Methane: The linchpin in the AF447 tragedy?

Cesare Marchetti
International Institute for Applied Systems Analysis
Laxenburg, Austria

Jesse H. Ausubel
The Rockefeller University, New York City

23 June 2009

The best minds and experienced persons have pondered the problem of the Air France 447 accident of 1 June 2009. As far as we know from published material, a self-consistent interpretation of the facts is still lacking. Hope persists that the discovery of the black boxes will make everything clear, a slender hope in our view, as the explanation may require a change of paradigm for which the aviation world is not prepared.

To tell the story from the beginning, we recall Thomas Gold, a physicist of great imagination and intellectual freedom and recently the subject of a Public Broadcasting System documentary, Renegade Genius . In latter part of his career the director of Cornell University's Astrophysical Institute, Gold searched for material balances of the planets. Gold found that Earth's atmosphere was surprisingly poor in oxygen. Pinpointing the cause, Gold offered the hypothesis that a reductant had been produced in vast amounts by Earth's mantle. It could have been methane, as some of the meteorites that accreted to form Earth some billions of years ago, the chondrites, are relatively rich in carbon, which in many situations in the depths of Earth could produce methane.

A simple example is that of diamonds, which grow from methane at a depth of 200 km more or less. But at the surface of Earth methane can be found everywhere, if in small quantities, and its isotopic composition can show it is not of organic origin. Because rocks can be oxidizing, Gold asked what may happen to percolating methane and found that at any depth life took possession of this source of energy anytime it could extract oxidants from the surrounding rocks. As scientists now progressively discover deep life, Earth's deep hot biosphere beats the surface life in

quantity and resilience.

The methane outgassing can be considered at a micro scale, as the fluxes are limited and often diffuse, even if the total amounts over the eons can be huge. Offshore of Norway, in the deep sea, mountains built by corals that never saw light feed on microorganisms feeding on seeping methane.

However, if methane collects into big bubbles underground, it can produce big effects. Among the very theatrical are mud volcanoes, which can be found in many places. The most showy are perhaps those located along the west of the Caspian Sea. A single eruption can throw in the air million of tons of methane. The billions of cubic meters sometime catch fire and sometimes not, in which case they remain more or less invisible. Methane has half the density of air and rises violently, with plumes as high as 30,000 meters. Lacking humidity that provides condensation heat, it also cools violently. A plume can be kilometers wide. The dimensions and the extremely low temperatures make them visible with satellites, if one is ready to search for them. (A bubble expands rapidly and should be very cold, producing condensation at its borders with the air; these circle-shades may be seen in satellite pictures, as their size can be some cubic kilometers.)

In 2000, after several crashes, Gold made the connection between methane plumes and unexplained aircraft accidents (see attached). An aircraft entering into such a plume is basically lost. The low density of methane makes the pitot tubes useless and the lift on the wings insufficient to keep the plane aloft. Moreover, the engines can shut off for lack of oxygen, and the wild lift can carry the plane up or down. Pilots and computers are upset by the inconsistency of the signals and are not instructed to react properly. In such a situation the pilot of the Egypt Air Flight 990 which crashed near Nantucket Island on 31 October 1999, presumably by entering a methane cloud, said appropriately “I rely on God.” Faith didn’t work, and after 30 seconds the plane was lost.

A valuable strategy for flight AF 447 would be to search for methane in all recovered pieces of the plane (and perhaps even in the dead bodies). Methane would enter the ventilation ducts, and even at concentrations that permit breathing it can explode in soft and hard ways that could split the fuselage and finally destroy the plane. Up to a point “organic” methane can be distinguished from the abiogenic by carbon isotopic analysis. Extra methane in the stratosphere could also be an indicator, if any satellites were appropriately positioned at the time of the crash.

Another hint may come from visual examination of wreckage. If the gas is, say, 5% of the air, a flame can ignite the mixture that blows with a puff, which could be strong enough to splinter the shell of a plane, but, being relatively cold, does not leave the burnish of an explosion.

Incidentally, the important crashes attributed by Gold to methane clouds are on the western Atlantic ocean border up to Canada. The place where AF 447 crashed is above an intricate side branch of the mid-Atlantic ridge, an area of intense tectonic activity.

A natural phenomenon that may pose a severe aircraft hazard?

Thomas Gold
Professor Emeritus
Cornell University
Ithaca NY 14853-6801

October 2000

There have been many serious aircraft accidents in recent years that have not had a satisfactory explanation despite exhaustive researches, and that have certain features in common. Those features include apparently a situation of extreme urgency and danger, so that there was no time for the flight crew to communicate details to the flight controllers; in some cases there were circumstances that seemed quite unexpected and perplexing to the flight crew, suggesting an urgent need to override the usual automated control systems and manually put the plane into a steep dive. In several cases this was followed by actions to avoid excessive speed that would threaten the structural integrity of the aircraft. Several accidents have another feature in common: they occurred along the edge of the North-Eastern American continental shelf. These include, among others, TW 800 on July 17, 1996, Swissair 111 on September 2, 1998, Egypt Air 990 on October 1999, and also the crash of J. F. Kennedy Jr. The case of the EgyptAir crash has recently come under public debate again as some new information has become known, and the explanation tentatively offered by the National Transportation Safety Board (NTSB), suggesting a suicide attempt by a co-pilot, has come under strong attack by Egyptian authorities, and does not fit with the new information.

In view of the statistically quite improbable occurrence of these accidents, it seems prudent now to widen the search to causes that have so far not been included among possible aircraft hazards, and that have possibly a relationship to geographical features. Among such, the massive emission of gases from the seafloor (or land surface) seems to us most worthy of attention.

Massive sudden eruptions of gases have occurred in many locations, bursting up through the ground both from ocean floors and from dry land. They often occur repetitively in the same area, and on land create what is known as "mud volcanoes". The amounts of expelled material accumulated in some mud volcanoes in the last million years are as large as 10 or 20 billion tons, and the estimates of the amounts of gas responsible are several times larger than that. The erupting gases are usually dominated by methane. Since methane is lighter than air, it races upwards at high speed. Many cases are known where the gas spontaneously ignited, and flames to a height of 6,000 ft have been photographed from Baku, in the active mud volcano area on the West shore of the Caspian Sea. Much higher brief flashes have been reported, up to 30,000 ft but these were too brief to be photographed. Massive flammable gas eruptions at or near times of earthquakes (before, during or after) are reported in historical and in recent times from many parts of the world.

Similar eruptions are indicated on the sea floors, where large areas are densely covered with "pockmarks", quite characteristic circular features in the ocean mud, with diameters of between 10 and 200 meters. These features were first detected in the North Sea by Dr. Martin Hovland, of Statoil, (the Norwegian oil company), overlying known gas and oil fields. Similar fields have since been detected in many parts of the world by sonar, again often showing a relation to underlying hydrocarbon fields, and also there showing features of repetition of outbursts, with methane again the major component. Both in mud volcanoes and in pockmark fields the emitted quantities of gas

in any single event may well amount to some millions of tons.

Another set of observations has now to be added: it is the occurrence of "mystery clouds" in the air. Satellite photography over a ten year period revealed more than two hundred clouds that rose up at a high speed from a small area of land or sea, forming an expanding funnel. Temperature observations showed a much lower temperature in the funnel cloud than in the outside air at the same height, and this implied that the rising gas must be one that is intrinsically much lighter than air. Only methane and hydrogen are candidates, and both are combustible. The largest such cloud on record was seen and reported by several airline pilots flying between Tokyo and Alaska, North-East of Japan, on April 9, 1984. They described it as a mushroom cloud that reached up to 50,000 ft, attaining a diameter of more than 200 miles.

Evidence of massive gas emissions have recently been reported by the Woods Hole Oceanographic Institute, who conducted a sonar survey of the mid-Atlantic US continental shelf edge. Along a major fault line they found many and very large pockmarks, similar to those described by Dr. Hovland, indicating that sudden almost explosive gas eruptions had taken place there. Also recent reports from the Province of Quebec, of frequent and large displays of lights in the sky, clearly related to the swarm of earthquakes between November 1988 and end of January 1989 in the region of Sanguenay and Quebec City, leave little doubt that massive gas eruptions occurred there, with some flames reaching high into the sky. Altogether 46 such sightings were recorded in that period, some but not all coincident with earthquake shocks. Earthquake-related lights have been well known and reported since antiquity, and indeed one very large event involving gas flames was reported in 1663, not far from the Sanguenay region, close to the St.Lawrence River.

I had investigated in 1982 a "near disaster" of a British Airways 747 plane flying at 37,000 ft over a volcanic region of Java. All four engines stopped shortly after it had entered a visible but tenuous volcanic cloud. After gliding down to 15,000 ft without power, and there apparently leaving the cloud, all engines could be started again immediately. The same sequence of events was experienced two weeks later by an Air Singapore 747 plane over a nearby region, and many years later by a KLM flight over the Aleutian Islands. A gas lighter than air, and hence combustible, must have been responsible in all three cases, to have carried small volcanic dust grains to these altitudes, and its combustion may have been responsible for the engine failures that were so sharply limited to the flight within the cloud, probably due to the fuel- rich and oxygen poor mixtures of the gas adding to the airplane fuel. Gas eruptions of volcanoes are known of either kind: eruptions of a ground-hugging heavy gas identified as carbon dioxide, but also eruptions of a light and flammable gas, probably methane, whose density is a little more than half that of air.

With three large planes having come so close to disaster, but yet able to give a precise account of the events, one has to take the threat of gas emission seriously. The belief that such emissions can come only from volcanoes has been voiced, but is clearly wrong in view of the facts already mentioned. What threats would massive gas emissions pose for aircraft?

One effect I have already described: the possibility of inducing failure of all engines. But several other aircraft hazards have also to be considered. One is due to the great upward speed the light gases would have, greatly in excess of the vertical speeds in ordinary atmospheric turbulence, and structural damage to the plane or serious injuries to persons may result from the ensuing violent vertical movement. The ignition and explosion of a large mass of gas external to the plane may be initiated by the engine exhausts and may be violently destructive, yet the recovered airplane skin would not show the shrapnel holes that would be the usual signs of explosions.

Other consequences of gas emissions are the dangerous and misleading indications that the flight

instruments would provide. Air speed indicators and air pressure altimeters would give quite false and fluctuating readings. The autopilots, programmed for air, may have totally erroneous responses in the light gas, as indeed may the pilots themselves, who would be perplexed by a situation they had never encountered or contemplated before.

A further hazard is that clouds of low density gas may not support a plane, even at a flying speed that would be amply high enough in air. This would cause a stall of the aircraft, or be preceded by automatic stall-warning that requires the pilot to turn the nose down into a dive, and then confront the danger of excessive speed.

Then there are the various fire hazards resulting from combustible air-gas mixtures, especially in some confined spaces in the airplane where flames could be supported, even if the same gas-air mixture would readily be extinguished in the external high speed airflow. That danger may be highest in cable ducts where damage could destroy the airplane control system.

The North-Eastern coastline or edge of the continental shelf of the US and Canada, is the northward continuation of the line whose investigation I have already mentioned. This extension also has a history of earthquakes and gas emission from sand beaches and water surfaces beyond the shoreline. Such emissions had not ceased around the times of the aircraft disasters. A large number of reports were phoned in to police and emergency services in New Brunswick and Nova Scotia on October 27, about three days before the Egypt Air crash, stating that at 9:30 p.m. a large fireball had been seen streaking across the night sky. The details reported did not correspond to a meteorite, but included reports of flames and events much slower than those caused by meteors. A peak in the number of reports recorded prior to an event must be taken seriously, if the number greatly exceeds the number on other days, as was the case here. There were similar reports also before and after the TW 800 crash. There was also a report from Swiss Air 111 of a strange smell about three minutes before the declaration of emergency. This is particularly suggestive of gas effects, as a similar report was made in one of the near accidents over Java, where gas certainly was involved.

We may then wish to investigate whether some features of aircraft disasters along this region, the four disasters mentioned and several others that have also occurred along this corridor, could have an explanation in terms of the list of hazards I have mentioned, or others that have not yet been considered, that could be attributed to gas eruptions.

Mr. Jack Reed retired from the Sandia National Laboratory, an expert in sound propagation, has noted that the "loud" boom heard by many eye witnesses at the time of the TW 800 crash on a 25 mile stretch of Long Island, nearest point to the plane 15 miles away, was far too loud to have been caused by the proposed explosion of the empty central fuel tank. In his view a one ton bomb of TNT would have been the least required to make such a sound at that distance. Nor would such an explosion have caused the various external luminous phenomena that have been reported by many. Also it is doubtful that an explosion of such a small amount of fuel vapor could have had the power to tear off the entire front section of the fuselage. The absence of shrapnel holes in the recovered skin of TW 800 was taken to exclude a bomb explosion inside or outside the plane. However, a massive external gas explosion would produce no shrapnel.

The facts newly announced about the EgyptAir disaster make clear that a deliberate dive had seemed imperative to the pilot then at the controls, and that a dangerous overspeed situation had then arisen. After a brief recovery to level flight, again a dive seemed imperative, and the overspeed may then have destroyed the plane..

There are many steps that can be taken to find whether the sequence of disasters along this heavily traveled corridor may be due to gas emissions. As an immediate step I urge the continuation of the

sonar search for pockmarks on the ocean floor along this coastline in the regions of the four disasters mentioned and others that occurred near this geographical line, since this will have a good chance of showing whether these accidents were indeed over locations at which strong gas outbursts had occurred. A routing change may then be indicated as the first step to avoid further disasters.

Further considerations on methane outgassing and the AF 447 disaster

29 Sept 2009 notes Cesare Marchetti & Jesse Ausubel

Tsunamis are the subject of much scientific study and literature. Because tsunamis are often associated with earthquakes, the prevailing wisdom assumes that the movement of the water is generated by the movement of the ocean bottom. The raised water producing a tsunami can now be calculated with fair precision, since satellite and oceanic measurements provide the basic data. In a quantitative study the late Cornell University Professor Thomas Gold showed, however, that the intuitive interpretation of the sea bottom moving during the earthquake and giving the push does not give a satisfactory explanation because the vertical displacement of the sea bottom should be hundreds of meters, while actual ones are measured in some meters.

The mechanism to displace such huge masses of water implies the presence of a big bubble of gas expanding with the declining pressures corresponding to the trip from the sea bottom to the atmosphere. Gold calculated the size of the bubble that corresponds to the water displaced in a large tsunami and found billions of cubic meters. Emissions of this size in short times can be found on land, for example, from the mud volcanoes that occasionally pop up west of the Caspian Sea. The gas emitted is basically methane and produces gargantuan flames.

The existence of tsunamis without a corresponding earthquake encourage examination of the validity of a model centered on outgassing. Mud volcanoes usually are not associated with earthquakes.

Methane outgassing events may leave traces on the seafloor in form of pockmarks, a form of volcanic crater with comparable diameter. In the flat and sandy North Sea the pockmarks appear clearly to sonar because methane that keeps trickling out sustains colonies of micro-organisms and animals with shells that feed on them and form stony blocks that reflect sonar waves. Mud volcanoes on the seafloor and on land have similar dimensions, plus the pile of rubble the gas has carried up during the eruptions.

Marine life hints at large-scale outgassing in other ways. Deep in the dark Norwegian sea, a rich ground for oil and gas exploration, large coral reefs, some as high as 35 m, grow feeding on micro-organisms that may be feeding on methane seeps.

In the case of the ocean, most outgassing methane, because it is insoluble in water, will come to the surface and, if concentrated, rise as a cloud, as the density of methane is about half that of air.

The methane clouds could rise violently and become very cool as they rise very high as they would contain little of the water vapour that provides extra heat by condensation in normal thermal columns.

As the configurations are unexpected, there is no regular service of observation. Still, the methane clouds are visible from satellites because condensation at their borders cast shadows on the ground. The existence of the recorded observations comes from Gold who, as director of Cornell Radiophysics and Space Research Center, had access to materials for relevant searches.

During day the clouds may be spotted by pilots by their frenetic activity and prudently avoided. During night the situation is different, because the radars are not set to signal methane or hydrocarbons, and usually autopilots are switched on.

In fact, three disasters when contextually a methane cloud could have been the cause happened during the night. We are referring to several accidents that occurred along the edge of the North-Eastern American continental shelf. These include, among others, TW 800 on 17 July 1996, Swissair 111 on 2 September 1998, Egypt Air 990 on 31October 1999. Sediments on the continental shelf and margin contain large amounts of methane hydride that can release methane if brought in contact with relatively warm seawater as an effect of a landslide.

An airplane entering such a cloud is basically lost. The low density of methane makes the pitot tubes useless and the lift on the wings insufficient to keep the plane aloft. The engines may be shut off for lack of oxygen, and the wild lift can carry the plane up or down. Pilots and computers are upset by the inconsistency of the signals and are not instructed to react properly.

If a pilot is alert, he reacts to the apparent loss of speed and stopping of the engines due to air turning into methane by putting the plane on a dive to restart the engines and to gain speed in terms of pitot signals. When it reaches a low altitude, he tries to put the plane level and after a short while it re-enters the atmosphere at supersonic speed**, in air**, and blows up.

In this situation the pilot of the Egypt Air Flight 990 that crashed in front of Nantucket presumably by entering a methane cloud said appropriately “I rely on God.” His invocation did not work, and after 30 seconds the plane was lost.

One American committee that studied the case ended with a biased conclusion that the pilot wanted to commit suicide as he kept invoking Allah. Egyptian authorities correctly mocked this conclusion (or assumption).

Radars covered the area relevant to Flight 990 so that the trajectory of the plane is fully registered (Figure 1).

Figure 1:Flight profile of EA990

The flight profile is coherent with a plane entering a methane cloud and falling like a stone for lack of lift. The pitots give very low speed, and the pilot tries to correct it by diving, as probably the engines were stalled or had no power for lack of oxygen. The black box recorded the captain asking, "What is this? What is this? Did you shut the engine(s)?"

The US National Transportation Safety Board report never mentions methane, and reaches no conclusion about the causes of the accident. Methane clouds have still not penetrated aviation culture, although, as said before, they are relatively frequent and observable from satellites.

These large emissions require particular conditions and, as suggested above, relate to plate tectonics and earthquakes in the ocean floor as well as landslides. A zone of particular activity is the Rift, a sort of volcanic chain surrounding the continents and providing the primary mover for their migration. A Rift chain goes from Iceland down under the South Africa tip. This Rift is the site of numerous earthquakes of considerable magnitude, 4 to7, tending to occur in sequence along the Rift.

AF 447 disappeared precisely where a Rift bends eastward to follow the shape of Africa and where the sea bottom is particularly rugged due to transversal fractures to accommodate differences in shear movements shown well in Figures 2 and 3.

An earthquake of magnitude 4.7 occurred on the central Mid-Atlantic Ridge within 100-200 miles of where AF 447 was last contacted. It occurred on 2009 05 31 0047:02 UTC 4.52N 32.56W at a depth of 170 km.

The following information appears in a blog where the webmaster comments: *I will print the comment but nothing further will be posted on geological factors; there are probably other websites that cover that in better detail.*

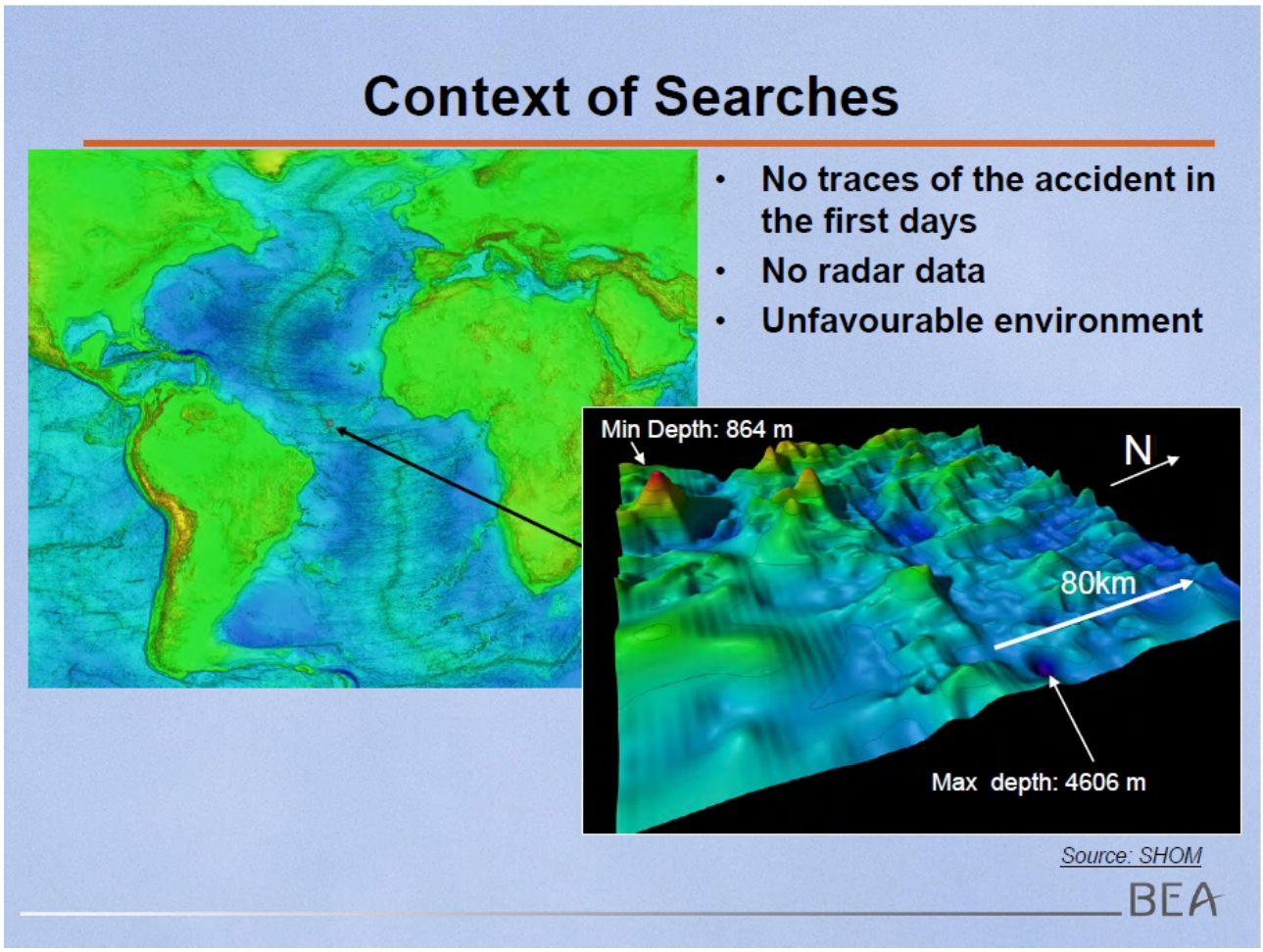


Figure 2

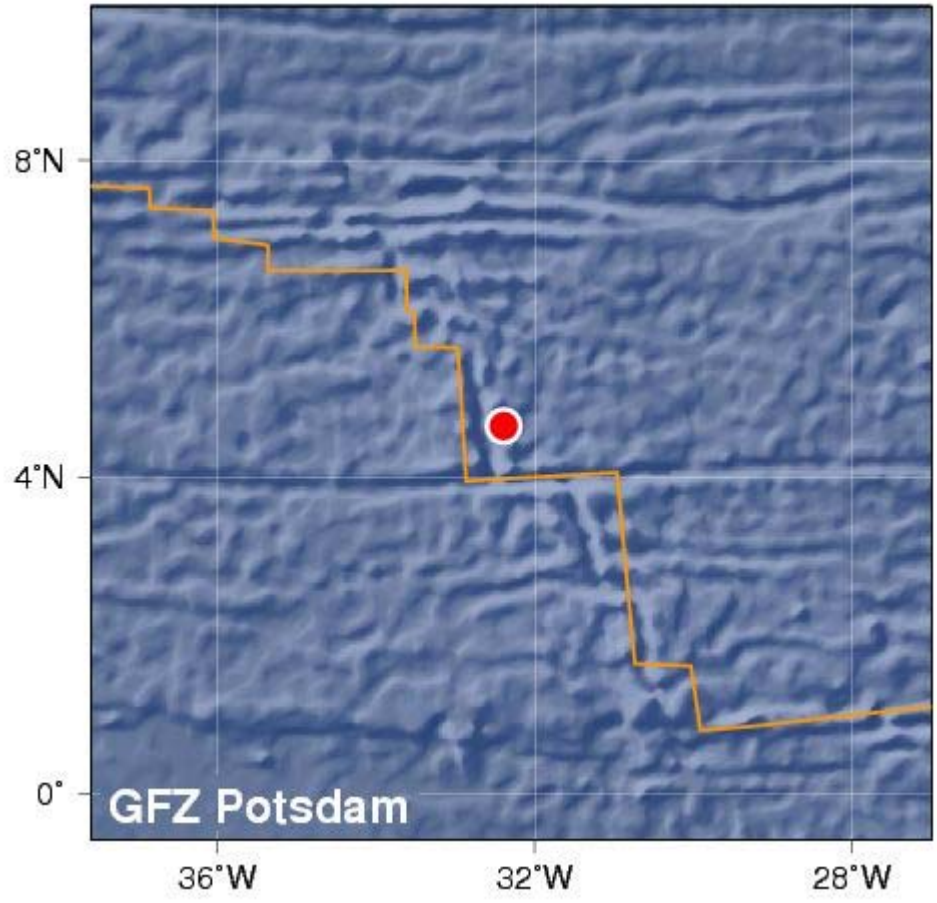
GFZ Potsdam
>> *GEOFON*
>> *Global*

Figure 3

Seismic Monitor

GFZ Potsdam - Earthquake Bulletin

Region: **Central Mid Atlantic Ridge**
Time: **2009-05-31 00:47:26.1 UTC**
Magnitude: **4.5**
Epicenter: **32.39°W 4.65°N**
Depth: **176 km**
Status: **automatic**



Disclaimer: Unless revised by a geophysicist, automatically determined earthquake locations may be erroneous!

Show epicenter location in Google Maps

List of phase arrivals

This is a product of the GEOFON Extended Virtual Network (GEVN) and credit belongs to all involved institutions. This page is also suitable for display on handheld devices.

Figure 4

While the location of the earthquake coincides with the area where AF 447 crashed, it is very important that the earthquake occurred at a depth of 176 km where the materials are sufficiently plastic to dissipate strains with a continuous motion without jerks. Gold studied the problem and found that an apparent rigidity can occur if the rock is mixed with a fluid such as supercritical methane, in our case at a pressure of around 50 000 atm. To help visualize the situation, recall that an egg white is liquid, but beaten with air rises to a sort of solid.

Vertical motion of the gas is possible if the pores start connecting and the gradient of pressure empties the lower pores and fills the upper ones. The process can reach a catastrophic speed and generate an earthquake. Once started, bubbles that may contain a billion tons of methane rise to the surface and produce a cloud. As said before, tsunamis would be generated by these clouds, and their size permits estimating the size of the emission. As Gold says:

> An estimate of the wave volume and hence of the gas masses involved can be made for tsunamis. Taking the observed period, the wave propagation velocity and the total wave energy quoted by Iida (1963) for the largest event recorded in 70 years (Sanriku, March 3, 1933), we obtain a volume of the order of $10^{12} m^3$ and hence a gas mass of the order of 10^9 tons. (For all other events the figures would be lower

For purposes of AF 447 and other unexplained air accidents, a bubble with a few million tons of methane might suffice.

In any case, one might hypothesize that a tsunami, a weak one, started from the area of the rift on the day of active volcanism and that subsequently methane, perhaps a few billion m3, reached the atmosphere, but stations measuring it in the atmosphere are sparse and perhaps not sensitive enough to feel the pulse.

While the pieces of the puzzle seem to fit, more direct proofs could be sought and obtained. Methane flowing from the sea floor into the ocean uses up the dissolved oxygen in the deep water and promotes mixing of the deep water with surface water. Important changes in ocean color might ensue, and in the case of AF 447 could perhaps have been observed by satellites on June 2 and the following week.

Fish and other marine animals would also die of suffocation and perhaps a change in the spectrum of species could be observed in the area of a methane bubble

broadly speaking. Census of Marine Life scientists in 2005 found a large dead zone around the epicentre of the Aceh Tsunami which they attributed to sediment loads but could also owe to the loss of oxygen stripped from the water by methane rising from the earthquake. http://www.telegraph.co.uk/news/uknews/1505534/Scientis ts-discover-tsunami-dead-zone.html

A plane such as AF 447 might spend ten minutes in the affected air mass or cloud, falling into an envelope of increasing pressure. Methane would penetrate all parts in contact with the atmosphere, e.g., the inside of the wings, engines, and landing gear cavities. Some porous structures may have retained some of it. Presumably the unusual air mix also entered the cabin through the ventilation and when the plane smashed open on the surface of the ocean. Evidence might be found in some of the passengers' objects with cavities, e.g., cell phones or luggage.

From the scant information about the passengers, they died through the acceleration when the plane slammed the surface of the ocean and did not drown. Debris from the plane suggest it reached the surface of the ocean intact, so passengers died from the shock; passengers still had their clothes on, so they did not experience supersonic catapulting. Cavities meriting examination may thus also include passengers' lungs. While methane could be present in the lungs for other reasons, hydrogen sulfide that often accompanies outgassing methane could strengthen the argument for outgassing as the cause of the tragedy.

Curiously, aviation and atmospheric institutions that measure and map all sorts of phenomena have yet to take up the question of methane outgassing in a serious and comprehensive way. Radars can be adapted to see the strong infrared signature of emissions of methane and other light hydrocarbons and, mounted on satellites, could produce maps of the emissions that could be ecologically important given the relatively long life of methane in the atmosphere

Mounted on aircraft, such radars might help save planes from very rare but very catastrophic events.

Yet more CM/JHA considerations:

```
a) Yellow flames

A following plane saw yellow flames on the sea, a common sight
when methane bubbles.

CNN:
Two pilots of an Air Comet flight from Lima to Lisbon saw a
bright flash of light in the area where Flight 447 went down, the
Madrid-based airline told CNN. The pilots have turned in their
report to authorities.

"Suddenly, we saw in the distance a strong and intense flash of
white light, which followed a descending and vertical trajectory
```

and which broke up in six seconds," the captain wrote in the report.

Our comment: No object can fall so fast; it might have been a meteorite.

"There is information that the pilot of a TAM aircraft saw several orange points on the ocean while flying over the region," he said.

Our comment: Orange points could be gas leaks but the question is where they were. The flames could be fuel. Gold reported that, when the planes he studied disappeared, there were reports of flames in the sky in the region. In the stories recounted by Gold, flames in the sky precede and follow one of the accidents near the US East coast, and, reported to the police, they were yellow and orange. The flares of oil fields are also yellow and orange.

b) Champagne glass speculation
blogger entry (not written by Marchetti/Ausubel)
http://www.weathergraphics.com/tim/af447/comments.shtml
"Tue, 9 Jun 2009 16:10:46 -0700 (PDT)
There was an earthquake of Magnitude 4.7 on the Central Mid Atlantic Ridge with 100-200 miles of where flight 447 was last contacted. It occurred on 2009 05 31 0047:02 UTC 4.52N 32.56W at a depth of 10 km. (You can find the map up under recent earthquakes).

The quake occurred on the East edge of a major plate boundary and could have triggered an undersea landslide, forcing crystallized methane up out of the trench where it would turn gaseous due to the decrease in pressure and increase in temperature. The methane gas would then bubble to the ocean surface.

There is a theory that methane bubbles are the answer to the mystery of the Bermuda Triangle . When a plane or ship encounters a methane bubble a plane could lose its lift and fall from the sky or a ship could fall into the bubble to then have the ocean swamp back over sinking it.

Typically a plane flying at 35,000 ft would not have to worry about this, since the methane would be well dispersed at that height. Given the storm conditions described on your website on the morning of 1 June 09, there could have been an effect like an upside down Champaign [sic] glass. The storm could gather the methane bubbles from a large area of the ocean surface, swirl them into the center and up the shaft to emerge at the cloud tops at around 35,000 to 40,000 feet in a concentrated amount. A plane hitting a methane rich environment could lose its lift and/or have its engines stall due to oxygen deficiency. Either condition would cause the plane to tumble out of control down into the dense cloud tops and turbulence, where the plane would experience structural failure due to the stresses.

I first deduced this as a possibility, then researched to see if there were any earthquakes in the region during this time period. Since I don't have any knowledge of the timeline regarding methane migration due to displacement, and the time it takes to turn gaseous, I don't know if this was a possible cause of flight AF 447's loss since the quake occurred a day before.

I am writing you due to your interest in this tragedy and you may know about oceanic methane bubbles or know where to direct this theory for consideration." G. R… Y….

CM/JHA comment: The position of the plane as indicated by the ACARS (Aircraft Communication And Reporting System) is slightly different from the position of the earthquake. However, the rising of a swarm of bubbles is not necessarily vertical and the plane was moving after the ACARS final information. Also, the quake was 176 km under the crust, so the precision is not absolute, and the plume coming up was also not necessarily vertical.

c) Could bubbles reach high in the atmosphere?

Is the mid-Atlantic far too deep for methane bubbles to reach the surface, let alone the atmosphere at 10 km high?

We think it is possible. The sea floor at 4000 meters means 400 atmospheres pressure. Gas drillers such as GHK Inc. find methane above 1200 atm (from memory). With an extra 800 atm, the methane could blow like a gun.
An origination 176 km deep makes 50,o00 atm taking into account that some of the depth is water, so the emerging gas rocket could blow upward very fast, a fast hot very high pressure configuration moving upward.

Perhaps the word bubble is not helpful; cloud or jet would be more dynamic. Let's use methane cloud. If the methane was originally at 176 km and about 50 000 atm, preoccupation about bubbling on the bottom of the ocean appears ridiculous. Incidentally, the depth of the ocean in Mid-Atlantic Ridge region is very variable, and the cloud could have escaped at shallow water depth. The absence of a tsunami argues for a relatively shallow escape.

d) Almost simultaneous engine explosions?

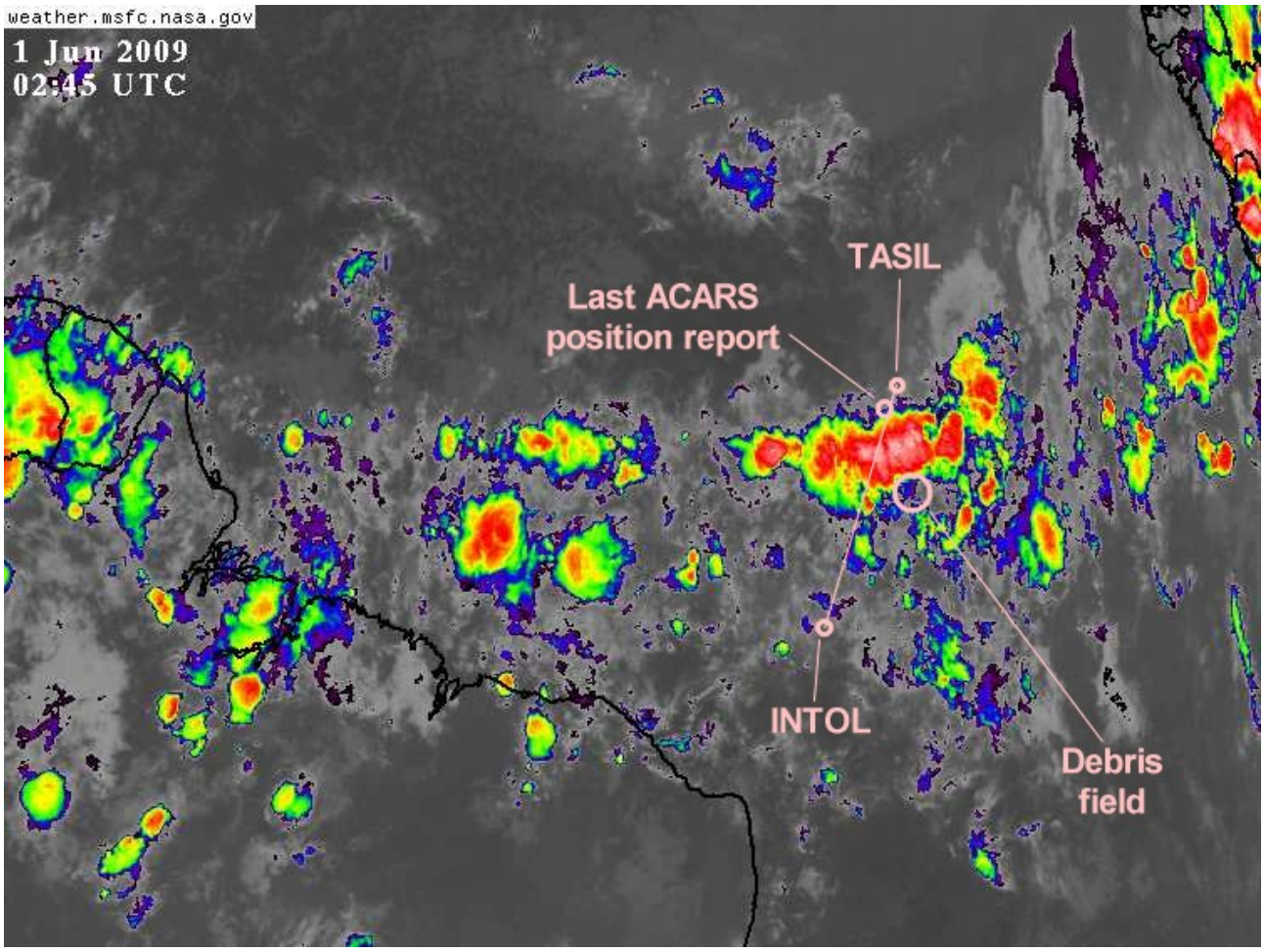
Details of the automatic messages sent in the last minutes of contacts may allow other details to be reconstructed. The last signal by ACARS was about a loss of pressure in the cabin. No signal came afterwards, presumably due to loss of electric power. If tongues of methane are inhaled by the engines, the fine balance of fuel and air to keep the temperature of the turbine to the maximum feasible level is lost. The turbine overheats and probably over-speeds. If the engine then explodes, blades may fly away and perforate the cabin leading to a loss of pressurization. Electric generators in front of the engines are destroyed when the engine blows up. But, if there is a small delay between the explosions of the two engines, power may be available to transmit the ACARS message for the first accident. When the second engine explodes, ACARS will stop unless the Ram Air Turbine (RAT) system for emergency power functions, which would require functioning of a number of things and a certain integrity of the wing where it is located, conditions improbable if both engines have exploded.

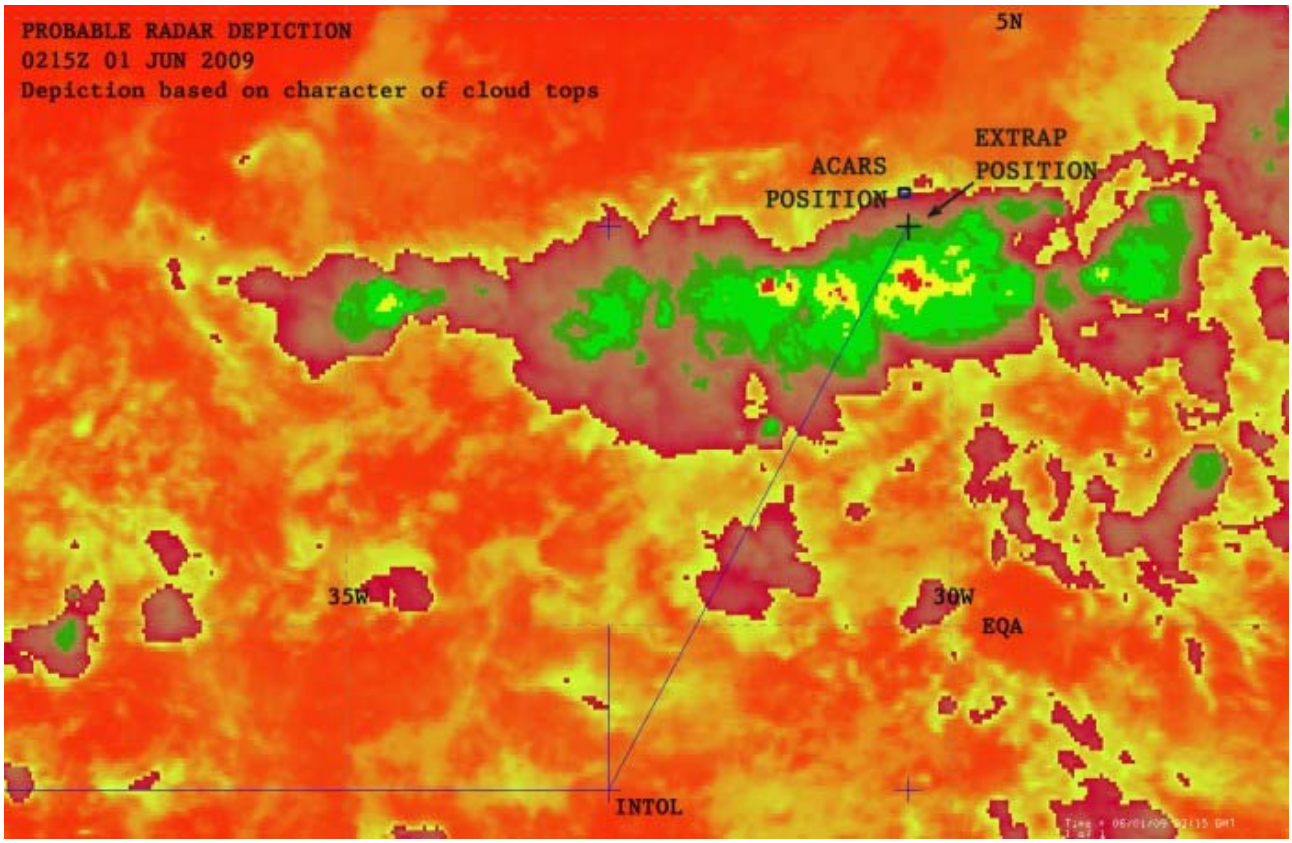
e) Where the crisis occurred – the role of the thermals

The plane fell after crossing the thermals even if the debris have been found south of the location, as the images pasted below show.
http://www.cloudsat.cira.colostate.edu/quicklook_images_remote/1A-AUX/1A-AUX.R04/2009/152/2009152022319_16452_CS_1A-AUX_GRANULE_P_R04_E00_1AA_small.png

The white spots at the top of the thermal in the first image should be very cold and could be rising methane plumes.

In any case, the plane fell after crossing the thermals.





f) Why have the plane and its black boxes not been found?

A possible explanation is that a methane burp lifted a mountain of mud that finally settled over the plane.

One might check whether any victims have mud in their ears, although the lifted sediments might not have reached the surface.

g) Centrifugal explosion?

The possible explosion of the engines by centrifugal forces is very important because it is testimony of the presence of methane in air. When an engine explodes, the blades fly out and perforate the cabin. The perforation of the cabin leads to a loss of pressurization, and the ACARS said that, if one engine blows due to methane, almost inevitably the other one blows. The silence of the ACARS may hint that methane was present.

Reportedly, part of engine was recovered, and it may provide relevant evidence.

On 28 September the program Voyager of Radio Televisione Italiana (RAI) aired a long segment on the Bermuda Triangle attributing to methane from hydrides the primary cause of perhaps 50 disappearances. The documentation appeared impressive. A strange thing is that none of the objects that disappeared has been found, dead bodies included. Perhaps the mud raised by the outgassing has settled back on the sunken objects, sealing them in the bottom.

The show also showed big pockmarks at the bottom of the ocean, suggesting that probably the emissions came from deep below, not from near-surface hydrates in the mud.

From the last radio communications of the few that could make them, the people were disoriented and so apparently were their instruments, e.g., the compasses. People could have been poisoned, but it is curious about the compasses - perhaps the people could not read them correctly.

The show mentioned the AF447 crash at the beginning but finally did not investigate it.