution for VIMS, to resolve details on Iapetus sufficient to determine regional differences in the distribution and the composition of the *"dark stuff." Which, in turn (for global coverage) – will require repeated, close-up fly-bys … at differing distances, geometries and lighting.*

*Which brings us to the critical, much higher-resolution new imagery required now (from Cassini's **Imaging Science Subsystem – ISS**) of this extraordinary "moon" ….*

Now that we have identified several striking areas on Iapetus from the previous imaging -- each exhibiting large-scale, unquestionably geometric surface features, which, together, present a highly provocative case for intelligent construction -- we obviously need much higher resolution imagery to literally resolve what we are seeing. Unfortunately, if you look again at the currently planned Cassini close approach to Iapetus in September, 2007 (below), the hemisphere which will receive the highest resolution imagery of the current Cassini mission during that one planned fly-by … is NOT the hemisphere that was imaged in December, 2004! It's the other hemisphere ….

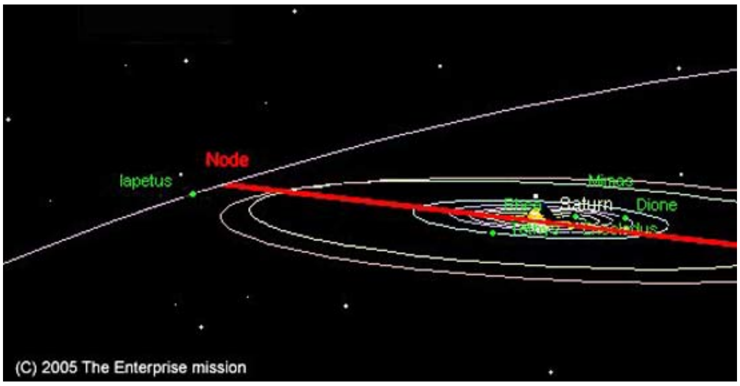


Thus, we will NOT have much (if any!) "overlapping, confirmatory, high-resolution imagery" of the remarkable anomalies that we have now identified on the lower-resolution pictures from December, 2004.

It's somewhat difficult to test a hypothesis … with a different data set!

The remedy for this is very simple: schedule at least one more, similarly close fly-by of Iapetus (in addition to September 10, 2007) … when the lighting and viewing angles are similar to the December 31st encounter.

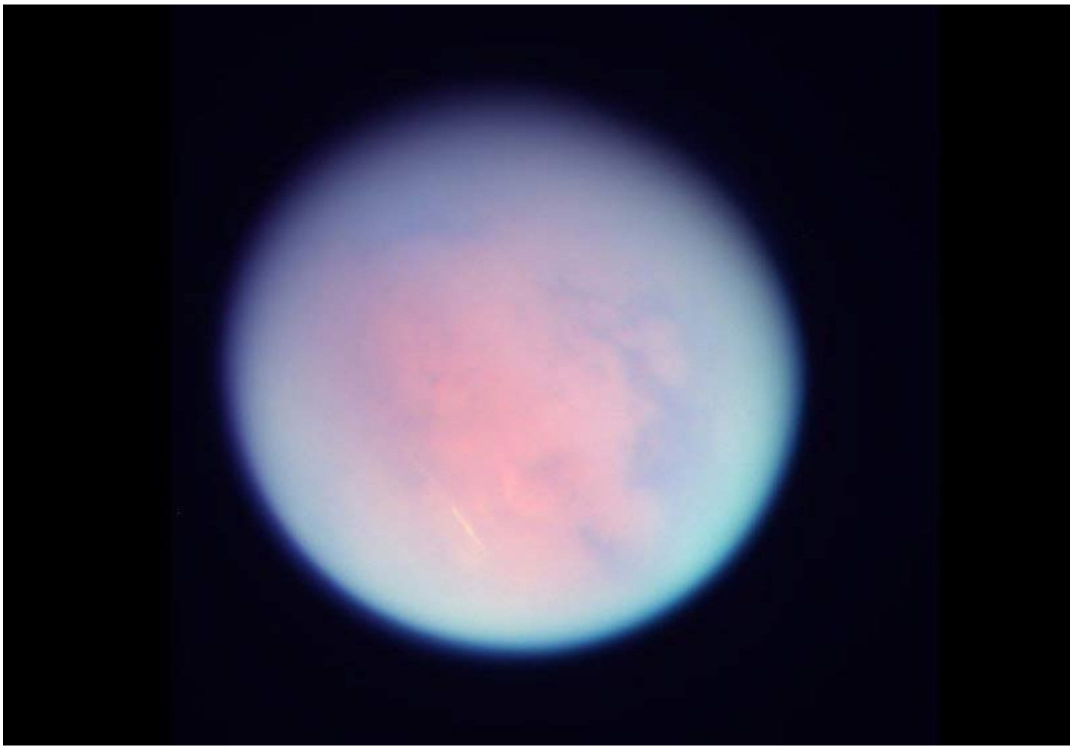
By good fortune (for that pesky "plane change problem" ...), this additional encounter would also have to occur near the western node of Iapetus' orbit -- when the "moon" is cutting down through the plane of the other inner moons, the rings ... and Cassini's current trajectory around Saturn (below). If an additional fly-by were to be planned for that brief window (we'll describe "how" this can occur, with your help, in Part 4), this additional reconnaissance (together with the 2007 encounter data) would give us, at minimum, adequate imagery of most of Iapetus' surface ... at a level of detail at least 100 times the current imaging.



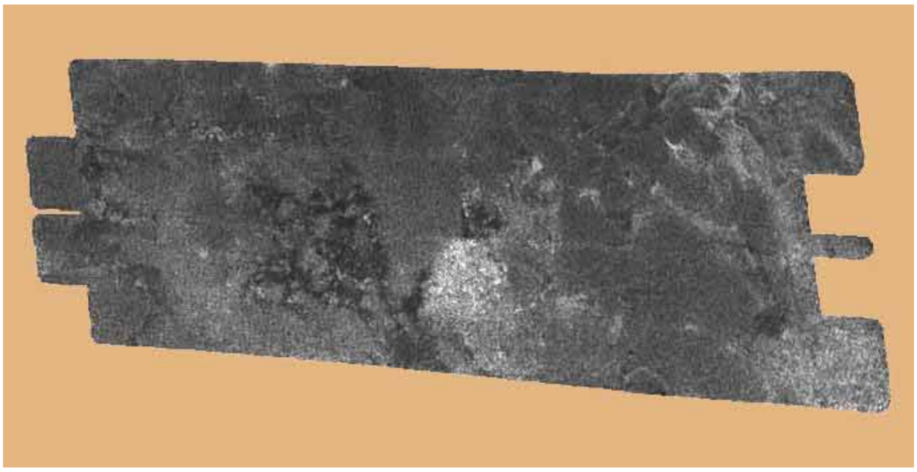
Only this type of synoptic, comparative, high-resolution coverage will allow truly scientific conclusions regarding the mind-boggling, potential artificial nature of the amazing Iapetus' geometry we've found ....

But, the importance of ultra-close-up imaging notwithstanding, the most important new observations Cassini could carry out at Iapetus – but only during really close fly-bys -- would be a series of side-looking radar observations ... 3-D radar images of all that amazing "stuff" that's down there!

Cassini is equipped (the first time for any outer planets mission) with instrumentation capable of active and passive radar observations. Its well-advertised mission priority is "radar imaging" the surface of the perpetually haze-shrouded largest moon of Saturn, Titan (in this false-color IR composite by Gerry Geist – below). But, "if time permits" (according to the official NASA press release ...) other targets also can be examined – including some of the icy moons ... and the rings.



During the first close-up Cassini Titan fly-by, in October, 2004, the spacecraft's side-looking radar returned a fascinating strip of imagery -- about 150 miles wide by almost 300 miles long (below) – showing the alien Titan landscape for the first time in a radar view, this one taken from only 750 miles above its surface.

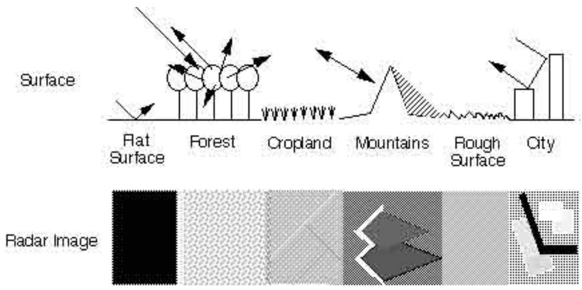


From JPL (below), here's a brief technical explanation regarding how side-looking radar "sees" a planetary surface ... and what it can detect:

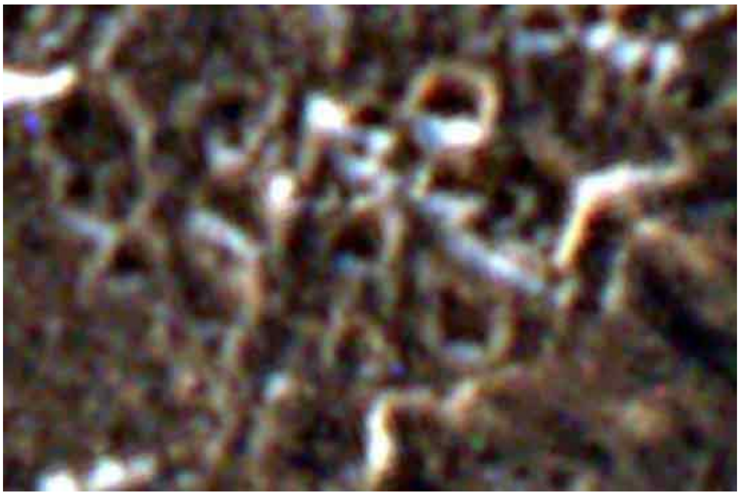
... a useful rule-of-thumb in analyzing radar images is that the higher

or brighter the backscatter on the image, the rougher the surface being imaged. Flat surfaces that reflect little or no microwave energy back towards the radar will always appear dark in radar images. Vegetation is usually moderately rough on the scale of most radar wavelengths and appears as grey or light grey in a radar image. Surfaces inclined towards the radar will have a stronger backscatter than surfaces which slope away from the radar and will tend to appear brighter in a radar image.

Some areas not illuminated by the radar, like the back slope of mountains, are in shadow, and will appear dark. When city streets or buildings are lined up in such a way that the incoming radar pulses are able to bounce off the streets and then bounce again off the buildings (called a double-bounce) and directly back towards the radar they appear very bright (white) in radar images. Roads and freeways are flat surfaces so appear dark. Buildings which do not line up so that the radar pulses are reflected straight back will appear light grey, like very rough surfaces [emphasis added] ....



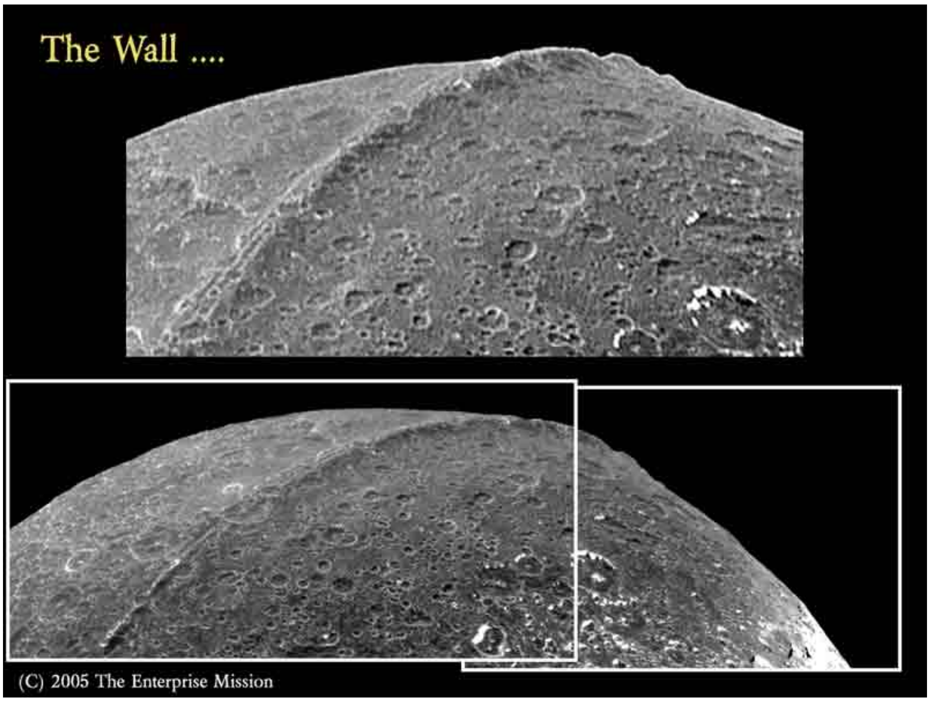
Imagine what this technique – which could easily confirm the "impossible" geometric forms littering the surface of Iapetus, much as it would see a terrestrial city filled with similar geometry (above - right) – could see in a close fly-by of Iapetus. And, what it could see inside Iapetus – if the short wavelength radar beams (2.2 cm) penetrated several miles into the interior, though the many apparent gaping "holes" (those pitch black features ...) seen in the visible light images?



If used to electronically scan this unique Saturnian "moon," the on-board Cassini radar transmitter and receiver -- utilizing the 13-foot-wide high-gain communications antenna on the end of the spacecraft (below) -- could create unbelievable high-resolution radar "imaging strips" across some of the most striking, large-scale geometric structures we've now discovered on Iapetus.

A prime target of such observations, now, would be the mysterious "Great Wall."

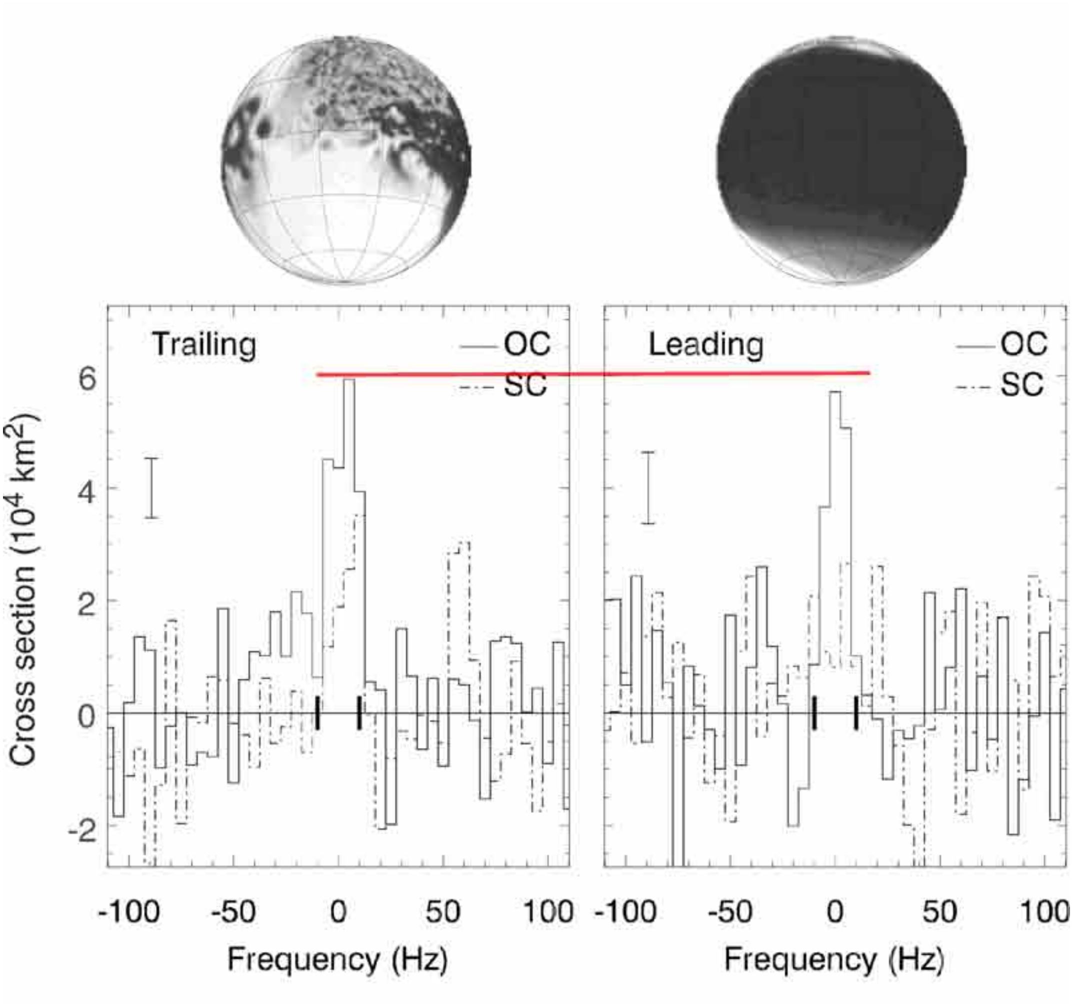
Imagine (depending on what it's really made of ...) being able to see details inside this astonishing structure with the Cassini radar, using this unique capability already at Saturn to gain crucial new scientific insights into its potential artificiality ... not possible from any other scientific instrument on board (below).



It has only been in the last few years that Earth-bound radars – like the upgraded Arecibo Radio Telescope (below) – have been able to send a 900 kilowatt signal all the way to Saturn (~770 million miles from Earth) ... and get an echo back from its (compared to Saturn, or the rings) relatively tiny icy moons. In analyzing the first radar echoes from Iapetus, in 2002, several new surprises were discovered.

[According to Gregory Black](), team leader from the University of Virginia:

> *It is known that the bright [trailing] side is mostly water ice, but we find it does not reflect the radar like other icy satellites that we've studied with the radar before. The ice on Iapetus appears much less reflective.*
>
> *Another surprise is that the radar system sees Iapetus as a uniform object [red line - below], meaning no difference between the light and dark sides [emphasis added]....*



Adopted from *Science*, Vol 304, Issue 5670, 553, 23 April, 2004

Black's et al. [2004 Science paper]() also put forth a plausible explanation for this anomalously low radar reflectivity of the "bright" (icy) side of Iapetus:

> *... the addition of 10 to 30% by weight of ammonia to water ice can increase its microwave absorption. Ammonia may have been an abundant constituent. In the saturnian protonebula that would have been incorporated into its satellites. The absence of spectral evidence for ammonia and ammonia products on the surface may be the result of selective depletion by ion sputtering, leaving an ammonia-poor crust over an ammonia-rich ice that would affect the radar reflectivity yet remain undetected at optical and infrared wavelengths ....*

The authors extended this speculation re some kind of "Iapetus radar absorber" to the equally puzzling lack of a significant difference in the radar returns ... between the leading and trailing hemispheres:

> *... a less likely absorber candidate is the dark material that covers the leading hemisphere. Although it appears to have a minor presence on the brighter, trailing hemisphere, an admixture of material in the ice below the surface could still attenuate the radar signal. To match the optical and infrared surface, this scenario would require a mechanism to deposit clean ice over the dark material on the trailing side [emphasis added] ....*

Given what we've discovered about Iapetus from the new Cassini images however, we are now in a unique position to suggest a very different explanation for this remarkably low radar return ....

Beginning in the 1960's, based on new radar and electromagnetic interaction theories developed by Russian physicist, Pyotr Ufimtsev, including his classic "Physical Theory of Diffraction," a way to make aircraft far less vulnerable to World War II-developed radar began to be explored. But, it is only in the last 20 or so years that this formerly super secret "black" technology – popularized as "stealth" – has finally come to light.

The full story behind the decades-long development (ironically, not by the former Soviet Union but by the United States) of this highly advanced military "countermeasures" radar technology is truly fascinating – finally culminating in the public revelation (by the U.S. Air Force, in the 1980's) of a radical new fighter bomber called the "F-117" (below).

LOCKHEED F-117 NIGHTHAWK

The technology beyond how "stealth" works – how an aircraft can be made to almost disappear from modern radar – relies on two, in principle, very simple properties: what the aircraft's made of (and/or, what it's coated with) … and what geometry it has assumed.

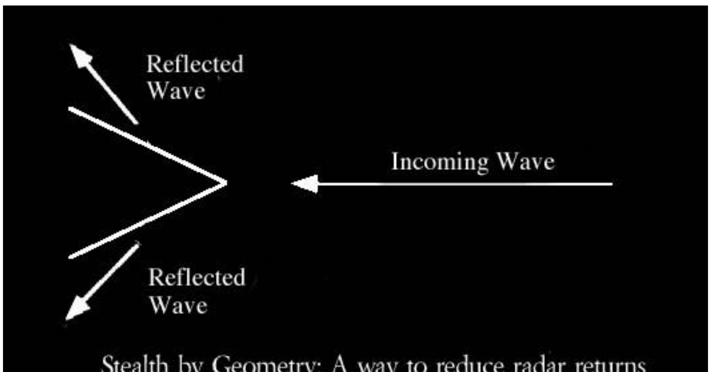
Some materials (like the "ammonia/ice combination" discussed in the preceding Science paper), absorb short wavelength radar signals quite effectively. If an aircraft were coated with such a mixture, it's so-called "radar cross-section" could be significantly reduced. In practicality, these radar-absorbing technological materials are not composed of impossible, frozen ammonia mixtures (!), but of special, internal "re-entrant triangle geometries" -- coated with a unique compound called a "carbonyl iron ferrite" … one of several metallic paints.

The result is a combination which effectively absorbs almost all microwave energy … across a major portion of the electromagnetic spectrum … resulting in true "stealth."

The companion method of making such a "stealthy" aircraft involves aerodynamically designing the airframe this "radar-absorbent coating" will be applied to, in such a way *that incoming radar beams are NOT directly reflected back toward the radar's source. This involves incorporating highly unusual planar geometry in the aerodynamic design … then applying the radar-absorbent coatings to this geometric airframe.*

The result is what gave the F-117 its unique, almost "alien" (and threatening) appearance when it was finally publicly unveiled (below): a plane that's truly more like a collection of flying pyramids … than a late 20th Century aircraft!

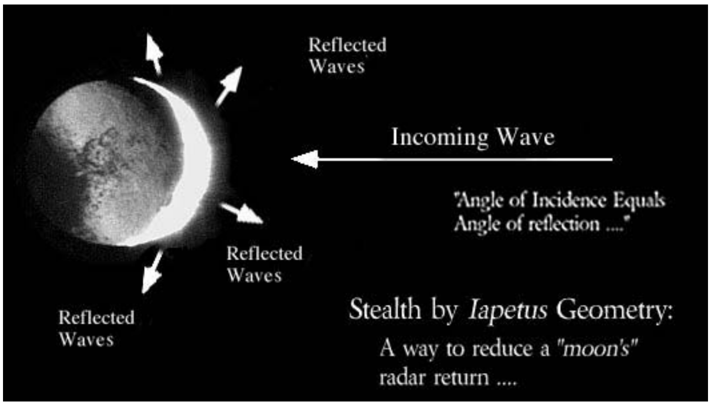
The reason for the pyramid-like appearance of the F-117 is directly related to this fundamental principle of stealth technology: a shape that geometrically redirects -- by simple reflection -- incoming radar energy away from returning to the transmitting antenna (below)!



Applied to what we have just measured -- regarding Iapetus' astonishing faceted geometry -- it seems equally likely that another, remarkable reason for Iapetus' "anomalously low radar reflectivity" could now be seriously proposed—

That, like the F-117's fundamental stealth design, the "moon's" Platonic geometry is redirecting incoming radar energy away from any radar source (below)!

The implications of this are far reaching ....

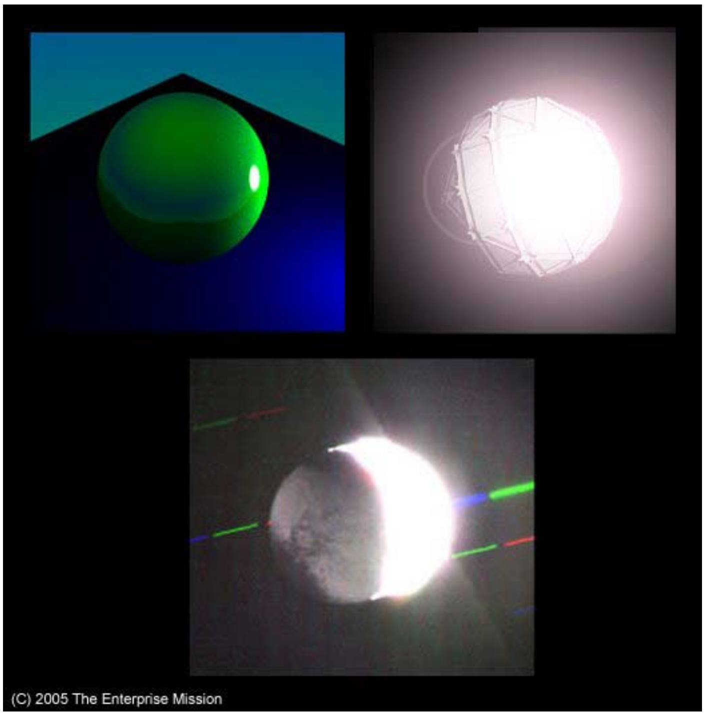


A major optical confirmation that this is what's occurring is provided once again by the new Cassini imaging.

Here (below), we display two of the "Saturn shine" exposures of Iapetus, acquired one day apart – on October 21st and 22nd, 2004. Look carefully at those long "diffraction spikes" that emerge in opposite directions in both images. Those are caused by the way the Cassini CCD camera system is oversaturated by a brilliant reflection from apparently one small, sunlit region on the trailing side of the "moon."

Now, if you measure the distance of this bright reflection from the sunlit limb, using the "diffraction spikes" as reference -- from one image to the next you'll see that it is changing … the reflection getting significantly closer to the visible "moon's" edge as the orbital viewing angle between the spacecraft, Iapetus and the Sun narrows over roughly a 24-hour period.

This progressive movement, relative to the "moon's" edge as the viewing angle changes, is the central hallmark of a mirror-like reflection – a so-called "specular reflection" (from the Latin specula, "mirror") – but in this case, not by a normal spherical surface (simulation, below – left) … but created by one of those huge, flat Iapetus surface areas (simulation, below – right), bouncing the scattered image of the Sun itself, from thousands of square miles, directly into the Cassini camera … an enormous flash of sunlight from one of the same flat areas seen profiled on the limb (below – bottom) as "a hundred-mile-long straight edge!"



An identical "mirror-like phenomenon" – but coherently reflecting radar signals away from any transmitters -- could in principle now explain the curiously "stealthy" Arecibo echoes recorded from Iapetus in 2002/2003. This startling new possibility – and its even more startling implications – only strengthens the idea that Iapetus could, in fact, be "an ancient spaceship moon …."

It also heightens the stakes for why this entire, extraordinary hypothesis must now be tested -- by going back to Iapetus as soon as possible … this time, also utilizing the full capabilities of Cassini's on-board radar.

Bulletin!

During the December 31, 2004 fly-by, according to a published pre-encounter timeline just discovered, the on-board Cassini RADAR experiment—

Should have already acquired such critical new data on Iapetus!

But, remarkably – out of all the many experiments and observations carried out by Cassini during its Iapetus encounter last December -- JPL has not published any results from these first, new radar observations of Iapetus! The echoes were to be acquired in several time windows, spaced throughout the two-day encounter -- from "about 14 hours before … to 20 hours after, Closest Approach" (see timeline, below).

Spacecraft time (UTC)	Time with respect to closest approach	Event
Dec 31 01:53	- 16h 56m	Turn cameras to Iapetus for global mapping Both the cameras and spectrometers will operate. At this range the cameras will be able to obtain images with about 1-kilometer resolution, while the Composite Infrared Spectrometer (CIRS) will take the temperature of Iapetus and study the composition of its surface.
04:29	- 14h 20m	Turn High-Gain Antenna to Iapetus for RADAR scatterometry Scatterometry involves broadcasting a signal and characterizing its echo; it's another way of understanding the physical properties (both composition and structure) of the surface.
07:03	- 11h 46m	**Orbit apoapsis (end orbit B, begin orbit C)** *Cassini* reaches her farthest point from Saturn at a distance of 60 times Saturn's radius, and begins moving toward Saturn again for the orbit that will take her past Titan during the *Huygens* mission.
08:00	- 10h 49m	Turn cameras back to Iapetus By looking at the edge of Iapetus's disk (the "limb"), the camera team will be able to study the moon's topography.
08:30	- 10h 19m	Turn High-Gain Antenna to Earth-line and play back data The playback will take about 4.5 hours, creating the space necessary for the flyby data.
14:00	- 04h 49m	Turn cameras back to Iapetus The cameras and spectrometers will be gathering data both before and after closest approach. The cameras will do global mapping, limb topography, and "graylight" observations of the night side of Iapetus. CIRS and VIMS will perform compositional mapping.
18:49:18	**- 00h**	**Iapetus Flyby Closest Approach** Altitude = 123,399 kilometers (76,677 miles), speed = 2 kilometers/second (4,500 miles/hour). At closest approach, the Narrow Angle Camera will have 740-meter resolution; VIMS will have as high as 20-kilometer resolution; and about three CIRS spots will fit acros Iapetus's disk.
Jan 1 05:00	+ 10h 11m	Turn High-Gain Antenna to Earth-line and play back data The playback will take about 6 hours.
12:00	+ 17h 11m	Turn cameras back to Iapetus
15:00	+ 20h 11m	Turn High-Gain Antenna to Iapetus for RADAR scatterometry
23:45	+ 28h 56m	Turn High-Gain Antenna to Earth-line and play back data The playback will take about 4.5 hours.

In terms of how these and other Cassini radar observations were to be carried out, here is what another official JPL release has stated:

> *... At altitudes between 22,500 and 9,000 kilometers (about 14,000 to 5,600 miles), the radar will switch between scatterometry and radiometry to obtain low-resolution global maps of ... surface roughness, backscatter intensity and thermal emissions. At altitudes between 9,000 and 4,000 kilometers (about 5,600 to 2,500 miles), the instrument will switch between altimetry and radiometry, collecting surface altitude and thermal emission measurements. Below 4,000 kilometers (about 2,500 miles), the radar will switch between imaging and radiometry ....*

Since Cassini never came closer to Iapetus in this encounter than about 80,000 miles, there could be no meaningful radar imaging during this particular opportunity (Cassini was too far away to receive adequate signal strength, and the geometry was wrong ...). But, according to this published pre-encounter timeline (above), there was expected to be enough signal for simple "scatterometry" scans (echoing efforts ...) -- to compare Cassini's recorded return signals directly with the puzzling 2002/2003 much more distant Arecibo's radar returns ....

Yet, despite the simplicity of the experiment and the obvious high scientific interest—

As previously noted, as of this writing there have been NO published results – not even abstracts -- concerning last December's Cassini radar echoes of Iapetus!

In striking contrast, NASA has presented reams of close-up images, preliminary composition measurements and estimated surface temperatures on Iapetus, a wide variety of data acquired by the cameras and spectrometers during the same December 31 encounter – much of it released within just days. It has even offered "wall to wall" raw imaging results on its Cassini website -- from not only all the Iapetus encounters so far, but of the fly-bys of ALL the other moons since it arrived at Saturn on June 30th.

During the first Cassini satellite encounter – the ~1200 mile historic fly-by of the 136-mile diameter, retrograde Saturnian moon, Phoebe – the Cassini RADAR experiment "pinged" a variety of signals off tiny Phoebe, as the spacecraft flew by on June 11, 2004, during its final few-million-mile approach to Saturn, after its seven year journey out from Earth ....

Official acknowledgement of preliminary results from these historic Phoebe radar scans was made almost immediately ... on June 18th ... within a week of the encounter. And a more detailed scientific paper on the Phoebe radar data was presented to the American Astronomical Society's annual Division of Planetary Sciences Meeting, in November, 2004. In that paper, anticipation of the up-coming December Iapetus radar observations was specifically cited (as a means of further, crucial calibration of the entire Cassini RADAR system) ....

But, after these "key observations" in December were successfully carried out, on the small matter of how Iapetus – a much more important target than Phoebe, one with far-reaching implications for the origin of the entire Saturn system (and, remember, key to "successful calibration of the entire Cassini radar system ...") -- actually reacted to these first-time Cassini radar scans ....

Nothing.

This, despite the fact that Dr. Charles Elachi, Principal Investigator for the Cassini RADAR Experiment, also happens to be—

The Director of JPL itself!

In fact, it gets stranger.

Unlike the DPS meeting following the Cassini Phoebe encounter, at which Elachi's team couldn't wait to report its first results, the JPL RADAR team seems almost to be hiding ... following the first radar close-up of Iapetus ....

In the next few weeks (March 14-18, 2005), a world-class, annual scientific meeting will once again take place in Houston, Texas -- the 36th annual Lunar and Planetary Science Conference (below). This is the yearly get together where all the latest NASA and other global space agency solar system discoveries are presented from the preceding year.

This year, three historic planetary missions and their results are taking center stage: the amazing NASA Mars Rovers ... because of their historic year-long surface explorations of the Red Planet; the European Space Agency's equally important Mars Express orbital Mars Mission ...; and, of course, NASA's Cassini Saturn Mission ....

A survey of the accepted scientific papers, already listed in the official program on the LPSC 2005 website, reveals the usual wide spectrum of solar system physics and discoveries to be presented at this year's Conference – including, three Special Sessions devoted exclusively to the latest Cassini Saturn results. In fact, there are seven papers in the Third Session alone, totally devoted to the first Cassini RADAR observations of Titan (below).

Thursday, March 17, 2005
SPECIAL SESSION
CASSINI AT SATURN III: TITAN SURFACE, RINGS, AND ICY SATELLITES
1:30 p.m. Salon B

Chairs: L. J. Spilker
T. V. Johnson

1:30 p.m. Stofan E. R. * Elachi C. Lopes R. M. Lorenz R. D. Kirk R. L. Paganelli F. Wood C. A. Wall S. D. Lunine J. Soderblom L. A. RADAR Science Team
Mapping of Titan: First Results from the Cassini RADAR **[#1714]**
The first Synthetic Aperture Radar swath across the surface of Titan has revealed a surprisingly complex surface.

1:45 p.m. Lopes R. M. * Elachi C. Stofan E. Paganelli F. Wood C. Kirk R. L. Lorenz R. D. Fortes A. D. Lunine J. Wall S. D. Cassini RADAR Team
Cryovolcanic Features on Titan's Surface as Revealed by the Cassini RADAR **[#1885]**
The Cassini RADAR obtained SAR images of about 1.1% of Titan's surface during the spacecraft's fly-by on October 26, 2004. These revealed surface features that are interpreted as the result of cryovolcanism, including extensive flows. New results from the T3 flyby will also be discussed.

2:00 p.m. Paganelli F. * Elachi C. Lopes R. M. West R. Stiles B. Janssen M. A. Stofan E. R. Wood C. A. Lorenz R. D. Lunine J. Kirk R. L. Roth L. E. Wall S. D. Soderblom L. A Cassini RADAR Science Team
Channels and Fan-like Features on Titan Surface Imaged by the Cassini RADAR **[#2150]**
Cassini's SAR data of Titan's surface show fan and flow features, sinuous and linear channels. SAR-bright return suggests surface roughness at the scale and bigger than Ku-band, and possible

But—

Out of a total of 39 Cassini papers at this Conference (not counting poster sessions ...) -- NOT ONE is going to address the first Cassini Iapetus radar results!

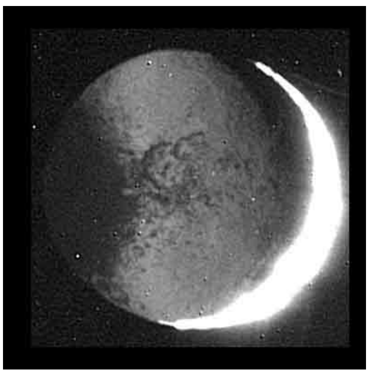
Not one ....

And that yawning, official silence -- given the literally hundreds of years that this Saturnian moon has puzzled generations of Earthbound astronomers, and after the first application of a radical new technology which might finally solve those centuries-old puzzles -- is just very, very strange ....

So -- what did Cassini actually hear on December 31 ... that would make JPL and NASA now treat the first, highly anticipated Cassini RADAR observations of Iapetus as if they never even happened?

During the 2002 and 2003 Arecibo radar efforts, Black's et al. observations of the trailing side only spanned three days – from January 8th to January 10th; their 2003 radar data on the mysteriously dark, leading hemisphere only two .... This meant that, because of its long, 79-day orbit around Saturn, Iapetus only rotated synchronously on its axis – relative to the incoming Arecibo radar signal – by a maximum of just under ~14 degrees during the 2002 observations. And only about 9 degrees during the observations in 2003 ....

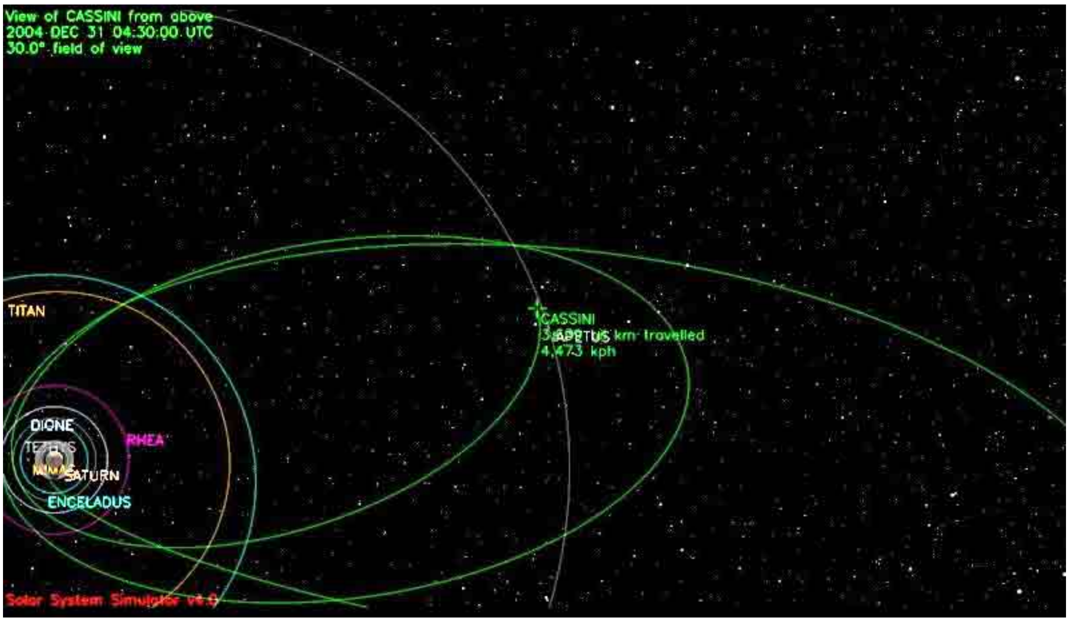
Given a minimum of 14 straight-edged facets completely around Iapetus from the October Cassini imaging data (count the outer edges - below), this implies about a 26-degree angle between each facet. Thus, the odds are that during the Arecibo observations in 2002/2003, the radar reflections – even over a three-day rotation of the moon -- were not directed "normal" (90 degrees) to any individual facet's surface. This, as we noted earlier, would elegantly explain why the signal seemed to be so "anomalously" weak: most of the signal [apart from that reflected ("scattered") by random craters on this ancient, battered surface ...] was actually being geometrically, "stealthily," reflected away from Arecibo ... into deep space.



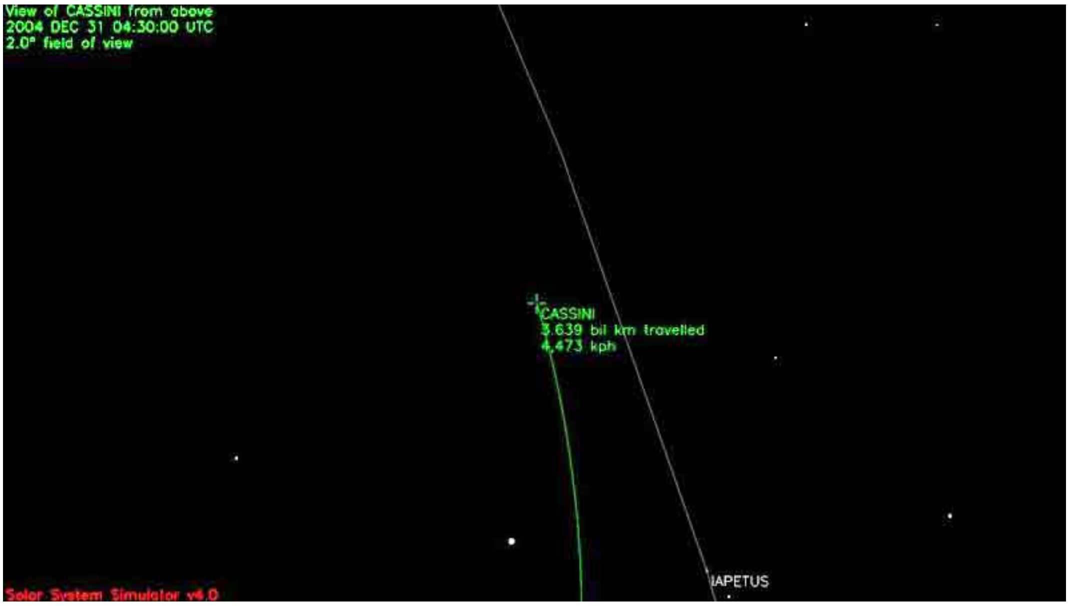
But, what about the recent, much closer (less than ~ 200,000-mile) Iapetus' radar echoes from Cassini?

Let's begin (again, courtesy of JPL's Solar System Simulator) by looking at the polar geometry of that encounter.

Here (below) is a simulated view, seen from above the north pole of Saturn (as well as the orbits of all the regular Saturnian moons, including Iapetus -- the outer, grey semi-circle). Cassini's trajectory around Saturn since it arrived in mid-2004, ending January 1, 2005, is marked in green. (On this scale, the Sun and Earth are about 150 feet beyond the image, top).

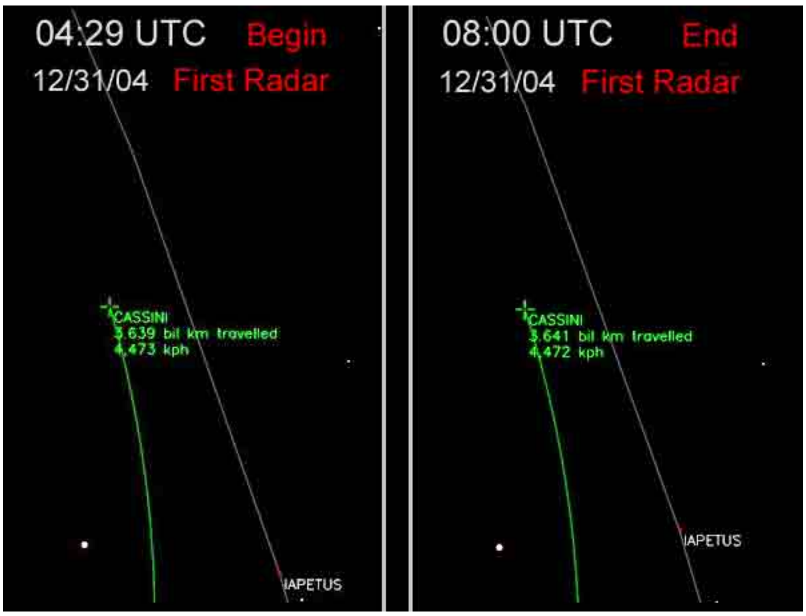


As you can now see in this closer view (below), the spacecraft started out "ahead" of Iapetus the night of December 31 (the "moon" moving along its own orbit, counterclockwise, upward), as the first Cassini radar sequence in the timeline was to begin: 04:29 UTC. This meant, of course, that the first Cassini radar ever from the mysterious object called "Iapetus" ... would be of the leading, almost coal-black hemisphere ....



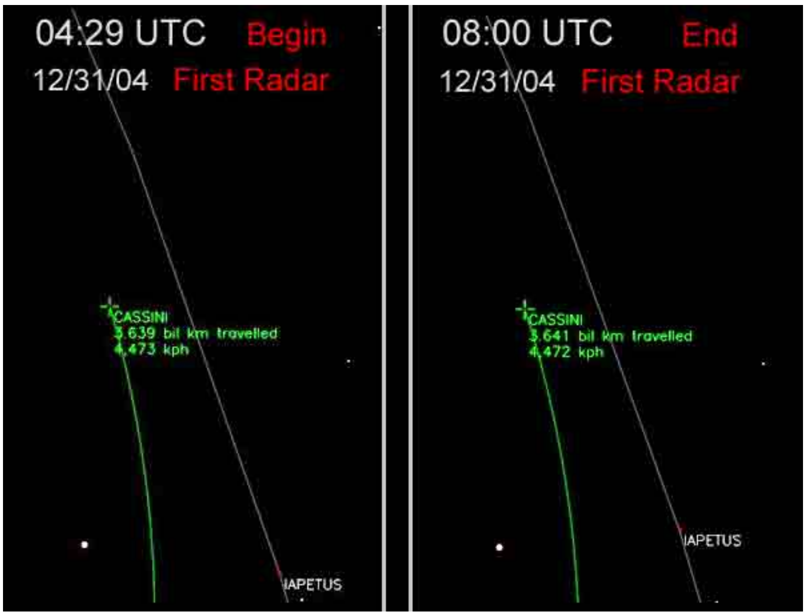
This first Cassini "scatterometry" radar sequence was supposed to last 3.5 hours.

In that time, as you can see in these two new close-up Simulator views (below), Iapetus was overtaking Cassini as they both orbited Saturn, the two bodies almost approaching each other, head on. So, the transmission angle between the spacecraft and the mysterious, dark hemisphere of Iapetus – but, in fact, the one with the amazing "Wall" -- changed very little during these first planned radar echoes -- only by about 2 degrees in that entire three and one half hours – far less than the 2002/2003 Arecibo radar observations.



The second Cassini opportunity for dedicated radar observations of Iapetus (again, according to the published timeline cited earlier), was to occur on January 1, 2005 – some ~20 hours after spacecraft Closest Approach – at 15:00 UTC (below). This scatterometry sequence was to be of the far brighter (visually) trailing hemisphere, and to last much longer than the first … ending at 23:45 UTC – for a total second radar observation period of almost 9 consecutive hours.

In that time (below), the changing spacecraft angle with respect to Iapetus' far brighter hemisphere (visually), the one with the now known "facets" (!), was considerably larger – some 15 degrees – comparable with the earlier Arecibo observations. At the same time, Iapetus' own sidereal rotation (relative to the stars) amounted to about one additional degree of angle change ….



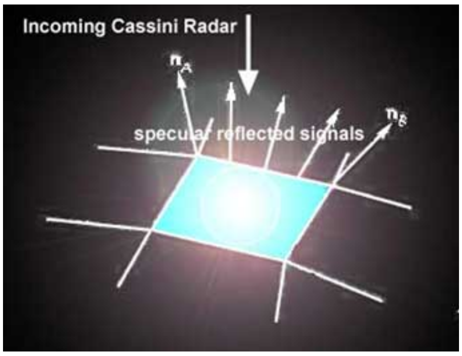
So, what am I getting at?

Because of its MUCH closer encounter distance (thus, significantly greater signal strength and much lower noise than Arecibo …), coupled with a long period of continuous radar observations, and the relatively large angle-change during this second radar acquisition, it's possible (in fact, more than likely …) that Cassini observed a dramatic, sudden INCREASE in received signal strength … as this first radar program on Iapetus was being automatically executed by the spacecraft.

This would have occurred as one of Iapetus' "flat panels" -- because of the "moon's" rotation, coupled with the spacecraft's motion -- approached ~ 90 degrees … relative to the receding NASA spacecraft radar.

If that happened, Iapetus' surface would have suddenly "lit up" with an enormous burst of energy from Cassini's outgoing radar signal -- reflected directly back toward the receding spacecraft, making it appear as if the moon's "cross section" had suddenly expanded by a hundred (or more) times!

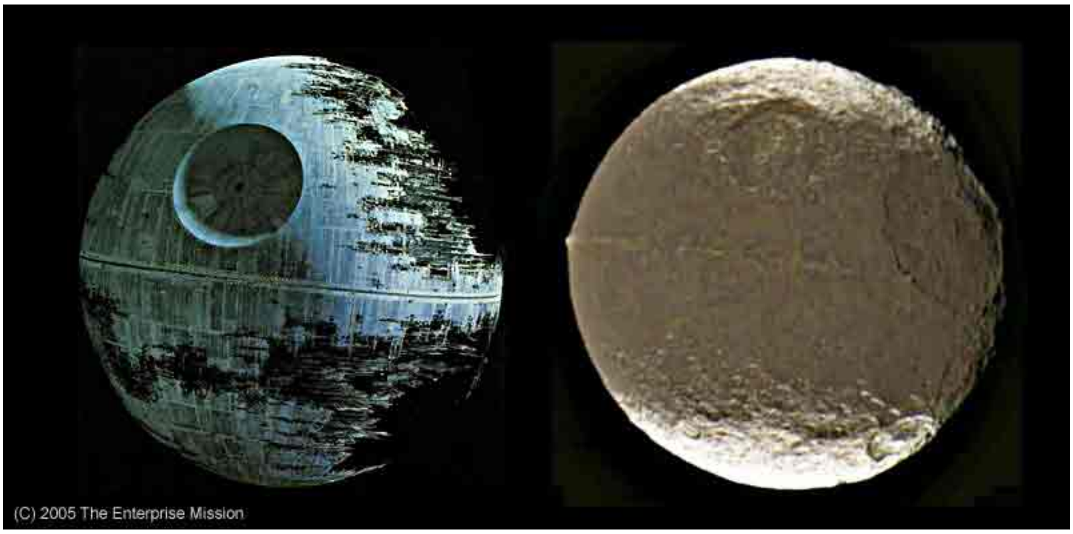
This "faceted return" (simulation – below) would certainly not have been consistent with ANY natural planetary radar explanation ....



Given that the folks at JPL are fully as capable as we are of putting this together, is it possible that this Cassini close-in Iapetus radar return was SO anomalous, that it was correctly analyzed ... for what it was ... within the first few hours of being received at JPL: the radar detection of an entire, artificial moon -- explicitly designed according to Professor Ufimtsev's cutting-edge electromagnetic theories?!

And that soon, "someone" – much higher up in government than JPL (or even NASA) – after seeing this definitive, highly anomalous radar data ... on a place with "hundred-mile-long-edges!" quietly issued a "gag order" on this entire "Iapetus intelligence experiment" ... in consonance with "Brookings?!

Because they too were beginning to suspect that this--



Is now much more than "mere coincidence?"

Stay tuned.