

# 21<sup>st</sup> CENTURY SCIENCE & TECHNOLOGY

WINTER 2010/2011

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- Radio Frequency Emission from DNA
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# 21<sup>st</sup> CENTURY SCIENCE & TECHNOLOGY

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## SCIENCE AND MORALITY

# Celebrating Robert J. Moon at 100

There is much to celebrate about the life of Dr. Robert J. Moon (1911-1989), who would have been 100 years old on Feb. 14, 2011. Many of our readers are familiar with Moon and the extraordinary impact the work of this creative scientist had in the Manhattan Project, in physics, in biology, and in the education of young scientists and others, including the editors of *21st Century*. A just released 45-minute video with Oyang Teng and Laurence Hecht ([larouchepac.com/node/17501](http://larouchepac.com/node/17501)) presents some highlights of Moon's impact, and a Fall 2004 special issue of *21st Century* covered in depth his life and work.\*

In today's largely anti-science and materialist world, where the qualities that Moon exemplified are in short supply, it is important that Moon and what he represents be available as a model for future generations, and future scientists in particular.

Moon never sought fame or fortune as a scientist; he passionately sought the causes of phenomena and how to use his knowledge and insights to improve the conditions of life in the present, and for the future. He grew up at a time when electricity and automobiles were coming into widespread use, and as a child he explored how both of them worked, becoming a skilled electrician, auto mechanic, and experimentalist at an early age. He continued his experiments in physics and chemistry, graduating from Southwest Missouri State College in 1930.

The key to science, Moon said, is to define a problem and then develop the tools needed to tackle it, as he had. His advice to college students was not to get

dependent on computers to solve problems, but to do hands-on experimentation in a laboratory. "The freedom to experiment in a laboratory is an essential part of a young scientist's education," he said. "You can't learn to be a scientist by passively taking in what someone else accomplished."

When he came to the University of Chicago in 1930, at age 19, Moon wanted to work on a new idea—controlled nuclear fusion. This put him in the Department of Physical Chemistry, working with Prof. William Draper Harkins (1873-1951), who had proposed the idea of fusion and whose work on the neutron Moon had studied. Harkins was happy to have Moon, who began working on the necessary equipment for fusion experiments (he started with building the University's first Geiger counter), and at the same time studying and discussing the new ideas coming out on particles and waves, and the connections of frequency with energy.

**Science and Optimism**

Science in this period was exciting, full of new discoveries, and optimism about the future. Scientists were not afraid to question the commonly accepted laws of physics and rewrite them as needed. During this time, Moon designed and built a 50-inch cyclotron, to accelerate charged particles. It weighed about 50 tons, and was superior to the first cyclotron, built by Ernest O. Lawrence at the University of California. He also wrote his doctoral thesis on diffraction patterns created by electrons in the surface of oleic acid, by which he was able to see the structure of liquid surfaces, and find the structure of molecules. Moon often returned in his thoughts to this early work, which applied ideas first proposed by Louis de Broglie, and would often insist that every electron commu-

\* Several articles from that issue are available at [www.21stcenturysciencetech.com/moonsubpg.html](http://www.21stcenturysciencetech.com/moonsubpg.html). The entire issue can be purchased for \$5 (\$8 foreign).

nicated with every other.

When the Manhattan Project began during World War II, Moon's cyclotron was essential as a source of neutrons for transmuting and testing materials, in particular testing the ability of graphite to slow down (moderate) the neutrons which would be used to bombard and split uranium, releasing energy in the process. It was Moon who figured out how to get the necessary purity in the graphite blocks so that they could moderate the neutron speed, and thereby accelerate the uranium fission into a chain reaction.

For Moon, the Manhattan Project days were characterized by the frequent discussions that went on, probing ideas with scientists from different disciplines, having deep conversations about the moral implications of the nuclear energy they were producing. Moon pursued this kind of theoretical and experimental probing throughout his life. He loved teaching, especially teaching others how to think deeply about an idea, simply by talking with them. And having them do the basic experiments, for example in electrodynamics, that had laid the basis for his understanding of how things work. It was his constant probing of new ideas, combined with his wide knowledge of classical physical and chemical experimentation, that gave him the ability to view space and time with increasing insight and precision.

Moon was directly involved in bringing Harry Truman the petition of scientists urging the new President not to drop the bomb (which their Manhattan Project had developed) on civilians, but to demonstrate its destructiveness on a remote island. And after the bomb was dropped, Moon made the decision to leave nuclear physics and work in other areas. He became a professor at the University of Chicago's Institute of Radiobiology and Biophysics, from where he rapidly developed several new inventions. The first, in 1949, was a radioactive measuring device, small enough to be inserted in a human heart to detect abnormalities in heart function.

Then, Moon designed and built the first scanning X-ray device, which produced superior images to standard X-rays, at 1/2,000 of the then standard dose. Subsequently, he developed this into an electron gun apparatus, that projected a



Philip Ulanowsky/EIRNS

*Dr. Moon teaching youth in a summer camp near Leesburg.*

sharp image of difficult-to-reach internal organs, like the stomach or lower intestines, onto a screen for medical diagnosis. (This was a precursor to the CT scan.) The device was also used for detecting flaws in metals, for example in nuclear reactors.

Moon also created what was called a neutron thermometer, which was designed to transform the heat of a nuclear reactor into electricity.

#### **Work with the LaRouche Movement**

In the early 1970s, Moon began to collaborate in Chicago with the political movement of Lyndon LaRouche. He ran for the post of alderman in Chicago, participated in national conferences, taught classes, and, in 1974 was a founding member of the Fusion Energy Foundation in New York City. He also served as an advisory editor to the Foundation's *Fusion* magazine, the predecessor of *21st Century*, and became the editor-in-chief of the Foundation's theoretical journal, *The International Journal of Fusion Energy*.

If I were to summarize Moon's work from the early 1970s until his death in 1989, I would say that most of the time he was just having fun, thinking and hypothesizing about the quantization of space and time, and teaching science to people of all ages. You can get a sense of this in his own words in a transcript of a class he gave in September 1987, in Lees-

burg, Virginia, which is published in the Fall 2004 issue of *21st Century*, where he discusses the evolution of his thinking about space and time, and how it led to his ordering of the Platonic solids into what we now call the Moon Model.

When the Fusion Energy Foundation (along with two other LaRouche publishing entities) was put into forced bankruptcy in April 1987, by a faction of the government out to "get LaRouche," it hit Moon very hard. Without any warning, the Foundation office, including Moon's desk and files, was locked up, along with all our books, papers, and file cabinets.

At the time, Moon was working on a proposal to set up a new science university, based on the principles of teaching science that he had elaborated over the years.

We soon established *21st Century Science & Technology* as a successor to *Fusion* magazine, and Moon persevered, beginning new work on biophysics and the process of aging, developing his ideas on the atomic nucleus, teaching, and advising. Moon died in October 1989, just after the forced bankruptcy was reversed by a Federal bankruptcy judge.

I cannot help but think of Dr. Moon now as being in God's time, *Kairos*, and perhaps still contemplating the nature of space, as he did when he lived in *Chronos*, man's time.

—Marjorie Mazel Hecht

**NASA BUDGET PROPOSALS: THE RACE TO THE BOTTOM**

Vying to outdo each other in their race to destroy the space program, the FY12 proposal outdo NASA's budget from the Obama Administration and the Republicans call for severe cuts, that would continue to make it impossible for Americans to ever get out of Earth orbit.

The Administration FY12 budget proposal freezes NASA's spending at the 2010 level of \$18.7 billion. This is \$300 million less than the FY11 Administration budget proposed last year, which was never passed. NASA, like the rest of the Federal government, is currently operating at its FY10 level through a Continuing Resolution. The Congress did pass an FY11 Authorization Act in October, which directed NASA to carry out a number of exploration programs, but that money was never appropriated.

The money that will be "saved" this year, when the Space Shuttle is retired, is allocated by the White House to increase commercial crew funding to \$850 million, which is a level that the Congress will not accept. The rest is for a \$1 billion "technology" development program, which Congress will also not go along with, because there is no serious mission in sight which would use new technology. For the Moon/Mars future, NASA has already told Congress that there is not enough money in the budget for a new heavy-lift launch vehicle for trips beyond Earth orbit, which Congress has mandated to fly by 2016.

The Republican budget proposal outdoes the White House, proposing what would be a \$578 million cut, for FY11. This is contained in their bill to fund the rest of this year, after the Continuing Resolution expires in March. In addition, the bill prohibits any funds from being used, in any way, to cooperate with the country with the world's fastest-growing space program—China.

**BRAZIL AND ARGENTINA TO BUILD NUCLEAR PLANTS TOGETHER**

Brazil and Argentina signed an agreement in late January to cooperate in building two multi-purpose research reactors—one for each country. This cooperation is "an non-renounceable common patrimony of the Brazilian-Argentine strategic association," Argentine President Cristina Fernández de Kirchner and Brazilian President Dilma Rousseff stated, explaining that the expertise that each nation has developed over the years will be brought to bear in this project, working through the Bilateral Nuclear Energy Commission (COBEN). Argentina's Atomic Energy Commission and Brazil's National Nuclear Energy Commission will work together closely in producing the research reactors.

The agreement emphasizes that cooperation in this field will have "a great impact on the development of their respective nuclear sectors." COBEN will also be instructed to continue advancing education and training of human resources, while the Permanent Argentine-Brazilian Committee on Nuclear Policy is instructed to deepen the dialogue, with bilateral and political cooperation in those areas encompassed by the bilateral nuclear agenda. Argentina and Brazil each has two nuclear reactors and one under construction;

**VERNADSKY INSTITUTE HELPS PREPARE UNMANNED MISSION TO PHOBOS**

Among the photos taken by the European Space Agency's Mars Express spacecraft in its fly-by of the Mars moon Phobos on Jan. 9, there are several that feature proposed landing sites for Russia's Phobos-Grunt mission, scheduled for launch later in 2011.

The photos, taken at a distance of 100 kilometers, show in new detail the previous and currently planned landing sites for Phobos-Grunt, which would be the first spacecraft to land on Phobos, reported Alexander Basilevsky, a member of the Phobos-Grunt team based at the Vernadsky Institute in Moscow. Using the new images, scientists can construct a high-resolution topographic map of the landing sites, which should help determine where Phobos-Grunt will ultimately touch down. That decision will take place later this year, most likely after the craft has been launched, but the new images indicate that the old landing site may be as hospitable as the new one, says Basilevsky.

The team also has selected potential landing sites on the Moon, for future Russian space missions there.

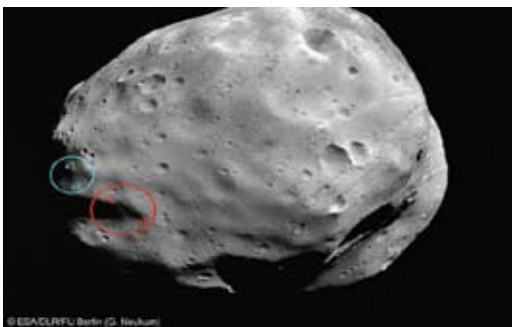
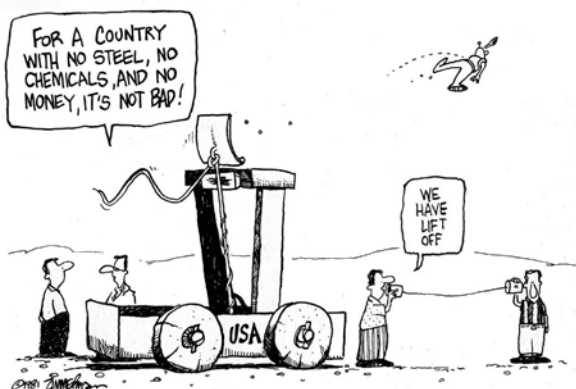


Image of Phobos (above) by Mars Express (shown here in artist's concept), taken Jan. 9, 2011, at a distance of 100 km. The ellipses mark the previously planned (red) and currently considered (blue) landing sites for the Russian Phobos-Grunt mission.



## NUCLEAR-POWERED MARS HOPPER DESIGNED BY INL TEAM

A team at the Idaho National Laboratory has designed a nuclear-powered hopper that can examine one Martian site, jump to another, and repeat, hundreds of times. "We've got a little guy that we think can hop about 15 kilometers [more than 9 miles] every five to seven days," says Steven Howe, director of the lab's Center for Space Nuclear Research. The hopper design is about as big and heavy as an adult emperor penguin and capable of travelling almost 200 times as far as the solar-powered rovers Spirit and Opportunity did in their first five years on Mars.

A single rocket launch from Earth could deploy several hoppers at once, and a few dozen hoppers could map the entire Martian surface in a few years, Howe says. Hoppers could also serve as a network of weather stations monitoring the Martian climate and could collect air, rock, and soil samples to send back to Earth.

The long-lived hoppers don't have to carry fuel with them, and they can suck up the carbon-dioxide-rich Martian atmosphere and use it as a propellant. On cue, stored heat from a radioisotope power source hits the propellant and rockets the hopper in an arc toward its next landing site. Smaller thrusts orient the hopper and soften its landing.

## AFTER STAY IN SPACE STATION, CHERRY TREE SEEDS BLOOM AND GROW

Tiny seeds from the prized Chujohime Seigan-zakura mountain cherry in Japan were sent to outer space in November 2008, to see whether it would help them to germinate, and the experiment was a success. Preservationists had been unable to cultivate more of the variety without grafting, because its seeds did not germinate. In a collaborative effort between preservationists and the Japan Aerospace Exploration Agency, about 265 Chujohime Seigan-zakura seeds were stored in the International Space station for 8 1/2 months, along with seeds from other cherry varieties.

Upon their return, some of the mountain cherry seeds produced buds, and others have shown extraordinary growth, reported *Yomiuri Shimbun* on Washington's Birthday, Feb. 22. This raises the important question of the effect of zero gravity and the cosmic radiation environment on life. Traditionally it has been thought that cosmic radiation is damaging to life, but this is an example of the opposite.

## FULL SUN NOW VISIBLE IN 3-D STEREO

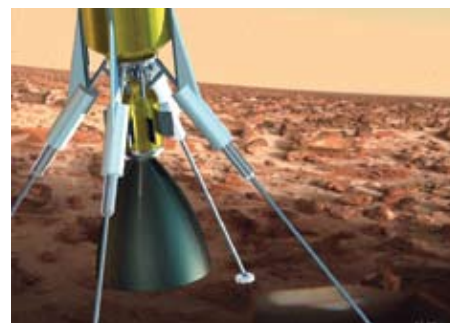
NASA's twin STEREO probes moved into position on opposite sides of the Sun on Feb. 6, and are now beaming back uninterrupted images of the entire Sun, front and back. "For the first time ever, we can watch solar activity in its full 3-dimensional glory," says Angelos Vourlidas, a member of the STEREO science team at the Naval Research Laboratory in Washington, D.C. "STEREO has revealed the Sun as it really is—a sphere of hot plasma and intricately woven magnetic fields."

Each STEREO probe photographs half of the Sun and beams the images to Earth, where researchers combine the two views to create a sphere. STEREO's telescopes are tuned to four wavelengths of extreme ultraviolet radiation, designed to trace key aspects of solar activity such as flares, tsunamis, and magnetic filaments. Now, active sunspots on the far side of the Sun, which can lead to coronal mass ejections that disrupt the Earth's power grid, will not hit as a surprise. Scientists will be able to improve space weather forecasts for airlines, power companies, satellite operators, and others.

For more information and graphics, see [http://science.nasa.gov/science-news/science-at-nasa/2011/06feb\\_fullsun/](http://science.nasa.gov/science-news/science-at-nasa/2011/06feb_fullsun/)



Idaho National Laboratory



Idaho National Laboratory

*The Mars hopper (above) would use heat from the radioisotope with a Stirling engine to generate electricity to power on-board scientific instruments and the propellant capture system. After collecting Martian rock and dust samples at the source, the hoppers could deliver them to an Earthbound rocket (top).*



Jay Friedlander/stereo.gsfc.nasa.gov

*An artist's illustration of the two STEREO (Solar Terrestrial Relations Observatory) satellites, which were launched in 2006. Prior to STEREO, astronomers could see only the side of the Sun facing Earth.*

# Luc Montagnier's Revolution in Biology



University of Calgary, Faculty of Medicine

*Nobel Prize laureate Luc Montagnier: His groundbreaking new work looks at the interplay of radiation with life.*

## New Evidence for A Non-Particle View of Life

by Laurence Hecht

Jan. 21, 2011

France's leading virologist, Luc Montagnier, has brought forth remarkable new evidence for a non-particle view of life. The emission of low-frequency electromagnetic waves from bacterial DNA sequences, and the apparent ability of these waves to organize nucleotides (the raw material of DNA) into new bacterial DNA, by mediation of structures within water, are among the important results reported to date.<sup>1</sup>

By demonstrating the interaction of living organisms with electromagnetic waves, perhaps including the low-frequency Schumann resonance waves in the Earth's atmosphere,<sup>2</sup> the work has revolutionary implications for biology and our whole understanding of the universe, extending the work begun in the 1920s by such figures as Alexander Gurwitsch, who detected ultraviolet radiations from growing plant cells.

The signals detected by Montagnier appear to be a property of most bacteria infecting humans, as well as many viruses, including HIV, influenza A, and hepatitis C. Further, it appears from the research, that some common diseases not previously considered to be of bacterial origin, may indeed be so. In evidence of that, signals identical to those detected in test tubes containing live bacteria, have been found in the blood plasma, and in the DNA extracted from the plasma, in patients suffering from Alzheimer's, Parkinson's disease, multiple sclerosis, chronic Lyme syndrome, rheumatoid arthritis, and various neuropathies.

Dr. Montagnier, who won the Nobel prize in 2008 for his 1983 discovery of the HIV virus, has proposed to employ these radio frequency techniques for detection of chronic bacterial and viral infections, and to explore means to use them in treatment of diseases including AIDS and autism. Montagnier also

notes that such techniques might some day provide a solution to the growing problem of evolution of antibiotic-resistant organisms.

Under attack from the science establishment in Europe and elsewhere in the West, Montagnier, age 78, has now made the decision to pursue further re-



Jiaotang University

*Prof. Montagnier at Jiaotang University in Shanghai, receiving his appointment in November 2010 to a university chair. Montagnier, under attack in the West, will continue his research at Jiaotang.*

1. L. Montagnier, J. Aissa, E. Del Giudice, C. Lavalee, A. Tedeschi, and G. Vitiello, "DNA Waves and Water," (2010) <http://arxiv.org/pdf/1012.5166>

2. The Schumann resonance refers to the waves of base frequency 7.83 Hz and its higher harmonics which propagate in the waveguide formed between the surface of the Earth and the ionosphere. In 1952, German atmospheric physicist Winfried Schumann hypothesized that lightning activity would produce such low-frequency waves, and by dividing the circumference of the Earth by the velocity of light, he predicted the approximate frequency later detected.

search in China, at a new research institute which will bear his name at Shanghai's Jiaotang University.

### The Non-Particle View

Montagnier's experiments bear upon certain crucial questions of scientific method which could not be properly addressed within the usually posed paradoxes of 20th Century physics, but which begin to find a clearer resolution when the subject matter becomes the relationship among the non-living, living, and also cognitive domains. For example, we knew already from the work of de Broglie and Schrödinger in the 1920s, that the paradoxes arising from the attempt to reduce experience within the non-living domain to a particle-based conception of substance, could be overcome by a wave conception which subsumed the phenomena of electromagnetic radiation and the old "mechanics" within a unified conception of microcosm and macrocosm.

However, Schrödinger was unable to carry over such insights into the domain of life, instead proposing a disappointing notion of local negation of entropy to explain the obvious upward organizing principle characterizing both evolutionary progress and cognitive human advance. That difficulty was resolved midway through the 20th Century by Lyndon LaRouche's recognition that human creativity, which he recognized as the driving force of human physical economic advance, and the actual source of wealth or value, as opposed to all prevailing theories of labor content or market valuation, was also the knowable principle of universal progress, or cognate with it. Therefore, the characteristics of that universally propagated creative principle must be adducible from properly constructed investigations into the relationship of cosmic radiations to life on Earth—provided that the usual flawed assumption about the completeness and efficacy of the human sensorium, the five senses, is cast aside, as LaRouche has recently emphasized.<sup>3</sup>

By revisiting the question of the interplay of radiation, including atmospheric and, implicitly, cosmic radiation, with life, the Montagnier experiments have brought to bear some fresh new evidence into this area of inquiry which had been declared almost *verboten* by the science establishment for most of the last century.

### The Experimental Evidence

To make these matters more transparent, let us now review in greater detail the extraordinary experimental results reported by Montagnier and his colleagues.

**1. Regeneration from filtrates.** In a paper published in 2009,<sup>4</sup> Montagnier et al. reported evidence of bacteria and viruses regenerating themselves from apparently sterile solutions. After passage through filters of pore sizes far smaller than the bacterium or virus, solutions which had contained infected cultures, but tested as sterile after filtration, were able to regenerate the



International Organization for Mycoplasmaology

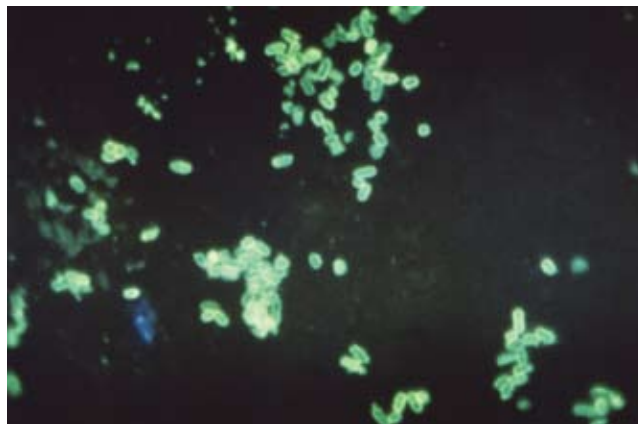
*Mycoplasma hyopneumoniae* attached to swine cilia. The mycoplasma are very small bacteria, without a cell wall, which are implicated in several human diseases.

bacteria and viruses that had infected them. The first experiments used *Mycoplasma pirum*, a species of small, cell wall-deficient bacteria, about 300 nM in size. The mycoplasma constitute a genus of very small bacteria, which are implicated in a number of human diseases and are resistant to many types of antibiotics.

After filtration of a culture of human lymphocytes infected with *Mycoplasma pirum* through filters of 100 nM or 20 nM porosities, incubation on a sterile culture of human lymphocytes showed regeneration of the original mycoplasma. The sterility of the cultures on which the mycoplasma was regenerated had been rigorously tested for traces of bacterial DNA, and showed negative. "Repeated search for traces of mycoplasma DNA by PCR [polymerase chain reaction] and nested PCR using specific primers for the adhesin gene or for the 16S ribosomal gene was consistently negative," Montagnier reports.

These were the results, first observed 10 years ago, which set Montagnier on this experimental path.

**2. Emission of low-frequency waves from the filtrates.** In the course of investigating this anomalous phenomenon, Montagnier and colleagues found a remarkable new property of these filtrates. After dilutions with water, the apparently sterile filtrates were shown to produce low-frequency electromagnetic



CDC

The more classical *Escherichia coli*, here shown magnified 1,250X in a fluorescent antibody stained photomicrograph.

3. For example, Lyndon H. LaRouche, Jr., "A Wedding Anniversary: The Sixth Sense," *EIR*, Jan. 14, 2011, pp. 4-22. [http://www.larouhepub.com/lar/2011/3802sixth\\_sense.html](http://www.larouhepub.com/lar/2011/3802sixth_sense.html)

See also, the report "The Extended Sensorium" by the LaRouche "Basement" Project, *EIR*, Feb. 4, 2011 and <http://www.larouhepac.com/node/17172>

4. L. Montagnier, J. Aissa, S. Ferris, J-L. Montagnier, C. Lavalee, "Electromagnetic Signals Are Produced by Aqueous Nanostructures Derived from Bacterial DNA Sequences," *Interdisciplinary Sciences: Computational Life Sciences* (2009) Vol. 1, pp. 81-90.





Jacques Benveniste, whose 1980s research found that an antibody remained in very diluted water—and who was then subjected to ridicule by the science mafia.

waves in a manner that was reproducible. Similar emissions were also found in apparently sterile filtrates of solutions that had been infected with a larger, more classical bacterium, *E. coli*, and with other microorganisms. But no signal was found in unfiltered solutions (Figure 1).

The waves were detected by an apparatus that had been designed by immunologist Jacques Benveniste.<sup>5</sup> Before being test-

5. Jacques Benveniste (1935-2004) had been the director of the immunology lab of France's National Institute of Health and Medical Research (INSERM). His research in the 1980s showed that water, which had once contained an antibody, but had been diluted to such a degree that no molecule of the antibody could remain, was still capable of acting upon a type of white blood cell known as a basophil. Benveniste concluded that the configuration of water molecules had become biologically active, despite the absence of the antibody. Benveniste's results were replicated by independent laboratories in Canada, Italy, and Israel, before their June 1988 publication in *Nature*. But in a follow-up visit to Benveniste's laboratory by a team including *Nature* editor John Maddox and magician James Randi, the results could be reproduced in many, but not all trials. Benveniste called the visit a mockery, and denounced McCarthy-like methods. But the high-profile defamation campaign by *Nature* caused him public discredit.

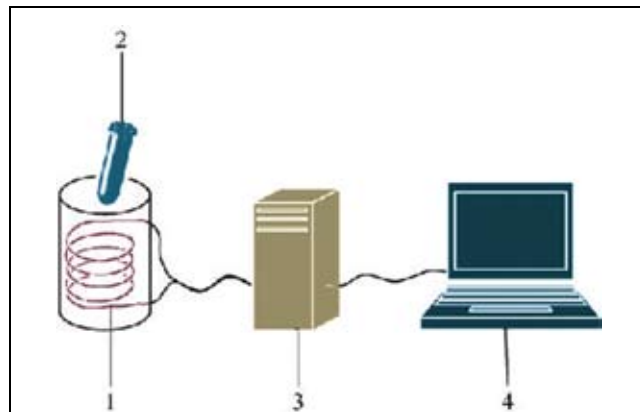


Figure 1

Device for the capture and analysis of electromagnetic signals: (1) a coil of copper wire, impedance 300 Ohms; (2) plastic stoppered tube containing 1 mL of the solution to be analyzed; (3) amplifier; (4) computer with software.

Source: "DNA Waves and Water"

ed, the samples are serially diluted, 1 part in 10, in small (1.5 milliliter) plastic tubes, which are then tightly stoppered and strongly agitated for 15 seconds, a critical step. The sample is placed inside a coil of copper wire of 300-ohm impedance, which acts as a detector of low-frequency electromagnetic signals, attached to an amplifier. Computer software is used to separate background noise, and the signal is Fourier-analyzed. The first low dilutions were usually negative for a signal. Positive signals were usually obtained at dilutions ranging from  $10^{-5}$  to  $10^{-8}$ , or  $10^{-12}$  (5 to 8, or 12 successive dilutions). Higher dilutions were again negative. The original unfiltered suspension was negative at all dilutions for all microorganisms studied (Figure 2).

When the signal appears, an increase in amplitude and in frequency over the background is detected. Frequencies close to 1,000 Hz and its multiples were found. The range of the detected frequencies falls in what is sometimes called the extremely low frequency (ELF) band of electromagnetic radiation (about 3 to 3,000 Hz). The bacteria are emitting frequencies which would be audible were they sound waves, but as electromagnetic signals are traditionally thought of as lying at the very low end of the radio frequency spectrum.

A remarkable feature of the results with bacteria and viruses is that many of the emitting filtrates are so highly di-

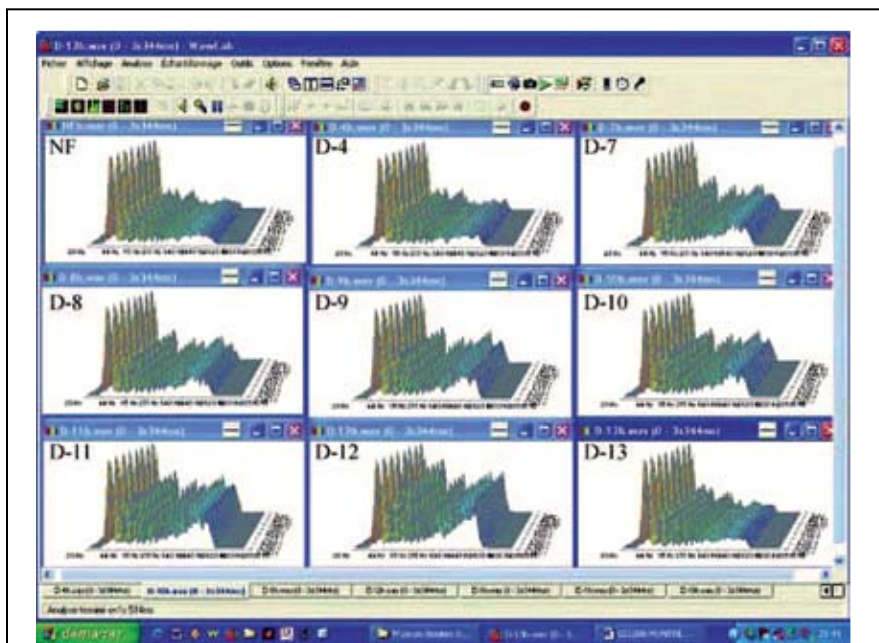


Figure 2

Fourier-analyzed signal from aqueous dilutions of *Mycoplasma pirum*. The spikes at the left are the 50 Hz signal from electric circuit. The spikes at the right (prominent in D-9 to D-12) are interpreted as the positive signal of about 1,000 Hz from the bacteria.

Source: "DNA Waves and Water"

luted as to have almost no likelihood of containing the original infectious agent or its complete DNA. In order to account for this, as well as the appearance of signals from pure water, Montagnier adopted an hypothesis developed by researchers into the anomalous properties of water, namely, that coherent, polymeric nanostructures are formed in the water. A number of physical studies have reported the formation of long polymers of hydrogen-bonded dipoles in water. However, these tended to be short lived. In Montagnier's view, the emitted signals may be a resonance phenomenon, perhaps depending upon excitation by the ambient electromagnetic noise. Their persistence after the removal of the agent which forms them might be due to a coherence effect produced by the radiations themselves, as postulated by Italian physicists Emilio Del Giudice and Giuliano Preparata.<sup>6</sup>

(Results dating back to the 1920s had shown the existence of emissions from living substances at the much higher frequency range of ultraviolet light.<sup>7</sup> Such emission was later confirmed by Fritz-Albert Popp, who named the phenomenon biophotons.



German researcher Fritz-Albert Popp continued the 1920s work of Alexander Gurwitsch, investigating emissions from living plants of high frequency ultraviolet light, which he named biophotons.

Popp and colleagues demonstrated that the light was coherent, somewhat like a laser; that the emitting molecules are coupled by a coherent radiation field; and that the source is the DNA in the cell nucleus. Whole body biophoton detection in Popp's lab showed a correlation with known biological rhythms of diurnal, lunar, and other periodicity, and suggested the existence of a globally organized biophoton field for the organism.<sup>8</sup>

**3. "Cross talk" between the test tubes.** In continued experimentation by Montagnier, it proved possible both to eliminate the signal from certain dilutions, and to cause others, which had not emitted, to begin emitting signals. This is the phenomenon Montagnier refers to as "cross talk."

In one series of experiments, negative (non-emitting) dilutions were combined with positive (emitting) dilutions. Thus, when 0.1 mL of a negative low dilution (perhaps  $10^{-3}$ ) was added to 0.4 or 0.9 mL of a positive dilution ( $10^{-8}$ ), the latter became negative. "This indicates," writes Montagnier, "that the 'silent' low dilutions are self-inhibitory, probably by interference of the multiple sources emitting in the same length, or

6. E. Del Giudice, G. Preparata, G. Vitiello, "Water as a free electric dipole laser," *Physical Review Letters*, Vol. 61, pp. 1085-1088 (1988).

7. See, for example, Gurwitsch & Gurwitsch, "Twenty Years of Mitogenetic Radiation: Emergence, Development and Perspectives," *21st Century Science & Technology*, Fall 1999, pp. 41-53.

8. cf. *Recent Advances in Biophoton Research and its Radiations*, edited by F.A. Popp (World Scientific, 1992).



CDC

Scanning electron micrograph of *Salmonella typhimurium* bacteria magnified 15,000X. Montagnier observed electromagnetic signals in dilutions of *Salmonella*, and other bacterial species.

slightly out of phase, like a radio jamming. Alternatively, the abundance of nanostructures can form a gel in water and therefore are prevented to vibrate."

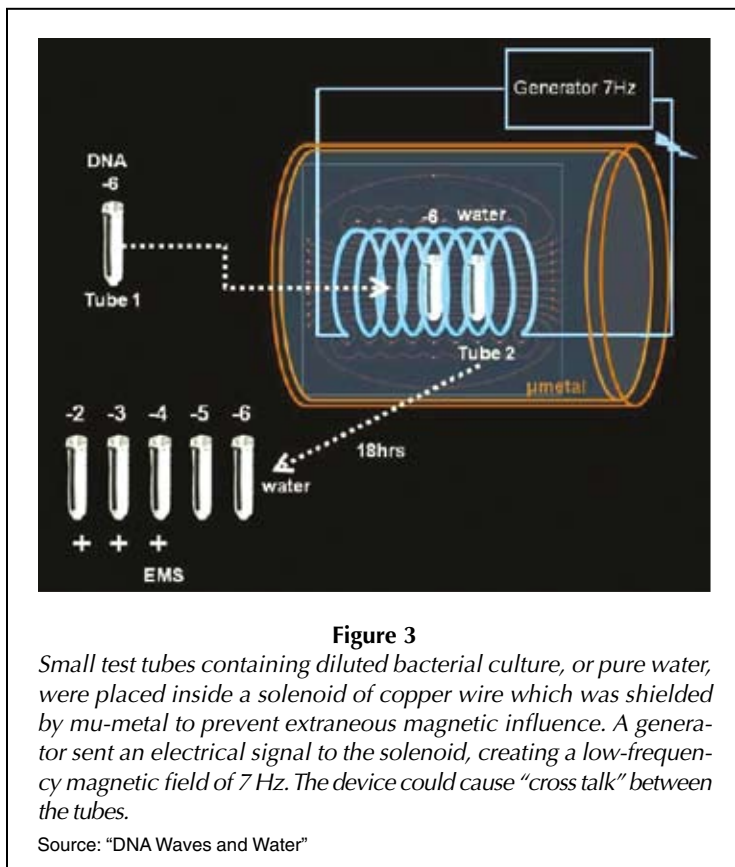
If this is truly a wave effect, it should be possible to demonstrate that the properties of the dilutions could be communicated, not by physically combining them, but by placing the plastic tubes containing them next to one another. This was demonstrated by placing a donor tube of a low "silent" dilution ( $10^{-3}$ ) of *E. Coli* next to a receiver tube of a positive "loud" dilution ( $10^{-9}$ ) of the same substance.

The tubes were placed for 24 hours inside a box surrounded by a nickel-iron alloy known as mu-metal, which has the property of suppressing low-frequency magnetic fields. The hypothesis was that the mu-metal would shield them from external



CDC

Scanning electron micrograph of the human immunodeficiency virus (HIV-1), which is spherical in appearance. Montagnier observed electromagnetic signals from a portion of the virus DNA.



**Figure 3**

Small test tubes containing diluted bacterial culture, or pure water, were placed inside a solenoid of copper wire which was shielded by mu-metal to prevent extraneous magnetic influence. A generator sent an electrical signal to the solenoid, creating a low-frequency magnetic field of 7 Hz. The device could cause “cross talk” between the tubes.

Source: “DNA Waves and Water”

electromagnetic noise, permitting the active electromagnetic emissions from the bacteria to act on their own. After 24 hours in the shielded box, the donor tube was still silent, but the receiver tube had also become silent. But when the receiver tube was further diluted, a signal appeared again.

“These results suggest,” writes Montagnier, “that the receiver tube was made silent by the formation of an excess of new nanostructures, which could emit signals upon further dilution.” By interposing a sheet of mu-metal between the tubes, it was possible to suppress the effect.

The cross talk also proved to be species specific. Electromagnetic signals were observed in dilutions of other bacterial species, including *Streptococcus B*, *Staphylococcus aureas*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Bacillus subtilis*, *Salmonella*, and *Clostridium perfringens*. The signals were detected in the same range of dilutions observed for *E. coli*, and the transfer effect was noted upon immersion in a mu-metal shielded box. But a species could only “talk” with a member of the same species.

#### 4. Wave transmission of DNA genetic information to water.

The next phase of the experimentation proved truly remarkable, for it comes close to challenging the tenet of biology, sometimes known as Redi’s principle, and also strongly defended by Pasteur, that all life comes from life (*omne vivum ex vivo*). Yet, a closer analysis will demonstrate that it is not the truth of the principle, but what we mean by “life” which is actually challenged by the results.

In experiments reported by Montagnier at a 2010 conference in Lindau,<sup>9</sup> a tube of pure water, when exposed to a second tube emitting signals, was made to emit signals, and then to cause DNA sequences placed into the pure water to assemble into sequences similar to those of the original emitting organism. Because of its importance we will summarize the experiment in as much detail as is available.

As reported in a 2010 paper on the experiment,<sup>10</sup> a fragment of DNA taken from the long terminal repeat of the AIDS virus (HIV) was used as the source. (The long terminal repeat is a portion of the DNA found in retroviruses that repeats itself many times over.) The fragment was then amplified by the PCR technique, in which a naturally derived enzyme, known as polymerase, artificially stimulates the DNA to reproduce many copies of itself when the nucleotides and other raw materials are supplied. Dilutions of the PCR-amplified DNA solution were then made, as in earlier experiments, until an electromagnetic signal was detected.

The contents of the tube were then filtered through 450-nm and 20-nm porosity filters, and diluted from  $10^{-2}$  to  $10^{-15}$ . A second tube containing pure water was subjected to the same filtration and dilutions. The tubes were then placed near to one another inside a horizontally oriented copper coil or solenoid (Figure 3). The solenoid and tubes are placed inside a container shielded by a 1-mm-thick layer of mu-metal. A low-intensity electric current oscillating at 7 Hz was then fed to the solenoid from an external generator for

18 hours at room temperature.

When the tube containing pure water was removed after 18 hours, it was found to emit signals, as did the tube containing the diluted filtrate of viral DNA. No emission occurred under the following conditions:

- Time of exposure less than 16-18 hours
- No coil
- Generator turned off
- Frequency of excitation less than 7 Hz<sup>11</sup>
- Absence of DNA in the first tube.

Now comes the most remarkable step. The ingredients for synthesizing DNA by the polymerase chain reaction (nucleotides, primers, polymerase) were added to the tube containing the pure water. It is expected that the PCR reaction should re-

9. “DNA between Physics and Biology: DNA Waves and Water” from the presentation of Dr. Luc Montagnier, Lindau, 28 June 2010 <http://montagnier.net/montagnier/index.php/publications/>

10. L. Montagnier, J. Aissa, E. Del Giudice, C. Lavalee, A. Tedeschi, and G. Vi-tiello, “DNA waves and water.”

11. Compare the experiments of Italian biophysicist Bruno Brandimarte in applying low-frequency magnetic oscillations, both *in vitro*, and to the healing of wounds and other pathologies. Brandimarte proposes that magnetic oscillations below 10 kHz are non-Maxwellian waves, which should be called *magneto-electric*, not electromagnetic. See, Bruno Brandimarte, “Whole-Body Magneto-Therapy Speeds Wound and Disease Healing,” *21st Century Science & Technology*, Summer 2010, pp. 21-30. [www.21stcenturysciencetech.com/Articles\\_2010/Summer\\_2010/Magneto-Therapy.pdf](http://www.21stcenturysciencetech.com/Articles_2010/Summer_2010/Magneto-Therapy.pdf)

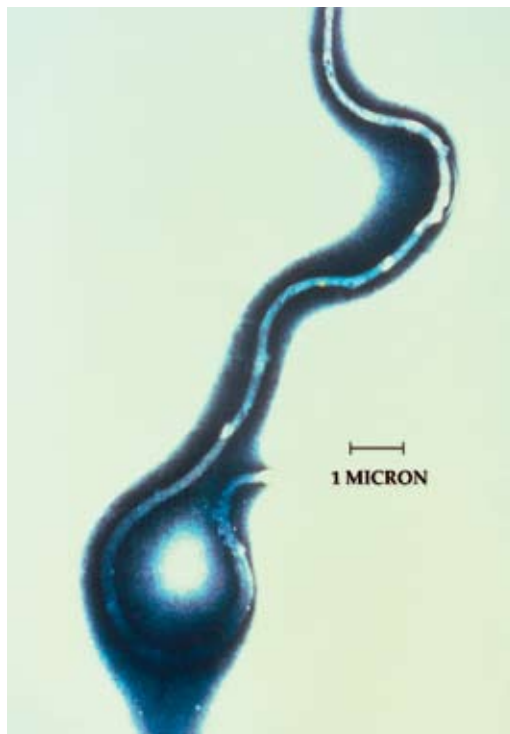
quire the presence of at least one copy of the DNA segment which is to be reproduced, to serve as an initial template for DNA amplification. This was not added. The PCR reaction was then performed in the usual way by cycled exposure to heat. The result was that the DNA produced from the tube initially containing pure water was of the expected size and 98 percent identical in sequence to the original DNA sequence from the long terminal repeat of the HIV. Out of 104 nucleotides (the molecules which join together to make up the DNA structure), only two were different from the original. The experiment was reproducible and successful in 12 out of 12 tries. It was successfully repeated with a DNA sequence from a bacterium, *Borrelia burgdorferi*, the spirochete responsible for Lyme disease.

Montagnier concludes his report with the observation:

These elements give support to a provocative explanation of our *Mycoplasma pirum* filtration experiment: The nanostructures induced by *M. pirum* DNA in the filtered water represent different segments of its genomic DNA. Each nanostructure, when in contact with the human lymphocytes, is retro-transcribed<sup>12</sup> in the corresponding DNA by some cellular DNA polymerases. Then there is a certain probability (even very low) that each piece of DNA recombines within the same cell to other pieces for reconstructing the whole DNA genome. We have to assume, that in presence of the eukaryotic cells, the synthesis of the mycoplasma components (membrane lipids, ribosomes) can be also instructed by the mycoplasma DNA. One single complete mycoplasma cell is then sufficient to generate the whole infection of lymphocytes. Recent experiments of the C. Venter group have shown [Gibson D.G., et al., *Science*, Vol. 329, pp. 52-56 (2010)] that a synthetic genomic DNA is sufficient to maintain all the characteristics of a mycoplasma. All the steps assumed in the regeneration from water can be analyzed and open to verification.<sup>13</sup>

12. By this, I believe Montagnier means to indicate that the single-stranded DNA is synthesized as in a retrovirus, but without the presence of the RNA template. Instead, the aqueous nanostructure serves as the "template."

13. Montagnier, "DNA Waves and Water," *op. cit.*



CDC

*Photomicrograph of Borrelia burgdorferi, the spirochete bacterium that causes Lyme disease. Montagnier also found electromagnetic signals from a portion of this bacterium in diluted water.*

### Again, the Non-Particle View

A broad view of the results of Montagnier, as also those of the Craig Venter group, touch upon a most fundamental question as to the nature of life. In stating the principle, *all life comes from life*, a principle which has never been shown to be violated in any experiment to date, it is usual to envision some material process, such as egg and sperm, spore, or cell division, as the responsible agent. In the results reported here, however, the life principle appears to be transmitted, not by the immediate presence of a material substance, but mediately, in connection with a signal detectable by electromagnetic apparatus. The fuller elaboration of the mechanisms, whether by formation of nanostructures in water as suggested, or perhaps by additional means, remains to be worked out. However, we can say that the Montagnier results, as also the widely reported results of the Venter group in creating a bacterial cell controlled by an assembly of a complete bacterial genome,<sup>14</sup> require an extension of that usually limited conception of

life. But it is the work of Montagnier, which sheds the greater light on the question.

The attempt to reduce the principle of life to something derivable from the laws of chemistry and physics was never very satisfactory. The argument of the vitalists, that an animating principle must be superimposed upon the presumed self-evident material substance of living matter, also had its limitations. With the results of Montagnier, we recognize that the principle, *omne vivum ex vivo*, still holds, but only on the condition that we adopt a non-particle conception of life.

14. In 2010, researchers at the J. Craig Venter Institutes reported what some called "artificial life" (Gibson, et al., "Creation of a Bacterial Cell Controlled by a Chemically Synthesized Genome," *Science*, Vol. 329, pp. 52-56, 2010). Ingeniously extending known methods of cloning, the team caused 100 components of artificially synthesized gene sequences to assemble into a structure virtually identical to the DNA of the bacteria *Mycoplasma mycoides*. Inserted into the cell of a closely related species of *mycoplasma*, the new cell grew into colonies, expressing the synthetic DNA sequence. The word "creation" in the article's title is, however, misleading. To those confused into supposing that life has been created *de novo*, some clarity might be achieved by the very rough analogy that the synthesis requires the *E. coli* and baker's yeast organisms as surrogate "father" and "mother," as it were. The synthesis requires staged insertion of the sub-products into the larger *E. coli* bacterium, and then into the DNA of *S. cerevisiae* (baker's yeast), where the artificial *M. mycoides* genome comprises about 5 percent of the total DNA length. Life is not created *de novo*, but only in the presence of life, as in the Montagnier experiments. This, apart from moral considerations as to the misuse possible in all genetic experiments, as also in the patenting of biological materials in agriculture, neither of which we take up here.

# THE GREAT SEA-LEVEL HUMBUG

## There Is No Alarming Sea Level Rise!

by Nils-Axel Mörner

In an interview and paper published in *21st Century* in 2007,<sup>1</sup> I have shown that global sea level is not in an alarming rising mode, which is the main threat in the International Panel on Climate Change scenario. If sea level is not rising at a high rate, there is no serious threat and no real problem. In subsequent papers, I continued to present new data on sea level stability. In Mörner 2007b, our field observational database from the Maldive Islands was described in detail. A new study in Bangladesh was published in 2010 (Mörner 2010a). New data with respect to general sea level changes were published in another paper (2010b). Also, my

1. The interview and article appear in the Fall 2007 *21st Century*. The interview is available online at [www.21stcenturysciencetech.com/Articles%202007/MornerInterview.pdf](http://www.21stcenturysciencetech.com/Articles%202007/MornerInterview.pdf)



Renowned oceanographic expert Nils-Axel Mörner has studied sea level and its effects on coastal areas for some 45 years. Recently retired as director of the Paleogeophysics and Geodynamics Department at Stockholm University, Mörner is past president (1999-2003) of the INQUA Commission on Sea Level Changes and Coastal Evolution, and leader of the Maldives Sea Level Project. Now he has his own company on Paleogeophysics & Geodynamics in Sweden, and can be reached at [morner@pog.nu](mailto:morner@pog.nu).

*While the IPCC and its boy scouts present wilder and wilder sea level predictions for the near future, the real observational facts demonstrate that sea level has remained virtually stable for the last 40-50 years.*

One of the approximately 1,190 beautiful coral islands that comprise the nation of the Maldives. As Mörner shows, the Maldives are not in danger of inundation.

short sea level booklet titled "The Greatest Lie Ever Told" (Mörner 2007c) was updated in new editions in 2009 and 2010.

Here I will investigate the proposed rates of sea level changes by IPCC and others.

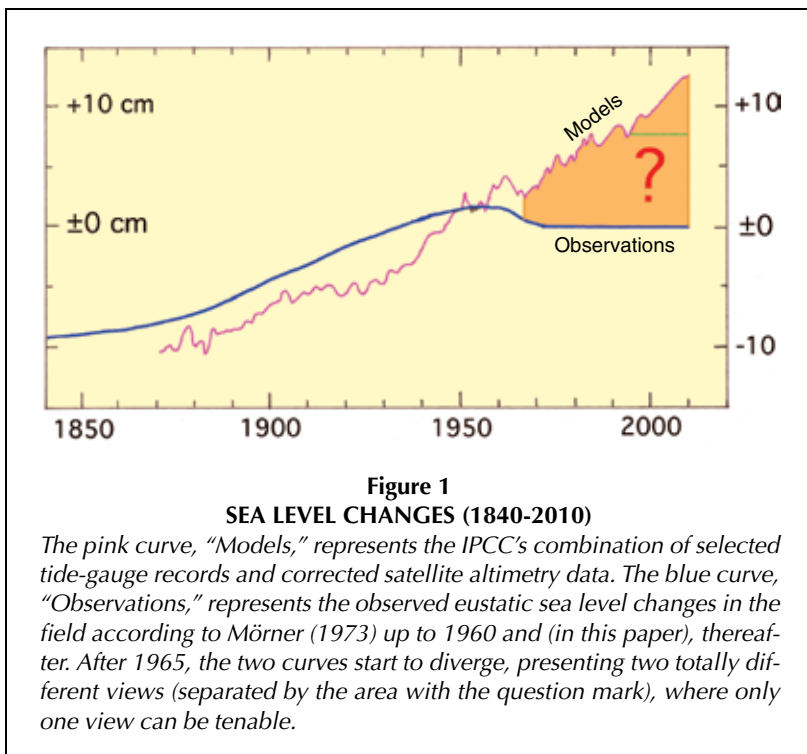
Figure 1 illustrates the differences between the IPCC models and the observational facts. After 1965, the two curves start to diverge significantly (the area marked with a question mark). This paper will highlight the differences and seek the solution of what data to trust and what to discard.

Figure 2 shows the spectrum of present-day sea level estimates. The proposed rates of sea level rise range from 0.0 to 3.2 mm per year. Obviously, all these rates cannot be correct. I will try to straighten out the question mark in Figure 1 by undertaking a critical examination of the rates given in Figure 2.

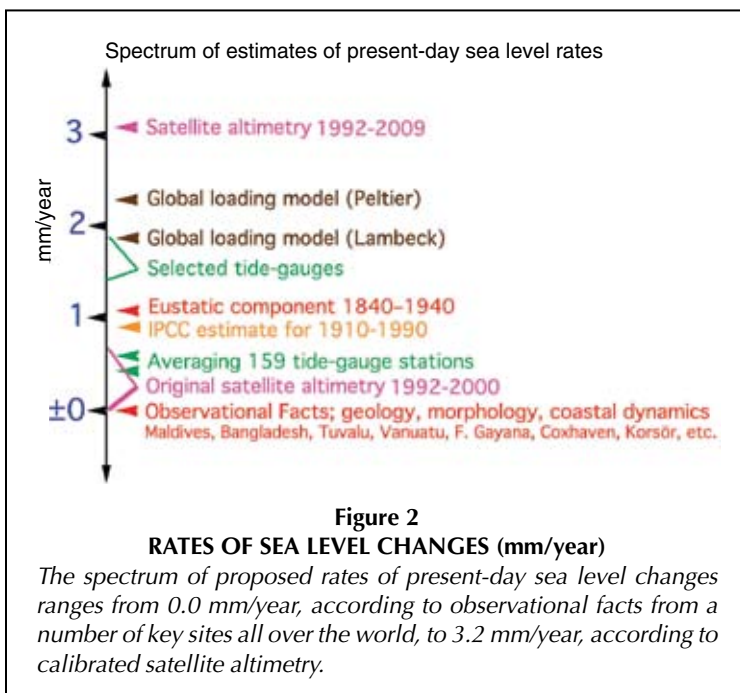
### Observational Facts

Clear observational measurements in the field indicate that sea level is not rising in the Mal-





dives, Bangladesh, Tuvalu, Vanuatu, and French Guyana (Mörner, 2007a, 2007b, 2007c, 2010a, 2010b). All these places are key sites in the sea level debate, where the IPCC and its ideological associates have predicted terrible flooding scenarios. The reality is totally different from what the IPCC claims, however, as highlighted in my interview and article in *21st Century*.



The IPCC group and the Presidents of the Maldives and Tuvalu continue to claim that the flooding is in progress, and will soon flood the islands and wipe those island nations off the surface of the globe (or rather ocean). Already here we are facing a behavior that well might be termed a "sea-level-gate." In an open letter to the President of the Maldives (Mörner 2009), I addressed the divergence between his claim and our field observations. No reply has come.

Bangladesh is a nation cursed by disasters— heavy precipitation in the Himalayas and coastal cyclones. As if this were not bad enough, it has been claimed that sea level is in rapidly rising mode. This claim has been totally discredited by my study in the Sundarban area, where the facts are that the sea has remained stable for the last 40-50 years (Mörner 2010a).

The erroneously inferred sea level rise has been used to create wild scenarios where it is claimed that tens to hundreds of thousands of people may be drowned and "millions of individuals will be displaced from their homes over the course of the century due to sea-level rise" (Byravana and Raja 2010). This is, indeed,

a terrible falsification of the actual situation. We are undoubtedly facing a "sea-level-gate." The journal that published this false claim, *Ethics and International Affairs*, refuses to print a comment "that focuses on empirical data." With surprise, we must ask: What is the meaning of addressing moral concern, if the entire empirical base is wrong?

In Tuvalu, the President continues to claim that they are in the process of being flooded. Yet, the tide-gauge data provide clear indication of a stability over the last 30 years (Mörner 2007a, 2007c, 2010b; Murphy 2007). In Vanuatu, the tide-gauge indicates a stable sea level over the last 14 years (Mörner 2007c).

From the coasts of French Guyana and Surinam there is a very excellent sea level record covering multiple 18.6-year tidal cycles (Gratiot et al. 2008). It exhibits variations around a stable zero level over the last 50 years (Mörner 2010b). For the same area, satellite altimetry gives a sea level rise of 3.0 mm/year. This casts clear doubt on the satellite altimetry value, as discussed further below.

The sea level record from Venice may be used as a test area for global eustasy.<sup>2</sup> Subtracting the subsidence factor, it shows no rise of eustatic origin, no acceleration whatsoever in the last decades; instead, it shows a sea level *lowering* around the year 1970 (Mörner 2007a, 2007c).

The northwest European coasts are interesting be-

2. Eustacy or eustatic change (as opposed to changes in land level) refers to changes in the ocean level (earlier thought to be global, but nowadays realized also to be regional, because of horizontal redistribution of water-masses).

cause here we have sites that are experiencing both uplift and subsidence. The tide-gauge at Korsør in the Great Belt (the strait between the main Danish islands of Zealand and Funen), for example, is located at the hinge between uplift and subsidence for the last 8,000 years. This tide-gauge shows no sea level rise in the last 50-60 years.

The tide-gauge in Amsterdam, installed in 1682, is the oldest in the world. Superimposing this subsidence record on the uplift record from the Stockholm tide-gauge, I was able to isolate a eustatic factor for the time period 1680 to about 1970 (Mörner 1973). This shows a rise from 1830-1840 up to 1930-1940 of 11 cm. In that 100-year period, the Earth's rate of rotation decelerated at a value which corresponds to a 10-cm sea level rise (see, for example, Mörner 1996). Consequently, there is a very good fit between sea level rise and rotational deceleration, which seems to provide a measure of a global sea level factor (the blue line with respect to the red line in Figure 3).

Cuxhaven, on the German coast, has a tide-gauge dating back to 1843, in an area that represents the subsiding segment of the North Sea coasts. Figure 3 shows the annual mean values for 160 years, with a long-term trend polynomial fitted to it (Herold unpubl.). This curve (blue) gives a slightly sinusoidal rising trend that represents the mean relative sea level changes in the area.



Paulo Filgueiras/U.N. Photo

The global warming mania has captured many leaders of small island nations. Here, U.N. Secretary-General Ban Ki-moon (third from left) addresses a breakfast meeting with representatives of small island states, in Cancun, Mexico, on the sidelines of the U.N. Conference on Climate Change.

Adding to this the eustatic component of the northwestern European region (Mörner 1973), we get partly the local rate of subsidence (red curve), and partly the eustatic component, extended up to the present and double-checked for the pre-1970 section (the difference between the blue and the red curves).

The regional eustatic sea level change decelerates after 1930-1940, becomes flat around 1950-1970, and falls from 1970 up to the present. This provides firm evidence that sea level is not at all in a rapidly rising mode today; rather there is



The kugelbake, an old wooden lighthouse at the North Sea port of Cuxhaven. This coastal area is an area of subsidence.

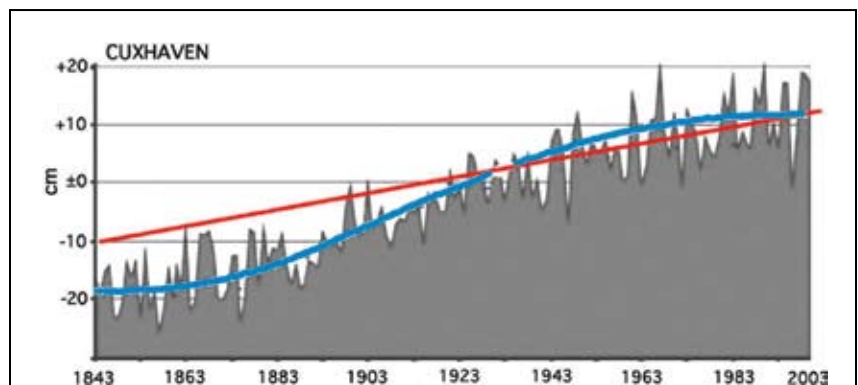


Figure 3  
CUXHAVEN TIDE-GAUGE RECORD

The gray area gives the actual tide-gauge reading for the North Sea German port of Cuxhaven for 1843-2003—that is, for 160 years. A polynomial was fitted (by Jörn Herold) to this tide-gauge record. Adding the eustatic component of Mörner (1973) for the period 1840-1970, gives a straight line of subsidence (red) with a rate of 1.4 mm/year. The eustatic component (the difference between the blue and red curves) can now be extended to 2003, and it shows a stop in the rise at around 1960, followed by a continual lowering up to 2003; that is, a trend totally different from that proposed by the IPCC models but in full agreement with the observational facts in Figure 1.



Vyron Lymberopoulos

Amsterdam has the oldest installed tide-gauge in the world, dating back to 1682. White marble stones (below) were inserted into the locks built after severe flooding (above).



eseas.org

A tide-gauge on an industrial pier in the Adriatic. It is grounded to the bottom with piles.



Vyron Lymberopoulos

the opposite trend: a slow falling mode.

These data are combined in the curve of “observations” in Figure 1.

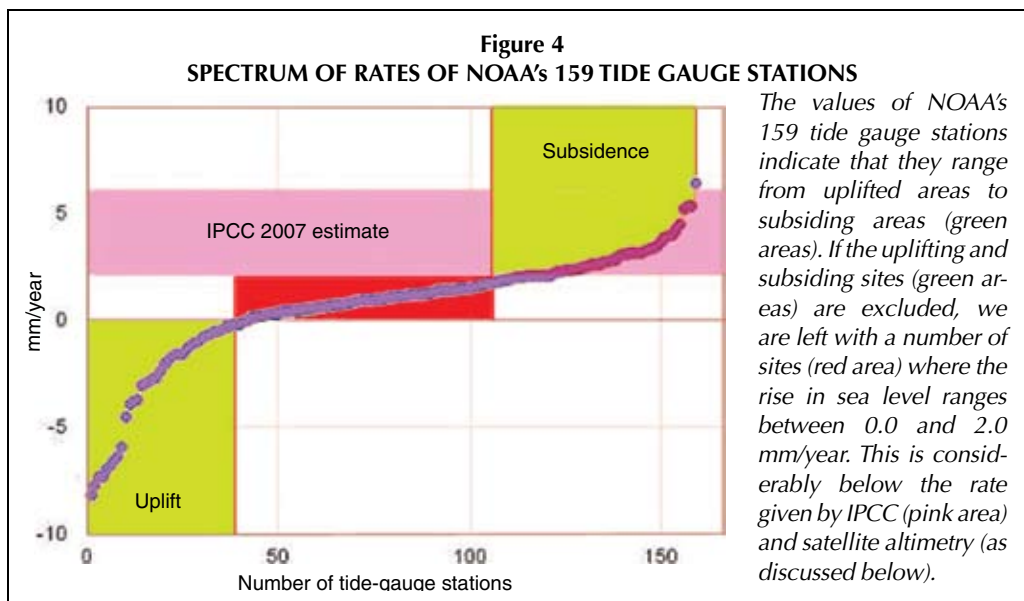
### Tide-gauge Records

Tide-gauges were installed at harbor constructions to measure the changes in tidal level and long-term sea level changes. The Amsterdam tide-gauge is the oldest, installed in 1682; the Stockholm tide-gauge is the second oldest, installed in 1724/1774; and the Liverpool tide-gauge is the third oldest, installed in 1768. Most tide-gauges are installed on unstable harbor constructions or landing piers. Therefore, tide-gauge records are bound to exaggerate sea level rise. The National Oceanic and Atmospheric Administration (NOAA) tide-gauge database includes 159 stations (Figure 4).

The IPCC authors take the liberty to select what they call “representative” records for their reconstruction of the centennial sea level trend. This,

of course, implies that their personal view—that is, the IPCC scenario laid down from the beginning of the project—is imposed in the selection and identification of their “representative” records. We start to smell another “sea-level-gate.”

With this selection methodology, Douglas (1991) chose 25 tide-gauges and got a rate of sea level rise of 1.8 mm/year; Church et al. (2006) selected 6 tide-gauges and got a rate of 1.4 mm/year; and Holgate (2007) selected 9 tide-gauges and got a rate of 1.45





mm/year (Figure 2). The mean of all the 159 NOAA sites gives a rate of 0.5 mm/year to 0.6 mm/year (Burton 2010). A better approach, however, is to exclude those sites that represent uplifted and subsided areas (Figure 4). This leaves 68 sites of reasonable stability (still with the possibility of an exaggeration of the rate of change, as discussed above). These sites give a present rate of sea level rise in the order of 1.0 ( $\pm$  1.0) mm/year. This is far below the rates given by satellite altimetry, and the smell of a “sea-level-gate” gets stronger.

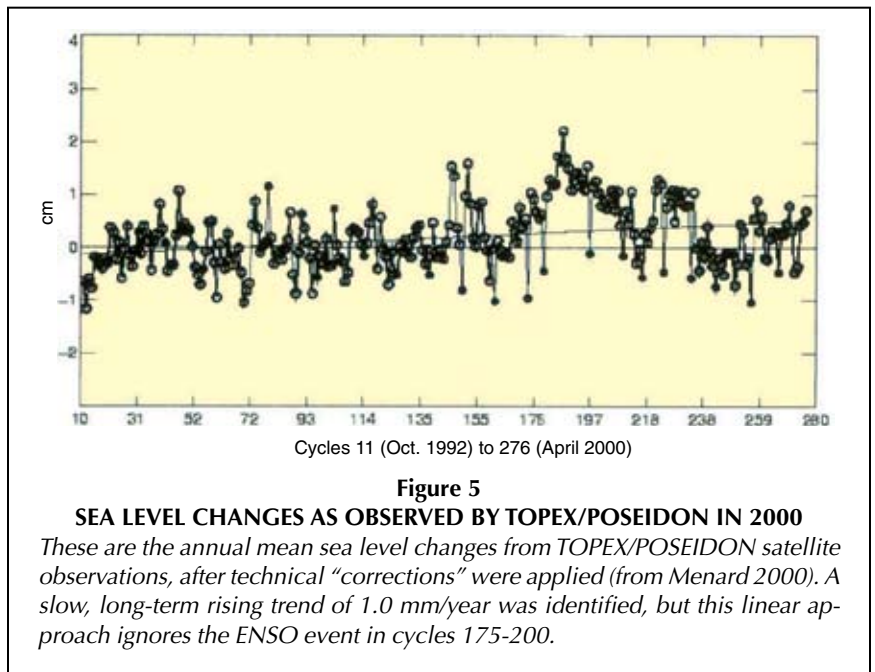
### Satellite Altimetry

Satellite altimetry is a wonderful new technique that offers the reconstruction of sea level changes all over the ocean surface. This is vital, as sea level not only changes vertically but also horizontally. The horizontal redistribution of water masses was first observed for the centennial to decadal Late Holocene sea level changes (see, for example, Mörner 1995 and 1996) and is clearly shown in the satellite record from 1992-2010 (see, for example, Nicholls and Casenave 2010; Casenave and Llovel 2010)). Great problems remain with respect to the zero level chosen and to the long-term trend, however (Mörner 2004, 2007c, 2008).

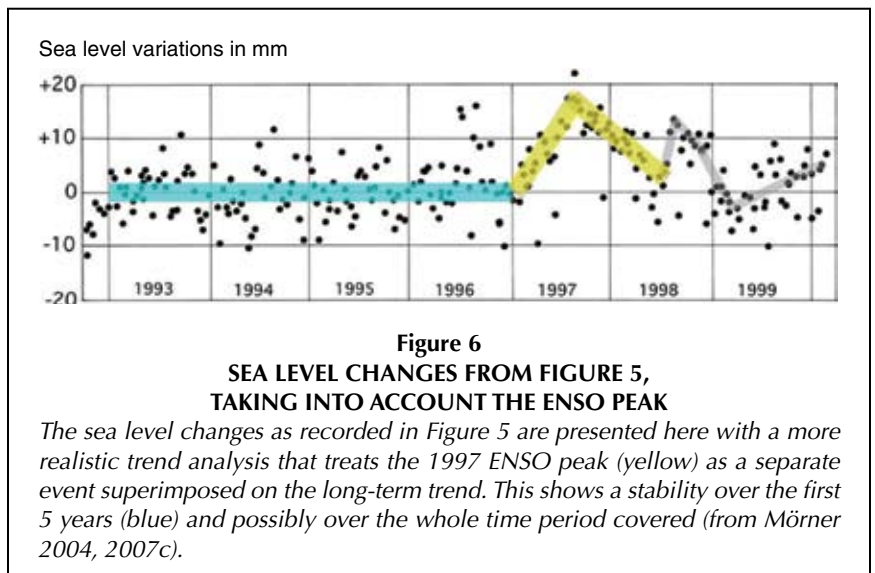
The Topex/Poseidon and later Jason missions recorded the variations of the ocean surface with high resolution. Having applied all technical correction needed, Menard (2000 and also Aviso 2000) presented a first sea level graph ranging from 1992 to 2000 (Figure 5).

The Figure 5 trend of 1.0 mm/year is established by the linear trend approach, ignoring the fact that the big high in cycles 175-200 represents an ENSO-event. (ENSO is the El Niño/La Niña-Southern Oscillation, a quasi-periodic climate pattern that occurs across the tropical Pacific Ocean every few years.) Therefore, a much more realistic approach is to treat that ENSO-signal as a separate event, superimposed on the long-term trend, as shown in Figure 6 (Mörner 2004). Figure 6 shows a variability (of  $\pm$ 10 mm) around a stable zero level (blue line) and a strong ENSO-event (yellow lines) in 1997. The trend thereafter is less clear (gray lines). This graph provides no indication of any rise over the time-period covered (Mörner 2004, 2007a, 2007c).

When the satellite altimetry group realized that the 1997 rise was an ENSO signal, and they extended the trend up to 2003, they seemed to have faced a problem: There was no sea level rise visible, and therefore a “reinterpretation” needed to be un-



*These are the annual mean sea level changes from TOPEX/POSEIDON satellite observations, after technical “corrections” were applied (from Menard 2000). A slow, long-term rising trend of 1.0 mm/year was identified, but this linear approach ignores the ENSO event in cycles 175-200.*

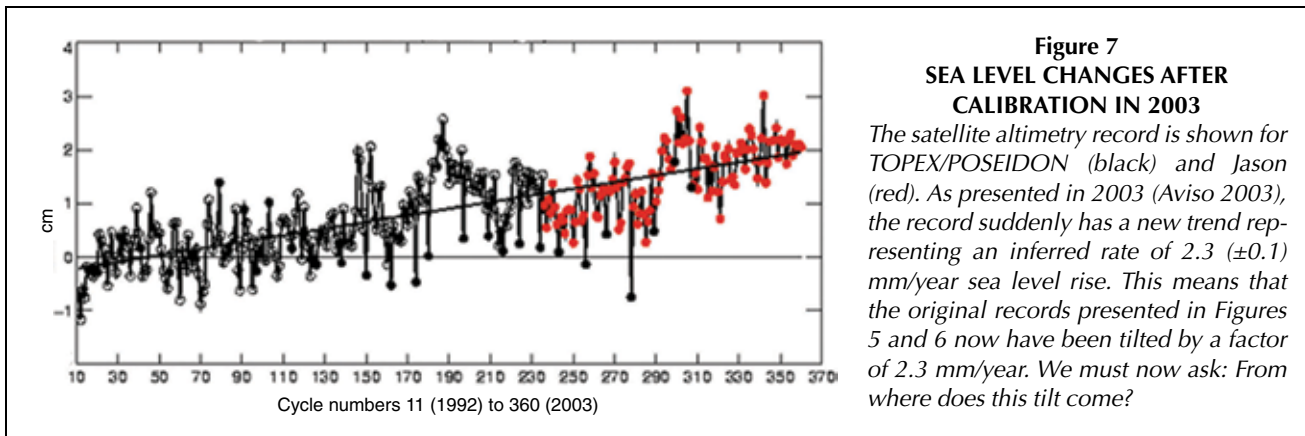


*The sea level changes as recorded in Figure 5 are presented here with a more realistic trend analysis that treats the 1997 ENSO peak (yellow) as a separate event superimposed on the long-term trend. This shows a stability over the first 5 years (blue) and possibly over the whole time period covered (from Mörner 2004, 2007c).*

dertaken. (This was orally confirmed at the Global Warming meeting held by the Russian Academy of Science in Moscow in 2005, which I attended). Exactly what was done remains unclear, as the satellite altimetry groups do not specify the additional “corrections” they now infer.

In 2003, the satellite altimetry record (Aviso 2003) suddenly took a new tilt—away from the quite horizontal record of 1992-2000, seen in Figures 5 and 6—of 2.3 ( $\pm$ 0.1) mm/year (Figure 7).

From where does the new tilt come? What lies flat in Figure 5 of 2000 is now tilted upward in Figure 7 of 2003 (Aviso 2000, 2003). Obviously, some sort of “correction” has been made, without specifying this in a way that allows evaluation (see Mörner 2007c, 2008). In most graphs representing the



satellite altimetry sea level record (on the Internet and in journal papers), it is not even noted that the graphs do not present trends as read by the satellites, but trends after “corrections.”

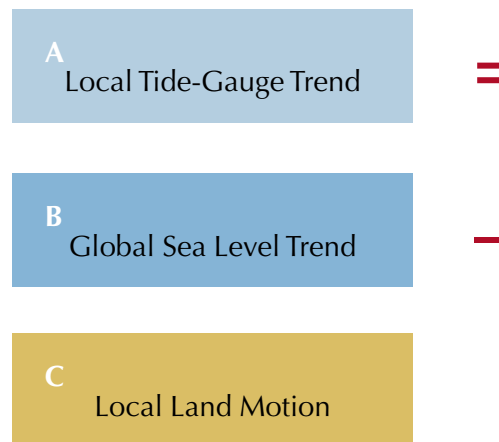
Originally, it seemed that this extra, unspecified “correction” referred to the global isostatic<sup>3</sup> adjustment (GIA) given as 2.4 mm/year (see, for example, Peltier 1998) or 1.8 mm/year (IPCC 2001). The zero isobase of GIA according to Peltier (1998) passed through Hong Kong, where one tide-gauge gives a relative sea level rise of 2.3 mm/year. This is exactly the value appearing in Figure 7. This tide-gauge record is contradicted by the four other records existing in Hong Kong, and obviously represents a site specific subsidence, a fact well known to local geologists.

Nevertheless, a new calibration factor has been introduced in the Figure 7 graph. At the Moscow global warming meeting in 2005, in answer to my criticisms about this “correction,” one of the persons in the British IPCC delegation said, “We had to do so, otherwise there would not be any trend.” To this I replied: “Did you hear what you were saying? This is just what I am accusing you of doing.” Therefore, in my 2007 booklet (Mörner 2007c), the Figure 7 graph was tilted back to its original position (Figure 5).

The calibrations applied to the satellite altimetry readings were discussed in Mitchum (2000—cf. Casenave and Nerem 2004; Leuliette and Scharroo 2010). The tide-gauge records play a central role in this, implying some sort of circular reasoning in arriving at the calibrations. Other important factors are the global isostatic adjustment (GIA) and vertical movements of the tide-gauge sites.

Mitchum (2000) states that in part, “We adopted the rate given by Douglas (1991, 1995) of  $1.8 \pm 0.1$  mm/yr,” and in part that “the tide-gauges were assumed to be vertically stable.” Both these assumptions are wrong. The 1.8 mm/yr rate is not well established, but rather the opposite (see Figure 2). The tide-gauge records, especially those selected, are far from vertically stable, but rather the opposite (this applies for the 6 sites used by Church et al. as well as the 25 sites used by Douglas). Mitchum (2000) provided the following relations (as expressed in the boxed equation below):

3. Isostatic refers to the balance of geological masses and the tendency towards equilibrium.



Each of the three boxes (**A**, **B**, and **C**) includes multiple variables that need painstaking and skillful handling, which certainly has not been done by the groups dealing with the satellite altimetry records and the IPCC community.

To establish a local tide-gauge trend (box **A**), is far from simple and straightforward. Cyclic trends, event signals, and segments must be identified and subtracted. Numerous different variables affect and interfere with the long-term trend. Very often, there is no long-term trend, just segments that need individual treatment (as in the case of the Bombay tide-gauge record, discussed by Mörner, 2010a). ENSO-events (like Super-ENSO events) must be subtracted, as illustrated in Figure 6 and shown for the Tuvalu record by Mörner (2007c, 2010b).

The proposed “global sea level factor” (box **B**) is never clear and trustworthy; rather, it is a matter of personal opinion, as seen in Figure 2. The rate of 1.8 mm/yr is surely an overestimate that is strongly affected by subsidence at the tide-gauges selected (Figure 2). In my opinion, a better value would be 0.0 mm/yr (or just a little above this).

The local land motion at the tide-gauge sites (box **C**) is another intricate issue that calls for geological understanding of the specific site in question. Local sedimentary ground changes (such as compaction, water withdrawal, and so on) is a prime factor to assess (Mörner 2004, 2010b). These changes cannot be recorded by satellite measurements, but only by site-specific knowledge. Many tide-gauges are installed on harbor construc-

tions and landing piers that are far from stable. Crustal movements and seismotectonics are other factors. In the case of the harbor in the Maldives capital of Malé, this island is so heavily overloaded by building that the harbor constructions fracture, and are dislocated in ways that invalidate any trustworthy tide-gauge reading there.

One thing is for sure: satellite altimetry is not providing what is often claimed, an “independent measure of sea level changes” as opposed to that of tide-gauges and global isostatic adjustment. Instead, it is a record deeply dependent on those variables.

With the space gravimetry observations from GRACE it has become possible to record changes in the ocean water mass (Casenave et al. 2009), which approximate the mean global sea level changes (Figure 8).

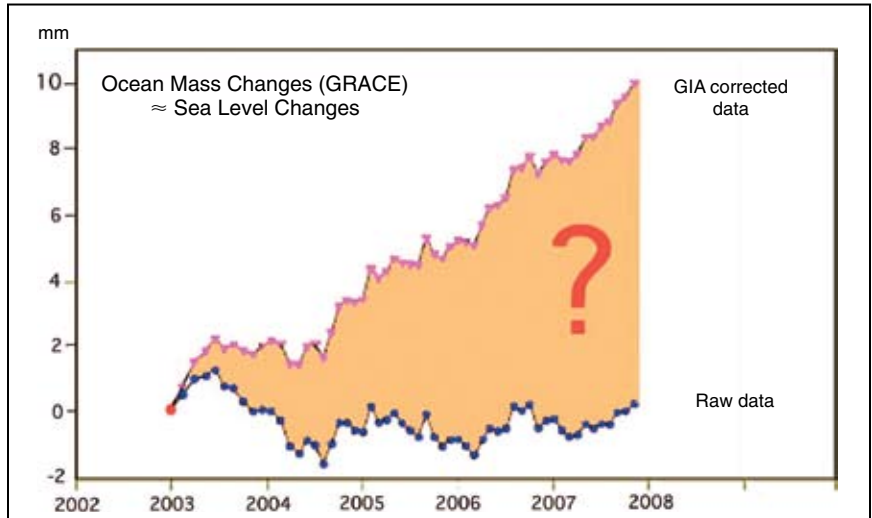
The concept of the global isostatic adjustment, or GIA, is a model, in which some data are in support (see for example, Peltier 1998) and other data are in direct contradiction (for example, Mörrer 2005).

GIA corrections have been applied to tide-gauges, sea level records, satellite altimetry, and now to ocean mass changes. It seems that without those GIA corrections, there is little or no room left for a global sea level rise. Correcting tide-gauges for GIA or regional crustal movement is not the correct way of treating these types of records. Instead, each site must be evaluated from its own criteria with respect to stability, wind, waves, sedimentation, compaction, loading, and tectonics. A blind GIA model correction may provide quite wrong results; it is a dangerous shortcut applied by those persons who are not sea level specialists by training, and hence without the skill to undertake careful site-specific stability analyses themselves.

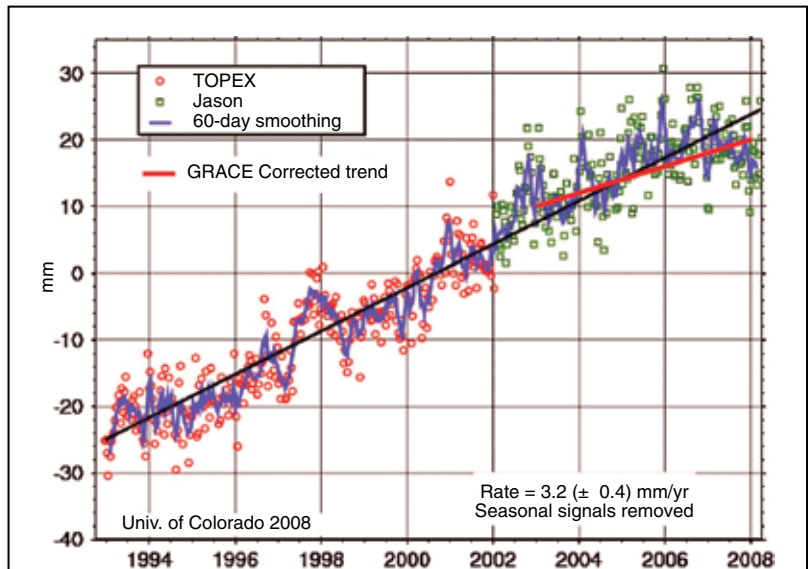
Figure 9 shows the satellite altimetry records as presented by NOAA (2008), which give a rise of  $3.2 (\pm 0.4)$  mm/year.

In Figure 10, the satellite altimetry record of Figure 9 is back-tilted to fit the original trend in Figures 5 and 6 for the period 1992-2000 (yellow fields) and the raw data of GRACE in Figure 8, for the period 2003-2007 (yellow line). This gives an uncorrected satellite altimetry graph showing no signs of any sea level rise. The original record for the period 1992-2000 is restored (cf. Figures 5 and 6) and the GRACE raw data fit the record perfectly well.

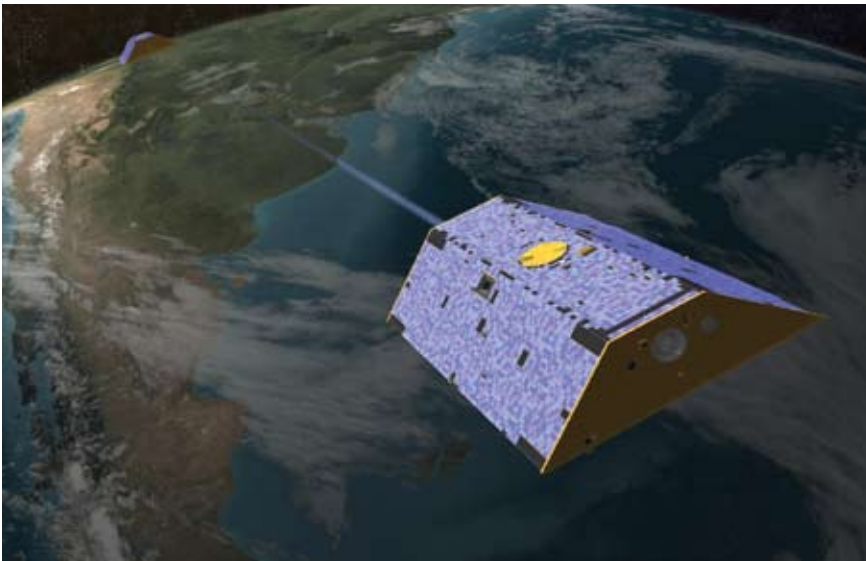
This implies that the Figure 9 satellite altimetry



**Figure 8**  
**OCEAN MASS CHANGES FROM GRACE SATELLITE DATA**  
*The space gravimetry readings from the GRACE satellites record changes in ocean mass which approximate mean global sea level changes (from Casenave et al. 2009). The raw data show a slight lowering by  $-0.12 (\pm 0.06)$  mm/year (blue dots). Inferring a global isostatic adjustment (GIA) correction, which is to be questioned, Casenave et al. (2009) established a corrected rate of  $1.9 (\pm 0.9)$  mm/year (pink dots). The difference is significant. The question is whether or not this “correction” is justifiable.*



**Figure 9**  
**SATELLITE ALTIMETRY AS GIVEN BY NOAA**  
*The TOPEX-Jason satellite data provide a record suggesting a mean sea level rise over the period 1993-2007 of  $3.2$  mm/year. The Figure 8 (GRACE) GIA-corrected trend for 2003-2007 (red line) agrees with the Jason data. This seems to verify that the satellite record is strongly affected by “corrections.” Consequently, this satellite altimetry graph has a long-term trend, which does not represent actual instrumental measurements, but is created by inferred “corrections.”*



NASA/JPL

An artist's illustration of GRACE, the Gravity Recovery and Climate Experiment, a joint U.S./German satellite mission that provides high-resolution estimates of the Earth's gravity field and its variability. Two identical GRACE spacecraft fly about 220 kilometers apart in a polar orbit, 500 kilometers above the Earth. They map the Earth's gravity field by accurately measuring the distance between the two satellites, using GPS and a microwave ranging system. This provides information about the distribution and flow of mass within the Earth and its surroundings, including changes caused by surface and deep currents in the ocean and exchanges between ice sheets and the oceans.

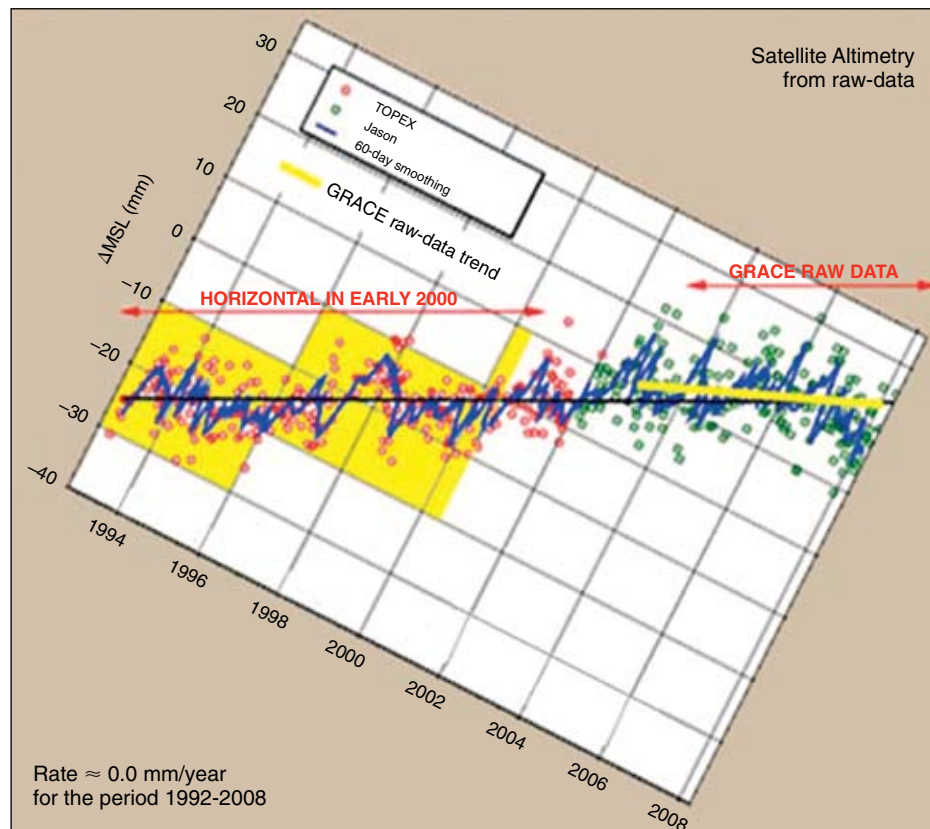
etry record is significantly altered by non-technical "corrections" (whatever they exactly may be). The "corrections" applied are not specified by the responsible groups at CNES (The French space agency, Centre National d'Etudes Spatiales) and NOAA. Various types of corrections can be applied, but these have to be clearly specified. This is not the case with the presently circulated trend of sea level rise from satellite altimetry (see, for example, Aviso 2003 and NOAA 2008). No doubt, we are here facing a serious "sea-level-gate."

If the "corrections" applied are not clearly specified (and discussed and argued for), then the product cannot be objectively evaluated. In this case, it seems to have merged into the sector of disinformation. What is worse, this seems to be intentionally done in order to back up the IPCC sea level flooding scenario.

I have previously claimed (Mörner 2008) that the satellite altimetry recording consists of three steps: (1) satellite instrumental reading; (2) "instrumental record" (after correction from technical

**Figure 10**  
**SATELLITE ALTIMETRY**  
**BACK TILTED TO ITS**  
**UNCORRECTED ORIGINAL**

The adjusted satellite altimetry of Figure 9 is here back-tilted to its uncorrected original trend. The original record for the period 1992-2000 (yellow field) showed variability around a stable horizontal zero line (Figures 5 and 6). The GRACE raw data (Figure 8) show a slightly lowering trend for the period 2003-2007 (yellow line). Together these two data sets indicate that the mean sea level trend has remained stable over the entire period.



Rate  $\approx$  0.0 mm/year  
for the period 1992-2008

adjustments), as presented in Figure 10; and (3) “interpretational record (after the application of “personal calibrations”), as presented in Figure 9. This is illustrated in Figure 11.

As reported above regarding such adjustments, an IPCC member told me that “We had to do so, otherwise it would not be any trend,” and this seems exactly to be the case. This means that we are facing a very grave, if not to say, unethical, “sea-level-gate.” Therefore, the actual “instrumental record” of satellite altimetry (Figure 10) gives a sea level rise around 0.0 mm/year. This fits the observational facts much better, and we seem to reach a coherent picture of no, or, at most, a minor (in the order of 0.5 mm/yr), sea level rise over the last 50 years.

### Conclusions

Observational facts indicate that sea level is by no means in a rapidly rising mode, but rather quite stable. This is the case in key sites like the Maldives, Bangladesh, Tuvalu, Vanuatu, Saint Paul Island, Qatar, French Guyana, Venice, and northwest Europe.

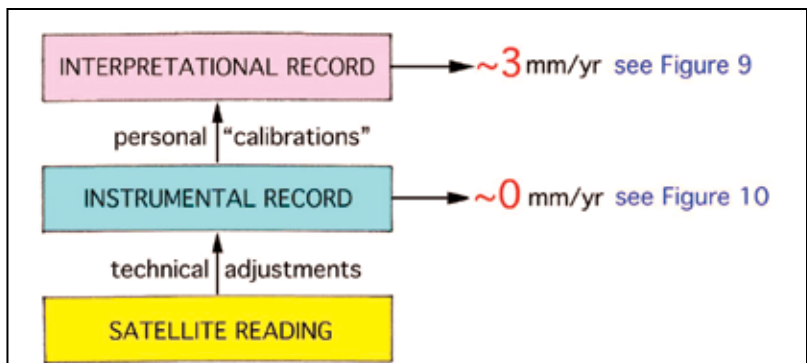
Tide-gauges tend to exaggerate rising trends because of subsidence and compaction. Full stability over the last 30-50 years is indicated in sites like Tuvalu, India, the Maldives (and also the Laccadives to the north of the Maldives), Venice (after subtracting the subsidence factor), Cuxhaven (after subtracting the subsidence factor), and Korsør (a stable hinge for the last 8,000 years).

Satellite altimetry is shown to record variations around a stable zero level for the entire period 1992-2010. Trends in the order of 3 mm/year represent “interpretational records,” after the application of “personal calibrations,” which cannot be substantiated by observational facts.

Therefore, we can now return to Figure 1 and claim that the “models” (pink curve) provide an illusive picture of a strong sea level rise and that the “observations” (blue curve) provide a good reconstruction of the actual sea level changes over the last 170 years, with stability over the last 40 years.

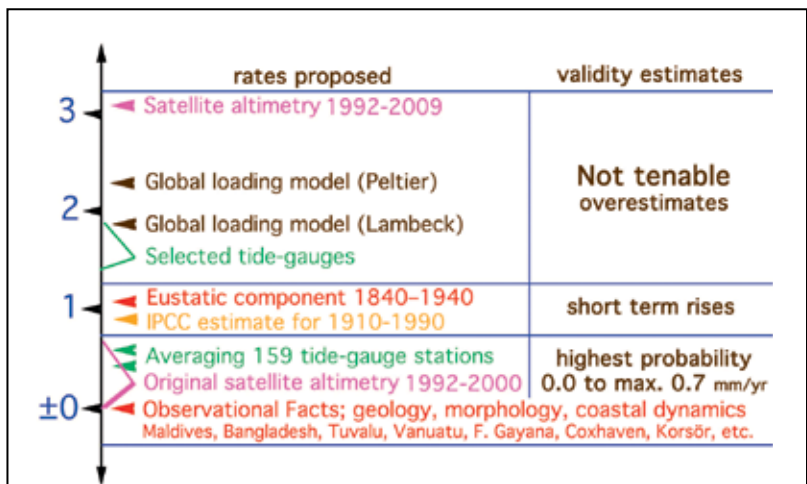
We can also return to the spectrum of present-day sea level rates (Figure 2) and evaluate the various values proposed. This is illustrated in Figure 12. Only rates in the order of 0.0 mm/year to maximum 0.7 mm/year seem realistic. This fits well with the values proposed for year 2100 by INQUA (2000) and Mörner (2004), but differs significantly from the values proposed by the IPCC (2001, 2007).

Thus we see that the sea level threat of the IPCC disappears. The idea of an ongoing sea



**Figure 11**  
**SATELLITE ALTIMETRY AND THE TWO TYPES OF CORRECTIONS APPLIED**

*Technical adjustments have to be applied to the satellite instrument readings. These corrections were applied to the original altimetry graph of Figure 5 (Menard 2000, Aviso 2000) and Figure 6. The “instrumental record” gives a sea level trend on the order of 0.0 mm/year (as seen in Figures 2, 6 and 10). By applying additional “personal calibrations” of a subjective nature, graphs (“interpretational records”) were produced (for example, Aviso 2003 and NOAA 2008) that give an inferred sea level rise in the order of 3 mm/year (as seen in Figure 9). Therefore, the “interpretational record” represents disinformation, not a true “instrumental record” (from Mörner 2008).*



**Figure 12**  
**EVALUATION OF RELIABILITY FOR DIFFERENT PROPOSED SEA LEVEL RATES**

*The spectrum of rate values of present-day sea level rise can now be estimated as to validity. Only values in the order of 0.0 mm/year (as suggested by observational facts) to a maximum of 0.7 mm/year seem probable. Values ranging from 1.3 to 3.4 mm/year are considered to be untenable overestimates. Values in the order of 1 mm/year represent minor centennial rises (and falls). This agrees with estimates of a possible sea level rise by year 2100 of  $5 \pm 15$  cm (Mörner 2004) and  $10 \pm 10$  cm (INQUA 2000), but differs significantly from the value proposed by IPCC of  $37 \pm 19$  cm (IPCC 2007).*



Malé, the island capital of the Maldives, where most of the nation's population is located. Dr. Mörner's research of the sea level record of the past 2,600 years shows a significant sea level fall in the 1970s and no signs of any ongoing rise.



A beach in the Pacific island of Tuvalu, where contrary to the IPCC fear scenarios, the sea level has been stable for three decades.

level rise that would flood islands and low-lying coasts, drowning tens of thousands of people and forcing hundreds of thousands, to millions, of people to become sea level refugees is simply a grave error, hereby revealed as an illusion, humbug, and terrible disinformation. This, without doubt, is a serious and shabby "sea-level-gate."

The true facts are to be found in nature itself; certainly not at the modelling tables. Some records are interpretative. Others are quite clear and straightforward. I have often claimed that "trees don't lie" (for example in Mörner 2007c), referring to the lonely tree in the Maldives, which indicated a stable sea level for the last 50-60 years (and therefore was pulled down by

hand by a group of Australian "scientists" and IPCC boy-scouts). And also the trees on the beach in Sundarban, indicating a strong erosion but no sea level rise at all (Mörner 2007c, 2010a).

By this I hope, we can free the world from the artificial crisis, to which it has been condemned by the IPCC and its boy-scouts, of an extensive and disastrous sea level flooding in the near future. This was the main threat in the IPCC scenario, and now it is gone.

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RUDOLF SCHULTEN'S HIGH TEMPERATURE REACTOR

# A Technology Ready for Today

by Dr. Urban Cleve

*Editor's note: This is an edited transcript of a talk Dr. Cleve gave to an Executive Intelligence Review seminar, Sept. 28, 2010, in Frankfurt, Germany.*

*Dr. Cleve was the head of the engineering department of BrownBoveri/Krupp Reaktorbau GmbH, where he was responsible for the engineering, design, building, testing, and putting into operation of the AVR high temperature reactor. Later he worked in management for companies that built large plants for energy and environment. He retired in 1992, and is now the last living member of the BBC/Krupp leading crew.*

*His presentation was translated from the German by Vyron Lymberopoulos.*

In its first issue of 2010, the German-language *Fusion* magazine reprinted a most interesting contribution by Dr. Rudolf Schulten, "Old and New Ways in Nuclear Technology," which was initially published in 1990. Today, more than 20 years after that first publication, it is exciting to give a lecture in which I can substantiate fully that High Temperature Reactor technology is still up to date, and I will provide the evidence that the thoughts and considerations which Dr. Schulten had as a young engineer during the 1950s, have been, and are still correct and trend-setting.

As a young engineer, I was excited about the task of collaborating on the reactor concept invented by Professor Schulten, the AVR Reactor in Jülich. At 33, I was in a leading position as head of the department for complete engineering and responsible for design, erection, testing, and commissioning of the complete reactor, up to its handover to the customer.

I have never lost this excitement, and therefore I am happy to give this presentation. I will begin with some basic considerations from the viewpoint of the energy policy of Germany at that time.

The German economy after the war was based on:

(1) The most inexpensive and as cheap as possible power supply for industry and households for electricity production. It

was believed that an excessively expensive price of electricity is antisocial, and by and large, that it would hinder the growth of the national economy.

(2) Security of supply.

(3) Optimum use of available fuel and capabilities for electricity and power production, both for households and transportation.

For this purpose, we had available solid fuel (coal and lignite), and liquid fuel (oil and natural gas). All these primary energy sources are suitable for electric power generation in power plants. To date, only liquid fuel is technically sound and economically useful for households and transportation.

In electricity production, the objective was then primarily to use coal and lignite. The noble energies, oil and gas, should

Dr. Cleve addressing the EIR seminar in Frankfurt.



EIRNS



The AVR experimental high temperature reactor. Dr. Cleve headed the engineering team that designed and built the nuclear reactor.



only be used in large power plants in special cases of great benefit to the economy. Back then, the popular belief was that these fuels would only be available for a limited period of time, perhaps up to the turn of the 20th Century. This turned out to be too pessimistic. Today, nobody knows how long these reserves will truly last, with a constant increase in the use of energy and a constant rising world population. Furthermore, the fact is that oil and gas are limited and becoming steadily more expensive. That surely does not need further discussion.

Germany is one of the poorest nations in oil and natural gas. Only coal is widely available. To counteract, at an early stage, an expected worldwide power shortage to come, and to avoid its effects, nuclear power plants were already being developed and built worldwide during the 1950s. The same shortage problem remains today, but in addition to nuclear plants, the so-called renewables—wind and solar power—are now considered alternatives. Some words on that later.

By the 1950s, Professor Schulten already had the idea of building very high temperature reactors, which would not only burn uranium-235 (of which there are relatively limited deposits in nature), but also breed thorium as nuclear fuel and then burn it as uranium-233. His deliberations for a technical solution were based on the following reactor fundamentals:

- Sphere-shaped fuel elements, because of their superior flow and heat transfer characteristics. During reactor operation, these fuel balls can be circulated, replaced, removed, and stored; and burn-up measurements of the fuel can be made.
- Graphite as a basic material for fuel elements and the reactor core, which would serve as a moderator for neutron radiation and is suitable in particular for very high operating temperatures.
- Helium as coolant, because of its very high heat-transfer coefficient.
- An integrated, self-contained primary circuit reactor concept, to obtain the highest safety standards
- Uranium-235 and thorium-232 as fuel, with the objective of breeding new fuel from the thorium, which decays to U-233.
- High operating temperatures for electricity production with the highest thermodynamic efficiency, for optimum utilization of the nuclear fuel.
- Use of the high heat made possible by the high temperatures of the nuclear reaction, transferred by the helium gas, for the engineering and chemical processes of gasification of coal,



*Dr. Rudolf Schulten, who developed the concept of the pebble bed high temperature nuclear reactor.*

lignite, turf, and other biomass. Thus, nuclear fuel would be used to produce liquid fuels for households and transportation.

- Inherent reactor safety. A Maximum Credible Accident or MCA scenario can not occur, even during complete failure of the cooling system.

These were the visionary considerations that led to the success of this technology then, and today, 60 years later, all these considerations are still valid, with no exceptions. In his field, Professor Schulten was ahead of his time, and in this respect, actually only comparable to space scientist Wernher von Braun.

The development pursued in Germany with the high temperature reactor is a big achievement, even though environmentalists do not want to acknowledge this and politicians have not yet recognized this. By the end of the 1990s, when the experimental AVR and the THTR (Thorium High Temperature Reactor)

were decommissioned because of political pressure, Germany had a leading position in this technology worldwide, almost a monopoly.

### Technical Challenges

The implementation of these ideas posed extreme demands on engineering technology. Helium gas constituted one of the largest problems. It is a very thin and dry gas, which had not been used to this extent before.

All the reactor components had to be constructed from scratch, without any prior examples and without previous experience. These components were tried and tested under normal conditions in test facilities, and most failed when installed in the reactor and operated under helium conditions. This inevitably led to constant schedule delays and cost increases.

As an executive, the pressure on me was enormous. From the top, it was once put forward to me: "You build everything two times." My answer was short: "Yes, that is nearly true, but nothing three times."

Testing and trying until ultimate reliability is achieved and all problems are identified and solved, is the decisive foundation for successful development. One time I angrily said, "What shall I do—avoid costs and keep deadlines, or build an installation that works; you can't have both?" I was young enough to assert myself.

It is beyond the scope here, to explain all the technical problems and point out the solutions. Nevertheless, to the engineers, one development, and one can say the deciding one, was very beneficial. This was the development of fuel elements

with so-called “coated particles.” Without this development under wide international cooperation, success of the AVR would have become vastly more difficult. The new graphite fuel pebbles, embedded with coated uranium particles, were developed—and this should be emphasized—in cooperation with: The AVR in Germany; the Dragon project in the United Kingdom; Gulf General Atomics in the United States; the Jülich nuclear research center in Germany; the Institut Laue-Langevin nuclear research center in Grenoble, France; the Austrian nuclear research center at Seibersdorf; the Petten reactor center in the Netherlands; the Atomic Energy Agency in the United Kingdom; the Union Carbide Corp. in the United States; and Nukem, together with Hobeg in Germany.

This unique international cooperation was mainly cofinanced by the Federal Ministry of Research and Education, which contributed a decisive share. The success of this devel-



*The successor to the AVR: The 300-megawatt Thorium High Temperature Reactor (THTR) operated for three years, until it was shut down for political, not technical, reasons.*

opment is best represented when one looks at the original design of the helium cooling system, in the AVR reactor. Initially, the radioactivity was calculated at  $10^7$  curie. Subsequently, the actual radioactivity measured amounted to 360 curie only.

### **AVR: An Unparalleled Success**

The AVR first went critical on August 28, 1966, after successfully passing all the test runs of different components, and nuclear physical measurements to verify the calculations.

On December 18, 1966, for the first time the steam turbine was connected to the grid, with an output of 6 megawatts. Thereafter the reactor was in operation for 22 years, until December 31, 1988.

The reactor was shut down in 1988 solely for political reasons. There were no technical doubts, and certainly no doubts of technical safety were present. For 22 years of operation, a technical safety upgrade was not necessary, no insolvable problems emerged, and no significant technical modifications were necessary. Everything was well thought out from the start.

One event, however, is of foremost importance. In 1967, for the first time, we tested a Maximum Credible Accident, which is one where the fuel elements lose their coolant and all reactor safety devices fail. This was a test of the reactor’s inherent safety concept, devised by Dr. Schulten, which ruled out the possibility of such an MCA. This exciting experiment took place privately, and was barely noticed outside of the plant.

The reactor was driven to the maximum power of 15 megawatts-electric and a predetermined operating temperature of 850° Celsius. Next, all safety devices were disabled, and the cooling gas fans were switched off. As we had calculated, the reactor cooled down by itself over a few days, dissipating the residual heat from the core to the outside.

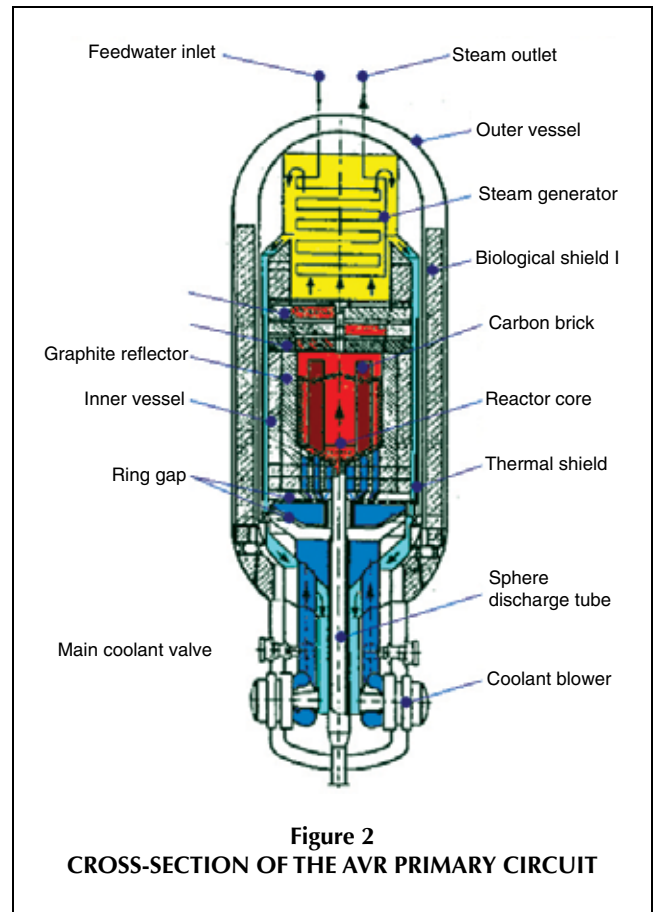
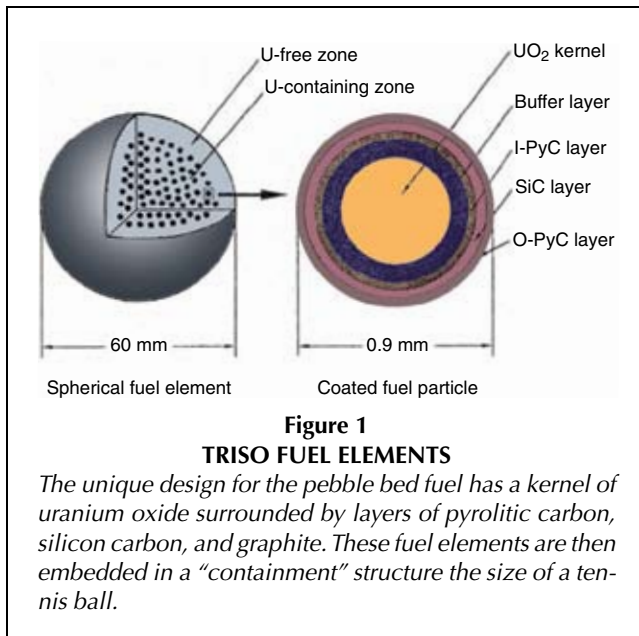
Worldwide, this was the first planned MCA in a nuclear power plant. Nobody outside noticed anything, no radiation penetrated



Hans Weingartz

*Political pressure shut down Germany’s high-temperature reactors. Above: An anti-nuclear protest in Bonn, after the Three Mile Island accident in 1979. Right: Green terrorists in the 1980s attack a German nuclear plant.*





outside the reactor core, and from the control room the operational staff could observe the course of the experiment unmolested. This MCA experiment was repeated in 1979, this time, however, with detailed recordings and measurements of the entire sequence.

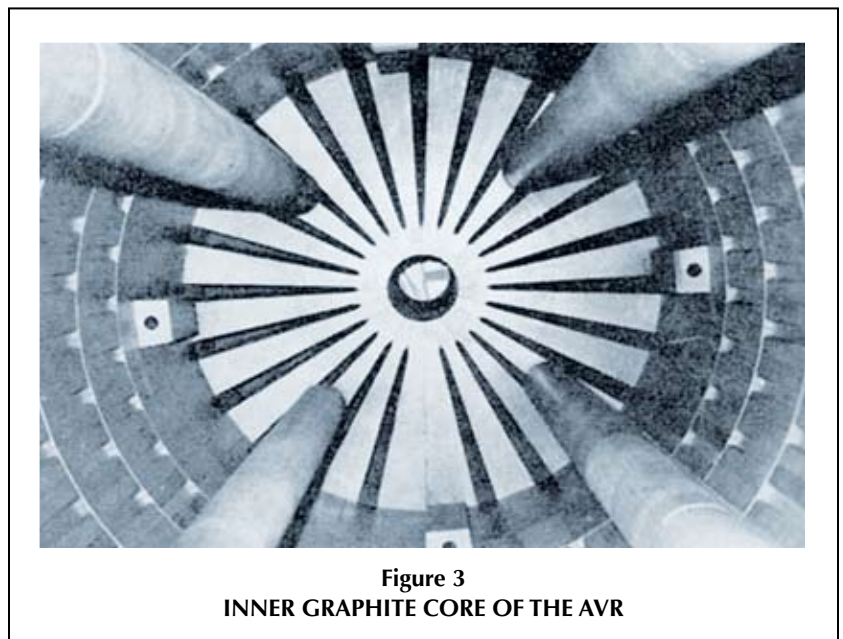
Chernobyl took place later, in 1986; it was not the first MCA. The terrible backlash of the Chernobyl disaster, a completely different reactor construction, weighs heavily upon any safety discussion of nuclear power plants even today. At present, the HTR is the only reactor concept, in which such an accident is ruled out, on the basis of nuclear physics.

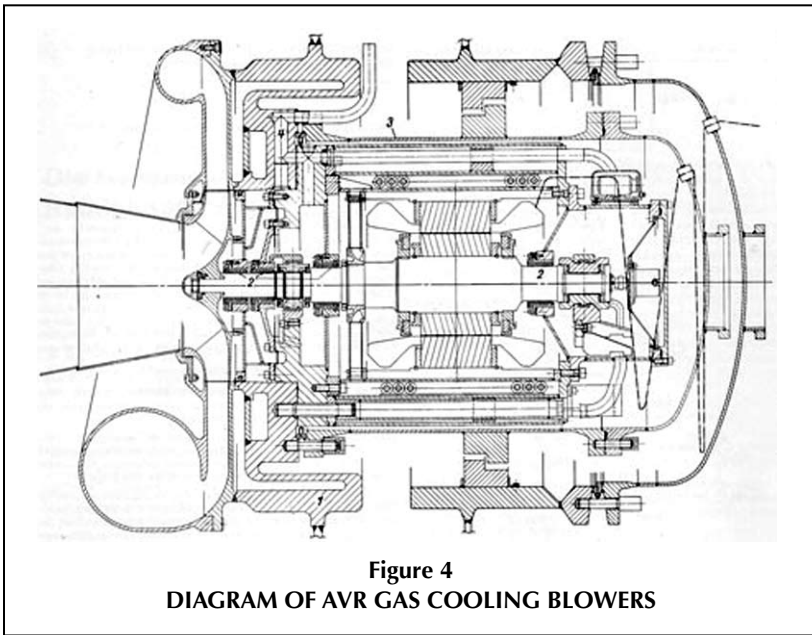
Keeping anything under wraps in politics and public opinion is incomprehensible to every nuclear specialist. And so, when we discuss failures, we should mention one serious failure in the AVR steam generator. The steam generator is considered a critical unit, because, if it leaks, water could permeate the helium system, requiring a total shutdown of operation.

Several hundred thousand AVR weld seams had been examined during construction, and all available testing methods were applied, even those newly developed. All inspections and pressure tests were passed without complaint. Obviously, the effects of water penetration in the system had been calculated in many computations and probes. All indicated that an alarming nuclear failure could not occur. But, sure enough, this failure did occur, although it was not related to safety. According to the international seven-stage assessment scale for incidents and accidents in nuclear installations, this failure can be categorized as a level 1—simply an anomaly.

Nevertheless, the stoppage of several

months, to repair the damage, was unfavorable from an operational standpoint. Practically all other reactor components operated without flaws. Partly worn-out components and small defects could be fixed during ongoing operation, making use of





**Figure 4**  
**DIAGRAM OF AVR GAS COOLING BLOWERS**

disassembly technology that was specially developed for such events, without exposing staff to excessive irradiation.

As a prototype, the operation of the AVR was an unparalleled success story. Not a single radiation accident occurred. During 22 years of operation, not a single employee was exposed to an excessively high radiation dose. The release of radioactive substances to the atmosphere was insubstantial; the exceeding of permissible doses did not occur even once. With the exception of the steam generator, all operational failures that were not 100 percent preventable can be classified as “0” on the assessment scale—having no or insubstantial safety related concern.

The utilization factor, the percentage of reactor online operation time over 22 years, was 66.4 percent. As an experimental reactor, particularly for testing various fuel elements, under the international development program mentioned above, the down time for this work is included. The highest operational availability was reached in 1976, at 92 percent. Although international statistics were not kept, certainly this was a world record for a technology developed from scratch.

#### The THTR Is Conceived As a Follow-up

Already in 1966, the basic concept for a follow-up reactor was developed. Output was specified at 300 megawatts-electric. Without previous operational experience, surely it was a giant leap from an 15-MWe experimental reactor to a demonstration reactor of 300 MW. After weighing all arguments, pro and con, it was a courageous decision to proceed with the larger reactor, and an appropriate one for today.

With respect to the AVR technology, we had to accomplish substantial construction alterations for the larger reactor:

- The steel pressure vessel had to be replaced. A prestressed concrete pressure vessel was designed, a completely new design, globally.
- The limited activity of helium permitted us to do without

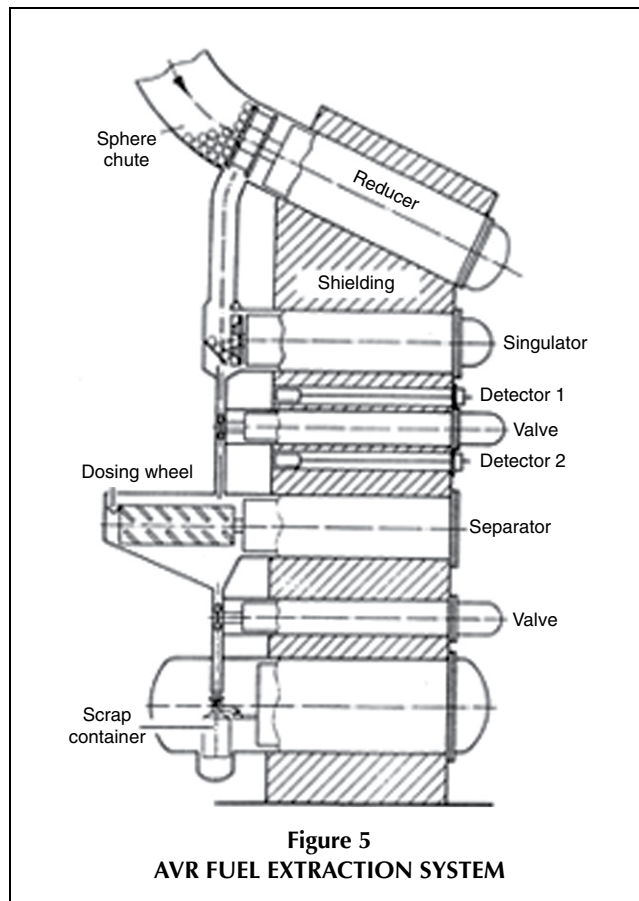
pressure-tight containment. Therefore, only an unpressurized steel casing was designed.

- Because of its increased performance, the gaseous helium coolant had to flow through the reactor from top to bottom; otherwise the fuel elements would withdraw to the upper layers.

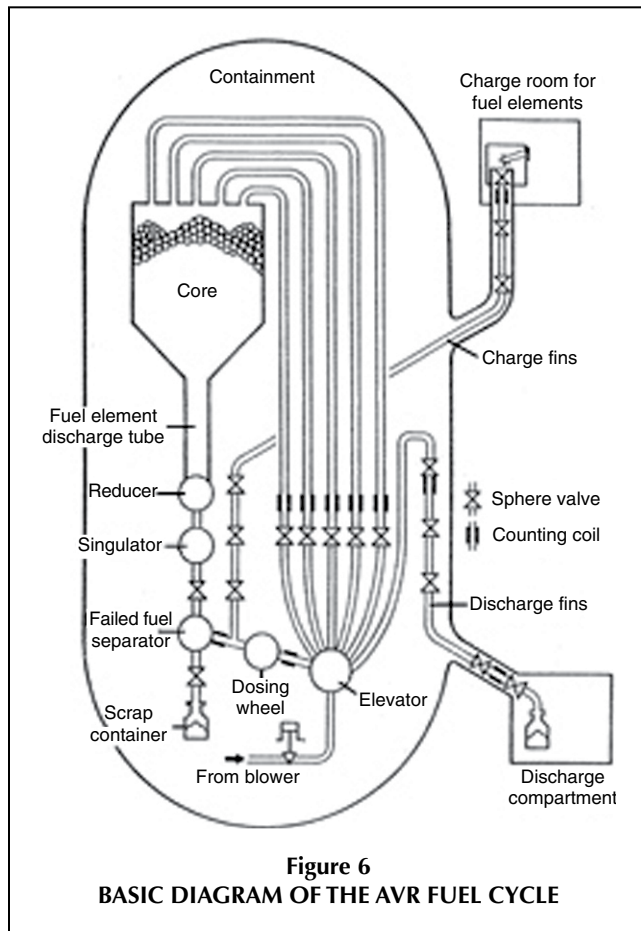
- A new mechanism was incorporated as the trigger for the fuel elements. Once this concept was well advanced during design, the reactor physicists found that the diameter of the pebble bed was so large, it was no longer practically possible to guide the shutdown and control rods in the outer graphite reflector without mechanical stress. Therefore, the reactor would not be able to shut down completely.

During a roundtable meeting with all staff members, this extremely difficult problem was discussed. After it became clear that damage endangering the staff, and above all, the environment, could not occur, it was decided to drive the shutdown rods directly into the

pebble bed. This resulted in a very complicated construction of these rods, and the possible danger of the destruction of fuel elements.



**Figure 5**  
**AVR FUEL EXTRACTION SYSTEM**



It was acknowledged that, in order to learn if this proposed construction was at all technically feasible, a reactor of 300-MW size had to be built. The alternative would have been a conventional ring core design, although without longstanding knowledge of operational behavior of the AVR's graphite interior, the construction risk for this design appeared even greater. Twenty-three years later, after the shutdown of the AVR, this decision proved to have been a mistake, because we found that after 22 years of operation the graphite interior of the AVR was as if brand new. Not a single block had shifted even 1 millimeter!

Unfortunately the decision was in favor of driving shutdown rods into the pebble bed. Operational experience with the demonstration reactor had to be postponed in order to make the final decision at a later stage. During commissioning, regrettably, the feared difficulties actually happened. The conditional difficulties were controlled during operation of the reactor, but nevertheless, the reactor operated for three years.

Comparing the failure rate between the AVR and the THTR shows the problem. The failure rate per circulated fuel element of the AVR was 0.0092 percent, compared with the THTR at 0.6 percent. Naturally that was

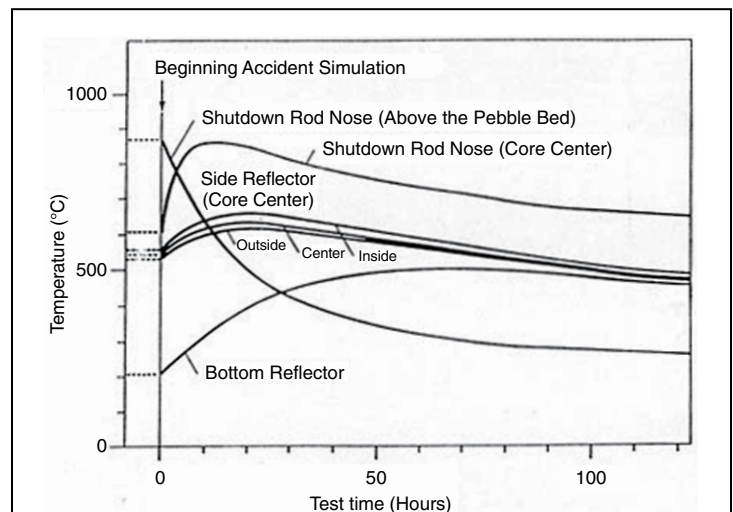
far too high. The sole causes of this high rate were the shutdown rods and the new trigger mechanism. All other components performed flawlessly.

The THTR operated for three years (1986-1989), accumulating 16,000 hours. This time of operation was sufficient to obtain sufficient understanding and experience to build additional reactors. A finding of major importance was the trouble-free operation of steam generation, with the highest thermodynamic efficiency, including intermediate super heating. The startup, shutdown, and routine operation of the THTR installation had operating results that were fully comparable to conventional power plants. As with the AVR, not a single relevant technical failure occurred. Despite problems that occurred, the operating staff was never overexposed to radiation.

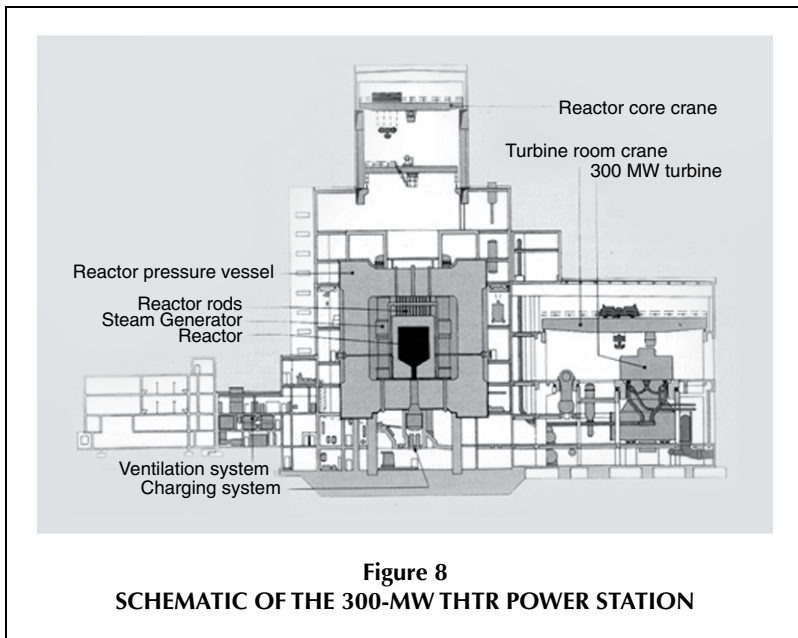
The essential findings and experience with the THTR-300 can be summarized as follows:

- According to guidelines of load distribution, HTR power plants can be utilized for the supply grid; control characteristics, also with regard to maintaining frequency, are perfect. When idle, even when repairing open primary components, the staff is not excessively exposed to radiation.
- The radioactivity of the primary gas helium did not rise when the pebble fracture occurred; the coated particles are so small and strong that they can not break.
- All newly designed components, and the entire installation, except for the above-described problem with excessive pebble fractures, functioned flawlessly.
- As demonstrated by unequivocal evidence, the safety technology is so advanced that no risk exists to the operators and the population. Because of the very low radioactive contamination of the helium, an evacuation of the population is not necessary in case of a worst conceivable accident.

Despite its short operating time, the demonstration reactor



**Figure 7**  
**LOSS-OF-COOLANT SIMULATED ACCIDENT TEST RESULTS**  
*The AVR shut down and cooled down as designed, when operators forced a loss-of-coolant situation.*



**Figure 8**  
**SCHEMATIC OF THE 300-MW THTR POWER STATION**

er nuclear sites are required. Experience with the THTR-300, has shown this is possible without any problems.

- A meltdown, a maximum credible accident, is ruled out from the standpoint of nuclear physics—the inherent passive safety system of the reactor.

- The spherical-shaped fuel elements proved to be the best nuclear fuel. To a large degree, the fissionable material in the fuel particles, with a diameter of only 0.5 mm, is kept inside the core of the coated particles by high density gas-tight covers of pyrolytic carbon (PyC) and silicon carbide (SiC). These layers comprise the first barrier to prevent the escape of fission products to the helium coolant gas.

Further, compared to all other designs, the spherical fuel elements have the advantage that they are very compact and easy to handle. Therefore, after many years of operation, the necessary space for intermediate storage or disposal, is very small, and can easily be accommodated in the concrete substructure.

has yielded all the necessary knowledge and experience required to build new HTR power plants safely. Although little known publicly, the decommissioned reactor provides the evidence that its prestressed concrete pressure vessel is the safest storage repository for radiating components. There is nothing more safe than this from a technical engineering standpoint. No radiation can be detected on the outside of the prestressed concrete pressure vessel. A nice restaurant built on the roof, with splendid views over the Münsterland would certainly be an excellent use for the site!

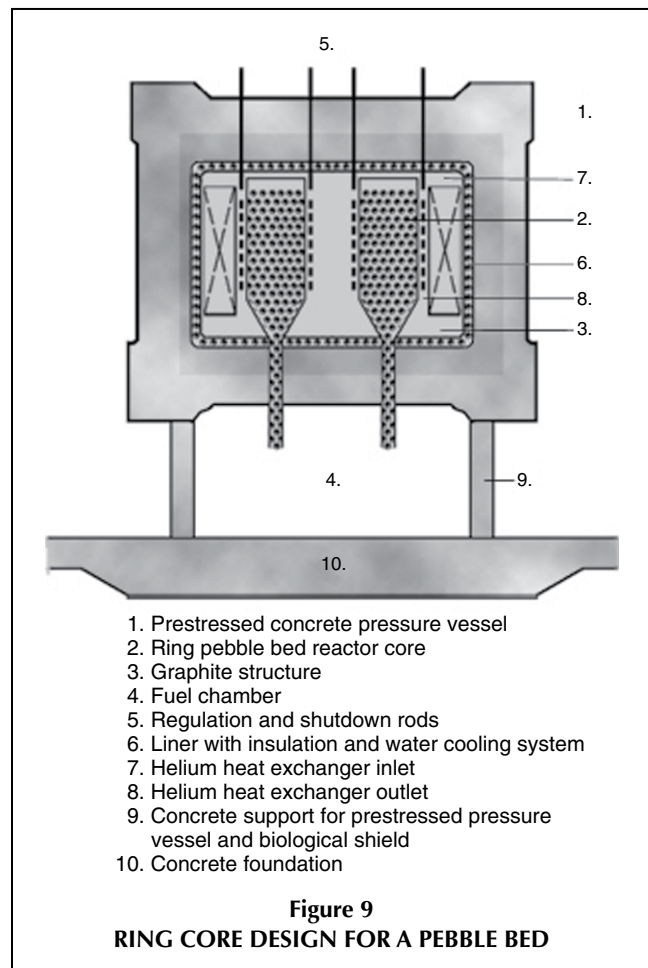
- In terms of safety, the prestressed concrete pressure vessel proved best; it is the important second barrier against the es-

### HTR Decommissioning Lessons

The results of the combined operational experience with the AVR and THTR show that, without further development, it is possible to apply this technology on a large scale. Here are some of my conclusions, from my experience:

To maximize safety is by far the most important criterion with a future very high temperature reactor. Furthermore, the question of final storage of radioactive materials, after decommissioning such an installation, should be planned from the start. The technology I describe, has to be understood as an integrated concept of self-contained Nuclear High Temperature Technology (NHHT). The following design principles are the centerpiece of NHHT:

- Earthquake resistance up to magnitude 6, which for our region here is the highest imaginable seismic security. This is achieved through an extensive, strong concrete foundation, which forms a large base area and enables a stable, gas-tight concrete substructure. All activities which could be associated with exposure to radiation are carried out in the space below the actual reactor. This, for example, includes performing repairs on components, decontamination of the components, and, eventually, permanent storage in confined spaces. Also it would be the final repository for spent fuel. The aim should be that no component that has been exposed to radiation must leave the premises. Therefore, no “spent fuel transports” to oth-



**Figure 9**  
**RING CORE DESIGN FOR A PEBBLE BED**

cape of radioactivity.

- An unpressurized containment surrounding the entire installation, constitutes the third barrier. The volume of this structure is so large, that it can trap and contain all the helium primary gas in the cooling system, without any leakage to the outside.

- Instead of a central fuel-element trigger mechanism with a centered pebble bed core, a ring core is built with multiple trigger devices. With the same basic concept, it enables a building of medium size to equal the high performance installations at optimal circulation of the fuel elements. The shutdown and control rods are installed in the graphite reflectors without mechanical stress.

- A double helium-helium cycle prevents the transfer of fission products, including graphite dust, to the exterior. The primary part of the reactor is also safe against “foreign object invasion” from the outside.

- This concept allows a simple means of control of the whereabouts of nuclear material.

- The pressure vessel’s 5- to 6-meter-thick walls of prestressed concrete provide safety against all kinds of terrorist threats, including aircraft crashes. These walls even stand up against targeted missile attacks.

To this extent, these advantages of technological safety could not be reached by any other known nuclear power plant.

### High Temperature Economics

Now, in summary, here is a brief assessment of the economics of HTR technology:

- The spherical fuel elements are the safest nuclear fuel. Operationally, they are most easy to handle and most safe to store permanently because of their low volume of radioactivity. Moreover, they allow change of fuel elements during operation and without shutting down the installation. This is a major advantage from the standpoint of operational economy.

- The high primary gas temperature allows the highest thermodynamic efficiency, hence the best utilization of nuclear fuel.

- In addition to generating electricity, the high-temperature heat can be used for various industrial processes; for example, for the production of liquid or gaseous fuels.

- The use of thorium-232 enables the breeding of fissile uranium-233 as new fuel. Therefore, the available reserves of uranium U-235, in combination with thorium-232 will suffice indefinitely.

### The Carbon Dioxide Myth

Finally, a word on the question of carbon dioxide in the atmosphere. Without CO<sub>2</sub>, the planet Earth is uninhabitable. Those who claim that CO<sub>2</sub> is a “harmful gas” or “toxic gas,” and who aim for a zero CO<sub>2</sub> target for planet Earth, show an incomprehensibly low level of minimal, most elementary basic knowledge, and lack of general education. Accurate scientific evidence of the CO<sub>2</sub> influence on the climate of our planet

Earth does not exist. On the contrary, for millennia the climate of our Earth has been changing, even without human beings. Nature, not man, but also the universe, with the Sun, Moon, and stars, govern our climate.

Dr. S. Fred Singer comprehensively described this in his book *Nature, Not Human Activity, Determines the Climate*. With the exception of Germany and some European states, all states are acting accordingly worldwide, especially the United States and China. Therefore, the planned emissions trade for power plants is complete and utter nonsense. Nuclear power plant operators should not emphasize the advantage of zero CO<sub>2</sub> emissions, only the economic supremacy of the nuclear technology.

In all nuclear power plants, electricity is generated at a cost factor 6 to 30 times lower than is possible in installations with renewable energy, now and in the long run. Electricity costs comprise a crucial share of the burden on the population, and high electricity prices are extremely anti-social. Above all, energy-intensive industry, which today makes millions of secure jobs available, would have decisive disadvantages compared with foreign competition if Germany persists with so-called renewables. Germany is weakened, and possibly will

be destroyed by the high cost of “renewable energy.” This most certainly will lead to a decisive weakening in all sectors of our economy, with the result that there will be no money available for our social programs.

Only an energy mix by the most inexpensive production plants is an economically sound energy mix. As I explained at the start, this was true in the postwar years, and still is true today. In a letter to the editor of the daily *Frankfurter Allgemeine Zeitung*, on July 19, 2010, Dr. Jürgen Grossmann described the situation as follows: “It is all about a brutal industrial policy.” Whoever does not acknowledge this, and act accordingly, commits a sin against the German economy.

How absurd are the efforts by our government and the opposition parties, attempting to gain worldwide leadership in “renewable energy” so as to prevent CO<sub>2</sub> emissions and thereby protect the climate, is demonstrated by a simple calculation, which appeared in a letter to the editor of the *Frankfurter Allgemeine Zeitung*, of January 14, 2010, (and which brought me tremendous support):

“When there is no man-made CO<sub>2</sub> produced at all in Germany, and the nation would have ceased to exist, this reduction would account for 0.00004712 percent of total CO<sub>2</sub> emissions produced on our planet worldwide. Those who still pursue this zero CO<sub>2</sub> target, therefore, must have succumbed to an unbelievable delusion of grandeur.”\*

\* For more detailed explanations of this presentation, see [www.buerger-for-technik.de](http://www.buerger-for-technik.de), nuclear engineering 2009 and 2010; [www.eike-klima-energie.eu/news-anzeige/umwelt-klima-energie](http://www.eike-klima-energie.eu/news-anzeige/umwelt-klima-energie).

More comprehensive articles about the CO<sub>2</sub> theme, written by thousands of scientists around the world, and not yet understood or read by German politicians, can be found at [www.eike-air-energie.eu](http://www.eike-air-energie.eu) and [www.buerger-for-technik.de](http://www.buerger-for-technik.de). I also recommend the book cited by Dr. S. Fred Singer.

**“When there is no man-made CO<sub>2</sub> produced at all in Germany, and the nation would have ceased to exist, this reduction would account for 0.00004712 percent of total CO<sub>2</sub> emissions produced on our planet worldwide.”**

# Let's Tell the Truth About Plutonium and Hanford

by Michael R. Fox, Ph.D.

On July 10, 2010, the *New York Times* published another article about the Hanford nuclear site in Eastern Washington, this one by veteran reporter Matthew Wald. (<http://tinyurl.com/2azj5kz>). It requires some corrective comments.

During World War II, Hanford was chosen by the Army Corps of Engineers to be one of the sites in what was then called the Manhattan Project. Hanford produced the majority of the nation's inventory of plutonium, including that in the bomb dropped on Nagasaki.

Having many decades of experience working at Hanford, including working with plutonium and managing a plutonium laboratory, it gets wearisome to read such superficial, inadequate, and misleading articles.

Given this specialized background, I feel an obligation to comment on the article by *Times* reporter Wald, the report he reports on, the authors of the report,\*

and some of the references listed in the report. My objections include the huge lack of context, exaggerations, omissions of fact, omissions of key research findings regarding health effects of plutonium, omissions regarding interesting aspects of the Hanford environment, inadequate literature sourcing, and omission of comments on other materials such as americium.

Let's start with the headline: "Analysis Triples U.S. Plutonium Waste Figures." Nowhere in his article does the reporter provide the relative magnitudes of the before and after values. Therefore, the reader cannot assess for himself the amounts of plutonium involved. Three times a small number is still a small number, for example. As written, therefore, the headline is irrelevant and meaningless.

But in the universe of problems with this *Times* article and the report it is based on, the lack of information on "Plutoni-



um Waste Figures" only hints at what lies ahead in terms of other irrelevancies.

The apparent purpose of the paper and the *Times* article is to create another image of looming doom related to the Hanford clean-up mission. Such stories of impending doom from Hanford have been frequent fare from Hanford critics for more than two decades, and all of them suffer from the same litany of exaggerated fears.

Central to the scare stories are the two familiar concepts—"deadly" plutonium and 24,000-year half-life. These have been common bugaboos since the 1970s, when the antinuclear forces and their friends in the media yapped in concert like Pavlovian dogs. The scare stories haven't changed for nearly 40 years, yet during this time thousands of workers operated quite safely with plutonium, because we happen to know a lot about it and how to work safely with it.

When one is managing a plutonium lab, with dozens of workers, personal safety of friends and colleagues was always of utmost importance and a nonsense part of everyday life. That safety effort paid off, in terms of establishing an excellent health and safety record. Obviously, we worked hard and carefully with safety training, laboratory conduct, practices, and habits.

## Gee-Whizzy Half-Lives

Now for that big number: One is reminded of children discovering a gee-whizzy new word or big number for the first time. "Hey, Dad, want me to count to 100?" With regard to that frightening 24,000-year half-life, the term half-life is commonly applied to all known radioactive materials, and is not scary for anyone



Savannah River Site/DOE

A processed "button" of plutonium.





DOE

*The F Reactor plutonium production complex at Hanford. The boxy building between the two water towers on the right is the plutonium production reactor; the long building in the center of the photograph is the water treatment plant*

who has taken course work in radiochemistry.

Nor in the universe of radioactive substances is the 24,000-year number unusual for a half-life. For example, potassium-40 is radioactive and along with two other non-radioactive forms of potassium, is measurably present in all forms of life—including humans, this author, the report authors, and the *Times* reporter. It has a half-life of 1.4 billion years. It is there in living tissue and quite measurable with today's detectors.

Radioactive thorium exists in all soil samples around the world, and has a half-life of about 14 billion years. Carrying the half-life discussion to its obvious absurd ending, elements such as lead, mercury, and arsenic, as stable elements may be described as having half-lives of eternity in length.

When one checks with the "Chart of the Nuclides," there are more than 3,000 known nuclides, and all but about 250 are radioactive. Many of them form and decay in trillionths of a second or less, and do not occur in abundance naturally. But we still know a lot about them. Others, as noted above, have half lives of billions of years.

One long-lived uranium nuclide has a half-life of about 4.5 billion years, the age of the Earth. Uranium, which can be found in all soil samples in the world, was discovered in 1896 by Antoine Becquerel of France. It has been 114 years

since that discovery of natural radioactivity, yet I'd dare estimate that even as a part of our natural environment, 99 percent of the public cannot give a 5-minute discussion on the subject. Same for about 100 percent of the media.

After more than a century of such public ignorance regarding our natural environment, it's way past the time that we learn. This is but a part of the huge con-

text missing from these discussions and articles.

### **Natural Radioactivity and Risk**

The discovery of natural radioactivity turned the world of physics upside down for the next 60 years, and was and still is a major factor in the history of 20th Century physics. There is much more to this subject than merely plutonium and its 24,000-year half-life. This world of physics is essentially unknown to the American public and to the uncurious media.

The Hanford Reservation is one of the most heavily monitored tracts of land in the world, and it has been reported on annually for about 40 years. These annual reports are in the open literature, and available to all. (See for example *Hanford Site 2008 Environmental Report*, <http://hanford-site.pnl.gov/envreport/>) Not surprisingly, these reports are rarely discussed by either the anti-Hanford critics or by any of the media.

These reports are phenomenal in both scope and depth of details. The distribution list for these annual reports is huge, going to state and Federal agencies across the nation. The reports also help explain why Hanford is *not* a threat to public health, because the radiation doses are far too small—often less than



DOE

*The canyon deck of the 820-foot-long 221-B plutonium processing plant at Hanford, which produced weapons plutonium during World War II.*



Library of Congress

*Putting radiation in perspective: The “Mile High” city of Denver, Colorado in 1898. Then, as now, residents of Denver received more natural background radiation (50 millirem) than U.S. citizens living at sea level (26 millirem). Radiation doses at the Hanford site are small, often less than the doses received from natural radioactivity.*

the doses received from natural radioactivity.

Based upon these environmental monitoring programs, relevant epidemiology programs, dosimetry measuring and monitoring programs, etc., for both workers and surrounding populations, the radioactive health threats from Hanford operations are so extremely small that they are statistically indistinguishable from zero.

Since the health threats from the Hanford operations are so small, a huge ethical problem arises out of risk management considerations. As of July 2009, Washington State had 6,664,195 people. The average mortality rate was 725 per 100,000, or a total of 48,285 funerals in 2008. Nearly 22 percent (10,622) of these were from heart disease and about 20 percent (9,657) of these were from cancer. Suppose we were concerned about reducing the cancer mortality rates for the State of Washington, with a fixed budget to do so. How would we allocate such resources?

Common sense would dictate using such allocations where the mortality rates were well above expected values. These locations do exist in Washington State, but such locations do not include Hanford. Given that the cancer excesses occur elsewhere in the state, what fraction of that fixed budget should be directed at reducing cancer at Hanford? The answer, if fairness applied, would be little or none.

However, the Hanford clean-up program (portrayed as a huge safety pro-

gram) is costing taxpayers about \$2 billion per year, with estimates approaching \$100 billion before it's done. No matter how much money is spent on Hanford cleanup efforts, a decline in the cancer rates will never be shown, because the Hanford cancer rates are quite normal now. In terms of basic principles of risk management, the Hanford cleanup is a tragic waste of taxpayer resources in the alleged pursuit of public safety.

Using the same fixed budget in the pursuit of public safety, hundreds, perhaps thousands of Washington State lives could be saved by spending these resources protecting people from measurably more harmful activities.

#### **‘Pure and Simple’ Lies**

The *Times* reporter quoted the activist lawyer Gerry Pollet as saying “What is reasonably foreseeable is that there are people who will be drinking the water in the ground at Hanford at some point in the next few hundreds years. We’re going to be killing people, pure and simple.”

Plutonium toxicity is most assuredly not that “pure and simple.” The activist lawyer apparently is a captive in his own demon-haunted world, as Carl Sagan might have said. His well-rehearsed lines have been commonly heard from him and from the anti-Hanford movement for years, without supportive evidence.

His statement is not supported by environmental and epidemiology studies of plutonium. His statement that “It has been found to cause lung, liver, and

bone cancer in humans” is also referenced in the Alvarez report,\* to another pamphlet with the same quote. The pamphlet was published by the Agency for Toxic Substances and Disease Registry (ATSDR). It, too, does not provide the literature source of the above statement about plutonium.

Since the statement is unreferenced it must be considered hearsay, of which there is plenty to choose from.

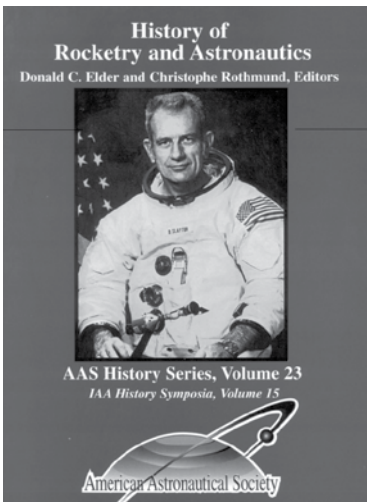
In strong contrast to the *Times* article, there are many quantitative scientific analyses of the “Myth of Plutonium Toxicity,” such as that by Dr. Bernard Cohen, at the Department of Physics at the University of Pittsburgh. (See, for example, <http://russsp.org/BLC-3.html>.)

#### **Some Plutonium Realities**

My experiences with laboratory studies of plutonium show that it is spectacularly insoluble in water and most other solvents. Plutonium prefers to remain in the solid state, often bound to soil solids; thus any study of the transport of plutonium through underground soil formations begs great and detailed scrutiny.

In many cases, plutonium also should not be considered lethal even if it is ingested. At low doses of plutonium in humans, epidemiology studies show that it was difficult to find observable harm, let alone cancer, and let alone death. The

\* The report, by professional anti-nuke Robert Alvarez, has been accepted for publication in *Science and Global Security*, a journal published by Princeton University’s Woodrow Wilson School of Public and International Affairs.



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*The Hanford site on the Columbia River. "After nearly 40 years, the Hanford critics continue to repeat the same old scare stories."*

cited report made no mention of these human epidemiology studies and the negative results.

My friend and scientific colleague Richard Emery performed a study of one of the ponds at Hanford which had received low levels of plutonium (<http://tinyurl.com/25odcag>). It was described as "one of the most contaminated bodies of water" in the world. This may have been factually true, but was missing the important context.

A careful reading of his research paper shows a much more interesting description of the pond, which had phenomenally low levels of plutonium. It actually supported a rich and diverse wildlife population from the bass and bluegill fish in the water, to a number of birds, and the population of predators of herons and coyotes.

These animals were thriving because the plutonium radiation doses were extremely low (in spite of the exaggerations). Emery also calculated that if a human ate one pound of the fish from this U-pond every day for 70 years, he would not receive a significant dose of radiation—hardly cancerous or lethal.

The pond and the rich wildlife populations have now been destroyed, thanks to fear and science illiteracy and the millions of dollars used to do so. This is one of the prices we pay for fear, exaggeration, and lots of money.

After nearly 40 years, the Hanford crit-

ics continue to repeat the same old scare stories, and the media continue to repeat the scares without fact checking, and continue to ignore a lot of the scientific literature. We have also learned that these "true believers," in the words of author Christopher Booker, exhibit a kind of moralistic self-righteous fanaticism justified by the supposed transcendent importance of their cause.

For years, this fanaticism has prevented an atmosphere of serious discussion, let alone a rational approach to the risk management of Hanford. In fact, the scare stories have made a mockery of risk analyses and risk management, not to mention the waste of billions of tax dollars thrown at Hanford cleanup in the pursuit of small or zero risk.

*Michael R. Fox, Ph.D., is a nuclear scientist and a science and energy resource for Hawaii Reporter and a science analyst for the Grassroot Institute of Hawaii. Now retired, he has nearly 40 years experience in the energy field and he also taught chemistry and energy at the university level. His interest in the communication of science has led to several communications awards, hundreds of speeches, and many appearances on television and talk shows. He can be reached via email at [mike@foxreport.org](mailto:mike@foxreport.org).*

*A version of this article previously appeared in the Hawaii Reporter.*

# Space Technology Can Transform Africa

by Marsha Freeman

No continent on Earth is in more desperate need of space science and technology than Africa. Dramatically raising the standard of living of Africa's peoples requires a brute-force, great-project approach, a leap-frog over 20th Century methods, to directly employ the most advanced technologies that are available, and those that are on the cusp of development.

As part of the global extension of the North American Water and Power Alliance (NAWAPA), the LaRouche Political Action Committee has proposed the Transaqua project, which would supply water to Lake Chad, and to the surrounding region, and be the centerpiece of economic infrastructure projects to unlock the potential of Africa. ([www.larouchepac.com/node/15817](http://www.larouchepac.com/node/15817)).

Transforming the continent through projects of the scope of Transaqua, requires mapping resources, comprehensive water management, geographic and geologic analysis, land use planning, the tracking of disease, and agricultural monitoring—all of which are done most efficiently using space-based technologies. Land remote-sensing satellites have long been recognized by numerous African nations as a necessary tool for scientifically informed economic development.

Communication satellites, which can connect rural and remote communities to educational programs, and health and other government services, also help to knit together a coherent national culture. Such satellites also connect African nations with each other, enabling international development projects with a continental impact.



GFSC/NASA/SeaWiFS

*The African continent is at the center of this global visualization, which was produced with data collected by NASA's SeaWiFS instrument. Dark green on land, and red, yellow, and green on the ocean, show where life is most productive.*

But more than any specific economic benefit from space technology applications, such national programs create a cadre of scientists, engineers, technicians, and highly skilled machine-tool and manufacturing operatives, who can then take the lead in creating quantum jumps in productivity throughout the



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*Nigerian engineers working on NigeriaSat-X at Surrey Satellite Technology, Ltd.*

economy, and laying the basis for the breakthroughs by the next generation of Africans.

## Enormous Potential

At present, only a handful of nations in Africa participate in the application of space technology, such as the use of remote-sensing and satellite communications capabilities. But the need, and the potential, are enormous.

South Africa, which has developed the most extensive space capability in Africa, announced the establishment of its South Africa National Space Agency on Dec. 9 of last year. It will bring together disparate space-related efforts in the country, and will also aim to revive space facilities that have been mothballed since the 1990s. The new agency plans to create a satellite-design and building capacity, using local expertise, building on its successful Sumbandila micro-satellite, and circumventing its reliance on satellites from abroad. This year, it will begin a feasibility study to assess the state of the facilities left over from its medium-range ballistic missile program, with the view toward creating a satellite launch vehicle, and will extend its participation in international astronomy projects.

Nigeria established its National Space Research and Development Agency in 1999. The nation's first satellite, Nigeriasat-1, was part of an international microsatellite Disaster Monitoring Constellation, and was built by Surrey Satellite in England. It was launched by Russia in 2003, and produces high quality remote-sensing images. Nigeria's first communications satellite, the Chinese-built

NigComSat-1, was launched by China in 2007. But the satellite failed on orbit a year later, and will be replaced later this year. Nigeria's NigeriaSat-2 is also scheduled for launch later this year, along with a training model, which was undertaken by Nigerian scientists and engineers.

The Algerian Space Agency was created in 2002, and soon after, saw the launch of its Alsat-1 remote-sensing satellite, also part of Surrey Satellite's five-satellite Disaster Monitoring Constellation. In July 2010, the European-built Alsat-2 was launched by India, which included an intensive training program for Algerian engineers and scientists.

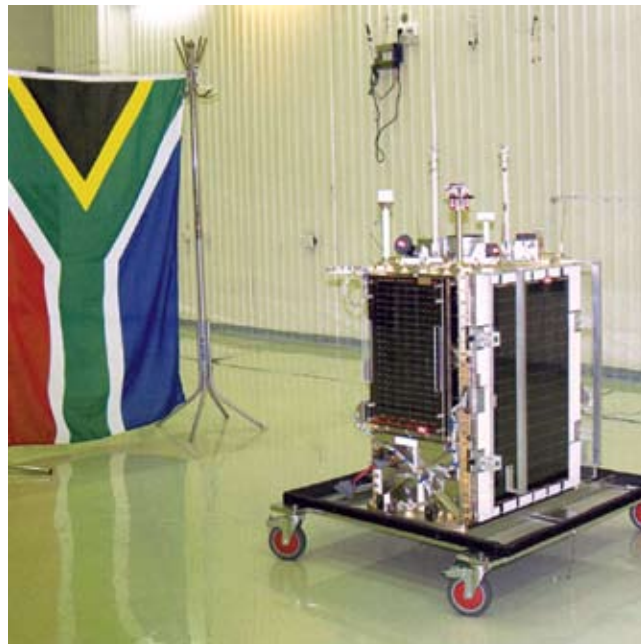
Egypt has operated its own European-built communications satellite since 1998. A follow-on, Nilesat-2, of similar design, was launched two years later.

A next-generation communications satellite, Nilesat-201, was launched in August of last year. For Earth remote-sensing capabilities, Egypt has teamed up with Ukraine's Yuzhnoy Design Bureau, and EgyptSat-1 was launched in 2007. The contract with Ukraine included the training of Egyptian satellite operators, and Egypt's ground receiving stations capture the satellite images.

Egyptian scientists, both at home and abroad, have participated with NASA and other international scientists in studies of the North African desert, the location of ancient subterranean water channels, and existing underground water resources. In 2004, an international team took deep radar sounding measurements at the Bakareza Oasis, testing instruments that could be used to find subsurface water on Mars.

### Going Regional

Various regional African space organizations have been proposed, and some have been created, to pool Africa's limited resources devoted to space applications. Nairobi, Kenya, hosts the Regional Center for Mapping of Resources for Development, which has the participation of 15 African member-states. Satellite data are used to predict floods, as an



www.sunspace.co.za

*South Africa's Sumbandila micro-satellite before its launch in September 2009, from the Baikonur Cosmodrome. Sumbandila means "lead the way" in the Venda language.*

early warning tool for disasters, to track water-borne diseases, and for infrastructure planning, continent-wide.

In 2009, former director of the space program of Egypt, Dr. Mohamed Argoun (see accompanying interview), speaking at the Global Space Technology Forum in Abu Dhabi, proposed that there be a Pan-Arab space agency in the future, when there is a concrete, multilateral program in place, with industrial and university participation. Middle Eastern and African Arab nations, he suggested, should develop a space technology industry, to contribute to a new, high-resolution Earth regional observation satellite.

Another regional initiative came in August 2010, when the Ministers of Communication and Information Technologies of the African Union agreed to conduct a feasibility study on the formation of an African

Space Agency. Its focus would be on telecommunications capabilities.

More recently, Dr. Argoun has proposed an AfricaSat, to bring together, and enhance, the technical and industrial capabilities of Africa. After his presentation at the 61st International Astronautical Congress, held in Prague, the Czech Republic, in September 2010, he was interviewed by *EIR's* William Jones about this proposal, and the importance of bringing water to the African deserts.

Science can still save Africa. This must start with a global financial and economic reorganization that begins in the United States, with the replacement of the bankrupt financial system through a Glass-Steagall policy, the return to a credit-based economic growth policy, and interna-

tional agreements to make that policy global. In this way, Africa can finally be free of hundreds of years of colonial rule, and decades of international financial strangulation, and ready to truly enter the Space Age.



www.sunspace.co.za

*Sumbandila image of the South African city of Stellenbosch, home of the university that helped design the satellite.*

# 'Bring the Benefits of Space To Developing Countries'

*Dr. Argoun is the former director of the space program of Egypt, the National Authority for Remote Sensing and Space Sciences (NARSS). He is currently professor of Aerospace Engineering at Cairo University. After presenting his paper, "Recent Design and Utilization Trends of Small Satellites in Developing Countries," at the International Astronautical Congress (IAC) in Prague, he was interviewed on Sept. 29 by EIR Washington bureau chief, William Jones, on his proposal for a continent-wide satellite project, to help industrialize Africa.*

\* \* \*

**Question: I'd like to ask you about the project you talked about yesterday in your presentation at the IAC. You stated that this project would help bring space technologies to Africa, and expand them to serve as a wedge toward economic development in a very hard-hit part of the world.**

The project is called Africasat. This is an effort, or a project, to bring the developing countries in Africa into space technology. Several countries in Africa have tried to build small satellites.

**Question: How many African countries involved in space technology are there now?**

South Africa is well-advanced in that direction. Egypt has an EgyptSat program. Nigeria has Nigeria-Sat, with two satellites, I believe. And Algeria. Also, Morocco has built a small satellite some years ago.

As I was saying in my talk, in 1990, there emerged a move to get developing countries into the space business. Basically, the theme is to bring the benefits of space to developing countries. One direction of this, was learning space technology, making the engineers, the technical people, acquiring all the ins and outs of this type of thing, thereby enhancing the industry and the

scientific research, and the public awareness of space, and eventually, using the applications and the technologies. So this was a technology-oriented type of project, as opposed to an application-oriented type, as opposed to using the images for development, which is another track of space applications.

On the technology aspect, many countries started building small satellites, and especially remote-sensing satellites, simply because they are simpler, easier to build, they don't cost much to launch, and they're smaller in size. So that is a way of getting into space technology without getting into very large satellites. For most of these countries, the years between 1992 and 2002, approximately, during that period of 10 years, became the period of launching many small satellites. It was pioneered by companies in the United Kingdom and in South Korea,



NARSS

*EgyptSat-1, here in an artist's drawing, is a minisatellite project of Egypt's NARSS (National Authority for Remote Sensing and Space Science) and the Yuzhnoye State Design Office of Ukraine. Yuzhnoye provided technical expertise, on-the-job training, and technology transfer to 60 Egyptian engineers and experts. EgyptSat-1 was launched in April 2007 from the Baikonur Cosmodrome.*



*Dr. Argoun: The AfricaSat project is the way for African countries to develop capabilities in space technology by working together to build satellites.*

who offered the technology to these countries, through cooperation and training programs.

The point is, that after a while, government support for these programs became less enthusiastic.

**Question: Is that because of the expense?**

Because of the expense. Also these countries don't have a very strong industrial base in high-tech. Therefore, these space programs exist generally as an island in the industrial space of these countries. It's difficult to support this and keep it going, because in order to keep it going, you need a lot of input from a strong industry. Governments support these programs because they promise a lot of industrial development particularly, but the economic return is kind of slow in coming, because the infrastructure for using space technology or space applications in these countries is not very strong.

You have satellites and they have advantages, but nobody uses them as much as they do elsewhere. So the satellites are there, but the satellites are only a tool of the technology.

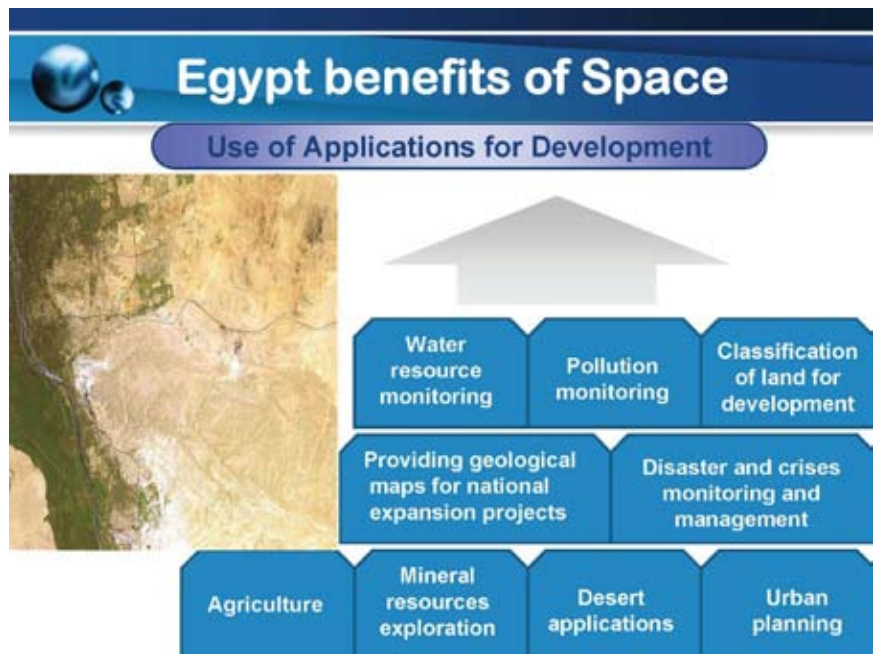
When you come to second-generation satellites, then you have a gap of government support. And this threatens the initial successful move of getting these countries into an initial industrial stage, basically through space technology. They begin to wonder—these things are difficult, they can't be done, they

haven't the background or the education in these countries, and so on. But, if you make a satellite, you can eventually make anything else. It is a way of transforming these developing countries into an industrialized country, in a way.

So when the interest wanes or fades a bit, these programs stop, many of them, or at least slow down. So the idea I was promoting in the AfricaSat project is that the way for these countries to continue getting into space and developing capabilities in space technology is to continue building satellites. But there is no need to build a satellite for each country, and have every country working on everything. We can achieve the same objectives, and much more efficiently, if all these countries join into building one satellite, and every country contributes in whatever area it wants to contribute.

**Question: Can you give an example?**

If a certain country has a particular interest, or a particular development in the communication area, they can design the communications system and build it. If some other country is in materials, they can work on the structure. So each coun-



*An illustration from Dr. Argoun's presentation to the Space Presentation Environment Conference in Cairo, May 2008.*

try chooses that, and they get the benefit of the choice they make.

This is similar to what happened in Europe, where the countries of the European Space Agency concentrate on the area they like, and everybody builds infrastructure in the area they want to develop inside their country, but they all participate in the global project. It's similar to that in Africa. And space by its nature is a collaborative effort. Even the satellite itself does not see borders, and new information flows freely in this area. Even in building satellites, it's much more efficient and much more economical if you do it as a collaborative effort.

So, what we are suggesting is that the project be under the United Nations umbrella, because the United Nations was the one that initiated the UNISPACE-III Conference, which was held in 1999, and really supported this. They encouraged advanced countries to transfer technology for space for peaceful purposes to underdeveloped countries. They encouraged underdeveloped countries and governments to get into this. And actually they are still organizing all these workshops to support these types of endeavors.

So, we are suggesting that under the umbrella of the U.N., there be formed a consortium, or a group of willing countries and willing entities, that together

will help build a satellite, over the long run, for Africa. And of course, it will be directed at the benefit of the African countries, not only in terms of technology, but also images and applications and the like. And eventually, two things will happen. The countries will have the knowledge and the know-how, and they will have a system that brings these countries together for major projects.

One of the problems in countries in Africa is that they do not cooperate effectively and there's no system for flow of management and information and working together. So, if you do a project like this and succeed in making it happen, then you unlock a lot of things.

**Question: How do you take this technology, perhaps relating to the Egyptian experience, in order to create a technical cadre which might have a more general benefit for the nation economically?**

This was one of the regional objectives for the space program when we proposed it. And that is, if you accept and succeed in implementing this program, it gives you a certificate of quality for your products and your processes that is valid everywhere in the world. In a way, space technology has certain features, that if it infiltrates into the local industry, it raises the quality level significantly.

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NARSS

*EgyptSat-1 being assembled in the nose cone of the Dnepr launcher, along with other payloads.*

Things like deadlines. The planning of space takes a lot of planning: Every move is carefully planned and timed very accurately. The quality of the materials, the inadmissibility of error in processes. If you bring these concepts, and do these projects with the local industry, then you raise the standard of that industry significantly. And if you succeed in the final product, then, as I said, you get the certificate of quality to expand. If Egypt makes satellites with their own people, then nobody will be worried about importing from them.

So to do this, we should realize that satellite-making is in a narrow strip of the industry. We are talking about a sector in Egypt that has 100 or 150 people working in it, and perhaps will become several thousand. It's not like a major industry. But, in certain areas of the industry, in electronics, in consumer products of a higher level, it's instrumental. It can change things.

So, what we tried to do is get the components and the parts of the satellites to be manufactured in Egypt under license. We succeeded in making a few,

not many, components. We planned originally in the EgyptSat program to build eight components, and we succeeded in three. So there is a degree of success. It's just a general concept, to bring in the benefits of space technology to industry, to scientific research institutions, to universities, and to the common people. We realize that this is not a great number of people involved, but it is important.



[iiinitiative.wordpress.com/category/satellites/](http://iiinitiative.wordpress.com/category/satellites/)

*Government representatives signing a memorandum of understanding, during the Third African Leadership Conference on Space Science and Technology for Sustainable Development, in Algiers, in December 2009. The African Resource Management Constellation involves an initial collaboration of Nigeria, South Africa, Kenya, and Algeria around sharing of satellite data.*

## DesertSat

**Question:** Now you have developed EgyptSat-1 and are working on EgyptSat-2, and then you will begin on DesertSat. Tell me about DesertSat and how you intend to utilize this. Obviously, this would be of service in dealing with that other major problem for Africa, which is water.

What we have in the Egyptian space program is the third satellite. We have had one every five years, but with a higher degree, an increasing degree, of local participation in each one. So we had 50 percent in the first one, where we were learning and getting the training, and so on; 60 percent in the second one; and we will have 85 percent and higher in DesertSat. EgyptSat-1 was launched in 2007, EgyptSat-2 was supposed to be ready in 2012, and 2017 for DesertSat.

Now the idea of DesertSat, is that Egypt, and Africa actually, have certain characteristics of its land—of course, it is desert. So what you need in a satellite to explore the desert is different from what you need in an education-type satellite or in an eyesight satellite, as in Canada. The sensors, or the scanners, which are the exploring vehicles of the satellite, will have different features, will look for different things.

What you look for in the desert is, as you mentioned, basically the water, traces of water, and possibly oil. And formations of minerals, and that kind of wealth. So we are looking at the spectral stamp of these phenomena and trying to make the sensor more sensitive to these than it is, for example, to ocean water.

One thing, for example, in looking for water: You would look for temperature, because if there is water in an area inside the desert, in a pool somewhere, but underground, what happens, is that the sand in that area might be slightly wetter, slightly cooler than the other sand. So you have to have a sensitivity to this differential in the temperature. This is what we're hoping—to get the sensor designed and built by that





Courtesy of Dr. Mohamed Argoun

*The Aswan receiving station for EgyptSat.*

time and fly it on DesertSat, and use that to map the desert in a different way. That was our objective with DesertSat.

We are now also working to try to design sensors at Cairo University, where I am now doing some research work, in that direction, and also trying to get international cooperation on these kind of operations.

It's interesting. We see this wealth of the desert, if you look at it in one way; and it is a big problem, if you look at it differently. And we have to utilize that in some way and this is one of the ways we can do that.

**Question: Tell me about the development of your space technicians. Initially, with EgyptSat-1, you sent out your people to Ukraine for training. How many were there at that time?**

There were 64. And there are another 60 or so who have entered the program.

**Question: Can you see the point where you would have the internal resources to build your own cadre independently?**

Certainly, I should think 64 is a large number for this type of work. When we first envisioned the project, and talked with many of the companies in the country, we talked about 20 or so. But our objective was different. It was to get a larger number and to use them, as I said, as a fertilization for other groups.

So for EgyptSat-2, a number like 300, or maybe around 240 specialists, would not be a large number. It's about what is needed. Because the 60 were just learners, but behind them was all of Ukraine's space industry. You can't transfer all of

that with 60 people. So we need to increase the Egyptian team for EgyptSat-2 to the range of 200 or 240. And that's happening slowly but surely.

**Question: Is the proposal for AfricaSat coming from the Egyptian government?**

No, it is actually coming from industry people, from people like myself who are interested in space. And we would like to get government and non-government or-

ganizations, research centers, and companies to participate in building this, but under the auspices of the United Nations, so as not to lose the initial effort that was done in building the first satellites in all



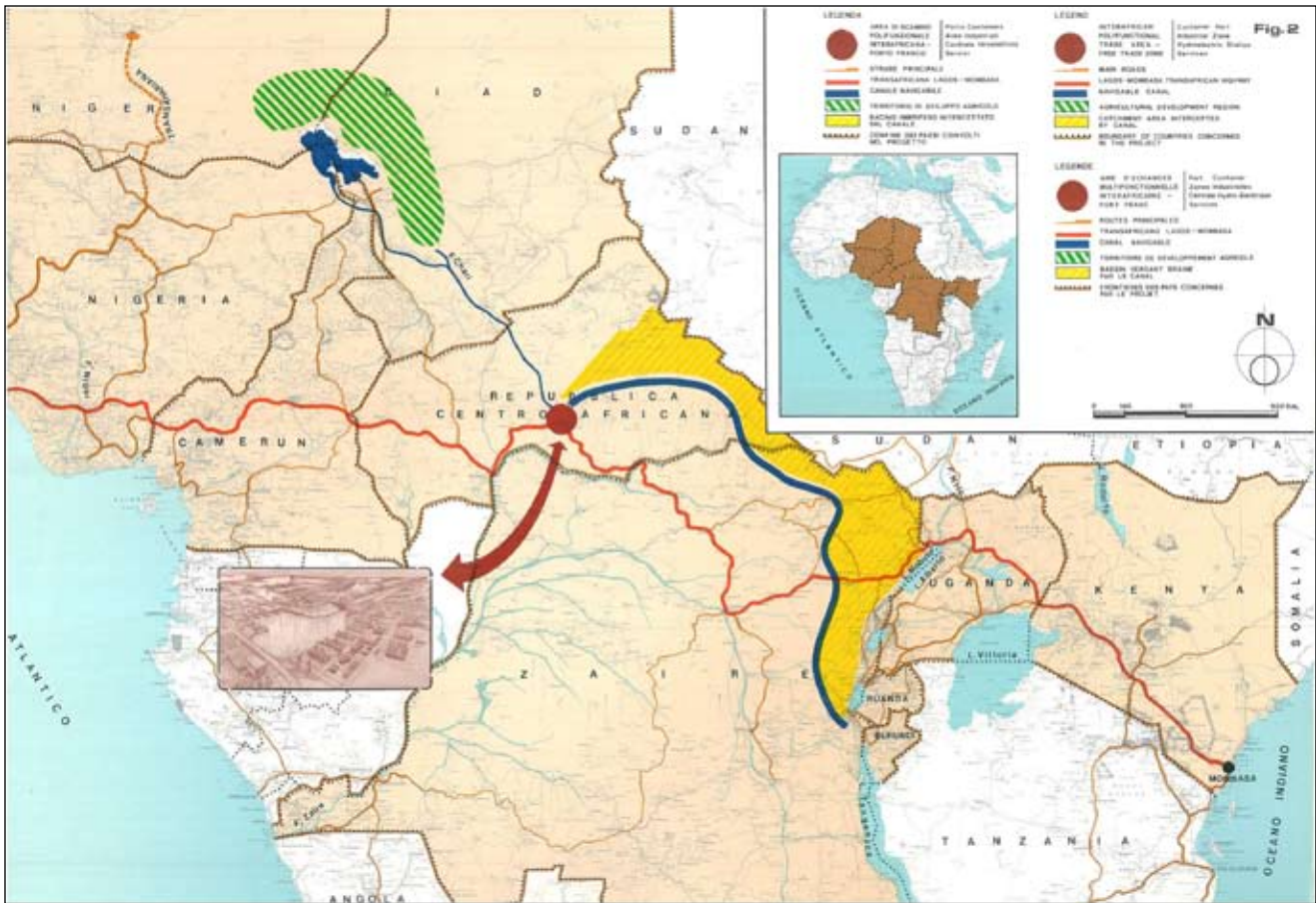
NARSS

*EgyptSat image of Cairo.*



GFSC/NASA

*A 2004 NASA image of a dust storm and Lake Chad (the olive green area). Egypt's DesertSat will be designed to specialize in viewing desert terrain, in particular searching for underground water.*



Schiller Institute

The development of the Lake Chad basin is one part of the huge Transaqua project, which would bring water from the Congo to replenish Lake Chad and reverse the desertification of the area. Lake Chad is in the upper left of the map, straddling the borders of Niger, Chad, the Central African Republic, and Nigeria.

these countries. Because, as I said, the states need much more of a push than was needed at first. And collaboration can ease the burden on each country.

**Question: And what is the level of cooperation between the African countries in this field today?**

It does not exist.

**Question: Then perhaps the International Astronautical Congress, which will be held in Capetown, South Africa next year, may be an occasion to push forward this proposal?**

We should start talking about it and getting some support for the idea, and hopefully it will eventually have enough support to form some active groups to start the planning process.

**The Transaqua Project**

**Question: The LaRouche Political Action Committee, and EIR magazine,**

**have recently relaunched the Transaqua project, to divert water from the Congo River to revive Lake Chad as the source of water for the Sahara region, and to use this project to begin to win back much of the area that has been lost to desertification. This is part of the global extension of the North American Power and Water Alliance [NAWAPA] project, being organized in the United States.**

About creating a new basis of water in the African desert: The problem is evaporation. The heat in that area is absolutely the highest temperature in the world. Actually, there is an environmental model that was built at Cairo University, and it shows that the heat, the temperature—this is the hottest spot on the planet, in the area near Aswan.

The rates of evaporation are very high, to the extent that you cannot use water spray efficiently, because while you are

spraying, a lot of the water simply evaporates. The surface of the particles in small balls of water atoms are flying around, and then, the temperature affects the atoms. So the temperature effect is very serious.

The projects for transporting the water are still viable, but they have to be in closed canals, in closed pipes, basically underground. There is only a limited amount of water that arrives in this area, basically coming from Nile sources, and a lot of it is lost with that vapor. Therefore, the investment really becomes putting this in closed pipes. And pipes are the way of doing it. If you do that, and you put that into deep lakes, rather than shallow lakes, then you can reduce the evaporation. So this is different engineering in looking at the problem. But still it can be done.

Definitely, you can bring these areas to life with water.

# A Feverish Malthusian Defends Malaria As a Non-Problem

by Donald Roberts, Ph.D.

## **The Fever: How Malaria Has Ruled Humankind for 500,000 Years**

by Sonia Shah  
New York: Farrar, Straus and Giroux (Sarah Crichton Books), 2010  
Hardcover, 307 pp., \$26.00

In contrast to Shah, I am an entomologist who has worked for 45 years to combat malaria, and I state unequivocally, from my experience in the developing sector, that DDT is an essential part of the armamentarium against malaria, and that indoor residual spraying with DDT

Clad in presumptions of an enlightened understanding of malaria, its history and evolution, Sonia Shah's *The Fever* presents a subtle array of denunciations and smear tactics against the tools, the methods, and even the motivations of key individuals who endeavored to control malaria, both past and present. Shah comes across as a journalist who is looking for fame. She describes herself as hating mosquitoes, but perhaps she hates people more.

*The Fever* is a book written to charm and soothe other people like herself, the armchair environmentalists who think people are the problem—and who want to eradicate DDT and other essential public health insecticides, not eradicate malaria.

Donald R. Roberts, Ph.D., is Professor Emeritus of Tropical Public Health at the Uniformed Services University of the Health Sciences. He is the coauthor of *The Excellent Powder: DDT's Political and Scientific History* (DogEar Publishing, 2010, available at [www.theexcellentpowder.org](http://www.theexcellentpowder.org)). His numerous field studies and published scientific articles on DDT over the past 45 years, have shown, in particular, that DDT has a unique effect of spatial repellency: Even more important than its killing effect, DDT repels mosquitoes.



Screenshot C-Span/bookTV

Author Sonia Shah thinks people, not malaria or mosquitoes, are the problem.

is most effective in stopping the spread of malaria. The key here is the unique spatial repellency of DDT: Mosquitoes, even those that are DDT-resistant, are



Still River Alliance

Contrary to Shah's belief, the New England mosquitoes were there before the early settlers built mill ponds. Here, an old mill pond in Danbury, Conn.



repelled by DDT and, more often than not, do not enter a house that has been sprayed.

I say this at the outset of this review, because it is crucial to keep in mind that Shah's denunciations of past and present programs to control or eradicate malaria are consistent with those who are responsible for allowing malaria to continue to kill millions of people—instead of eradicating the disease. My intention here is, for the record, to counter some of the misstatements Shah makes to build her case that malaria isn't all that bad.

### Precise Imprecision

*The Fever* introduces the reader to malaria parasites and possible evolutionary scenarios for species that infect humans. The author scrupulously avoids using technical terms in describing the natural

histories of the parasites, the diseases they cause, and the mosquitoes that transmit the parasites. Having sidestepped a defined technical vocabulary, Shah's writing must rest on the depth of her understanding and interpretation of the underlying science. This becomes problematic when she carelessly refers to the unicellular parasites as "gestating" in the mosquito, and states that the parasites cause blood to "curdle" in veins.

Although the terms are



Eugenio Arima/Michigan State University

*A saw mill near Brazil's western Trans-Amazon Highway. It was not government development projects in the Amazon that led to malaria increases, as Shah claims, but the government's phaseout of DDT house spraying—in response to WHO anti-insecticide campaigning and guidelines.*

not precisely wrong, they are nevertheless precisely imprecise, and contribute little to a clear definition of what occurs with parasites in mosquitoes or with parasites in human blood. But far worse than her failure to use precise descriptors in discussions of technical details, Shah mounts a number of deceptive and erroneous arguments.

For example, in Chapter 4, Shah reports that around the time of the Revolutionary War, the main eastern U.S. malaria mosquito caused major malaria outbreaks in New England, because the mosquito had spread north as settlers constructed large numbers of millponds. She infers that people were responsible for the outbreaks, because the settlers perturbed natural environments in ways that favored northward extension of the mosquito's range, and she asserts that those environmental perturbations led to malaria outbreaks where previously there had been none.

Shah's facts are wrong. Dr. Bruce Harrison, one of the world's leading malaria vector taxonomists and mosquito biology experts, states in a review of Shah's argument that Shah is clearly "... wrong in presuming (stating) that *An. quadrimaculatus* came up from the south when the dams were built. I think the current known distribution indicates that [the] species was there with the native Americans, before the settlers arrived and be-

fore malaria arrived in the new world."

Another story Shah related to further her claim that humans are at fault in promoting malaria takes place in the Amazon region of Brazil. Between 1970 and 1999, she says, the malaria caseload in the Amazon region of Brazil zoomed from around 30,000 to 600,000. She attributes those huge malaria increases to agricultural and mineral extraction projects promoted by the Brazilian government. In reality, however, Shah's example of increasing malaria in Brazil illustrates how the malaria burden grows when national programs stop spraying the inside of houses.

I was researching malaria, in collaboration with Brazil's national malaria control program, in the Amazon Basin during the 1970s, and I have monitored the course of its malaria control efforts ever since. I can testify that Shah's information is factually wrong. She should have looked more closely at what happened with Brazil's malaria control program, instead of making superfluous claims about the contributions of new extraction projects.

With a modest research effort, Shah would have learned about the large movement of people and extensive landscape changes in the 1970s, with construction of the Trans-Amazon Highway and the colonization program. That massive alteration of landscape and large movement of malaria-susceptible people

into those areas did *not* result in major outbreaks of malaria.

In fact, the mere 30,000 cases Shah cited for the 1970s were the result of Brazil's use of DDT. Spraying DDT in houses prevented malaria outbreaks along the Trans-Amazon Highway. Large increases in malaria only started in the 1980s, when the government began to ramp down its house-spraying program in compliance with World Health Organization (WHO) guidelines.

During the 1980s and 1990s, the number of sprayed houses in Brazil declined and the number of malaria cases grew. By inferring that malaria is caused by man's impact on the environment, Shah misses the point that our perturbations of natural or already impacted environments can have a positive, negative, or even no influence on malaria transmission.

### **Malaria: No Big Deal?**

In a chapter titled "The Karma of Malaria," Shah attempts to characterize malaria as a normal and natural part of life in malaria-endemic countries. She argues that the perception that malaria is a great killer and that it must be stopped at any cost, is not a view shared by the populations at actual risk of malaria. People in endemic regions, she asserts, accept malaria as a normal part of life. In other words, malaria is no big deal.

Shah touches on this theme repeatedly, as revealed in her statement about a boy who has just been diagnosed with malaria: "The boy, the reader is led to understand, has just received a death sentence. In fact, in endemic countries such as Mozambique, people get tested for malaria not because they are worried that they have it, but in the hopes that they do, for that would mean they don't have anything worse. The positive malaria diagnosis the boy received would have been, in fact, a solace."

This is a false and imperious argument. If there is any relief whatsoever in getting a malaria diagnosis (and I have), it comes from knowing that the disease can be treated. There can be some level of resignation at the repeated exposure to any disease, but this does not mean that people accept as desirable the burdens of malaria illness, the chronic anemia, the risk of low fertility, or the risk of death.

Does Shah actually think people would choose to have an enlarged spleen and liver, or to be severely anemic, or to have



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*Fred Soper (1893-1977) was an American epidemiologist who pioneered methods of disease eradication for malaria, yellow fever, and hookworm, in particular. During World War II, he worked with the Secretary of War in programs to control typhus and malaria. After the war, he directed the Pan American Health Organization.*



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*Soper made use of laboratory analysis in his eradication campaigns. Here, microscopists are screening *Anopheles* larvae for *Anopheles gambiae* in the 1930s.*

a neurologically damaged child, or to lose their infants to infections that can be prevented? Accepting malaria as a normal part of life doesn't mean that people wouldn't opt to be free of it, if given a chance.

### Contempt for Malaria Workers

Shah treats those who study malaria or work to control it with equal disdain. She relates a story about a visit to a research institute in Panama, during conditions of malaria outbreaks, where she describes how personnel were just talking and relaxing, instead of frantically attending to malaria problems. She generalizes from this experience as follows: "Anyone who has worked with health authorities in malaria endemic countries will recognize the pattern. Noises are made about the urgency of the malaria problem, the travesty of thousands dying from mosquito bites—and then the sleepwalker returns to bed."

Her message that malaria workers are willing to talk about fighting the disease, but aren't willing to do much, is absurd—an insidiously mean and unfair characterization. The institute in Panama is a research organization with staff working on many subjects, not just malaria. The government's National Malaria Control Program (NMCP) was the entity responsible for responding to the outbreaks, not the research institute that Shah visited.

As for NMCP people, my experience is the opposite of what Shah says. I find that malaria control workers are diligent and hard working. Almost without exception, they are required to abandon their families for days or weeks of work, and perform hard and arduous duty even though they are underpaid, underfunded, under-equipped, and understaffed. They deserve respect. Shame on Shah for such mean and unfair characterizations.

Another example of false logic is Shah's assessment of the relationship between malaria and poverty. She seems to be saying that those who suggest that controlling malaria will be an economic boon to malaria-endemic countries are wrong. She states: "... while [Jeffrey] Sachs and others have conducted widely cited studies on the correlations between malaria and poverty, none has been able to pinpoint a cause-and-effect relation. Does malaria cause poverty, as they say, or conversely, is poverty responsible for malaria?"

Shah continues this mindless argument without ever noting that no one proposes that it is either one way or the other. In fact, it is both; malaria is such a huge burden on malarious populations that it most assuredly contributes to poverty. Likewise, poverty is commonly associated with the substandard living conditions—for example, no screening, walls with cracks, or no walls at all—that

favor malaria transmission.

A reasonable perspective, which Shah apparently does not embrace, is that fewer malaria deaths and malaria infections will greatly improve human capacities and promote economic advancement. Likewise, to the extent that economic advancements reach the people, improvements in living conditions—for example, screening and better-enclosed houses—this will most assuredly help reduce malaria.

### A Misinformation Barrage

Shah saves her most blistering barrage of misinformation for coverage of the global malaria eradication program and the spraying of DDT on house walls. She introduces DDT with intertwining dark messages of chemical warfare, Nazis and the Jews, nuclear bombs, and Hiroshima. Outrageously, she insinuates that Fred Soper, an experienced DDT champion, was a "fascist," presumably because Soper carried out his wars against diseases with military precision.

Shah reports that the Allied military decided to advance the use of DDT during the war, "despite its alarming toxicity profile." She never explains what she means by DDT's "alarming toxicity profile." Today, after decades of study, DDT is considered safe for human exposure. In fact, there has never been a documented death or human illness as a result of



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*Dusting civilians and Allied troops with DDT saved millions of lives from the scourge of typhus during and after World War II. Here, typhus prevention in Italy during the war.*

exposure to DDT in the environment.

Shah prepares the reader for her anti-DDT onslaught by the old, but ignorantly false argument that DDT had no role eliminating endemic malaria from the United States. She states authoritatively, "By the time . . . the United States created the Malaria Control in War Areas program in 1942 (which would later become the Centers for Disease Control), the weaknesses of their antimalarial methods didn't matter anymore. Malaria had already nearly vanished."

The facts are otherwise. By the early 1940s, the ability of the United States to exert effective control over malaria was still limited, in spite of growing wealth and improving standards of living. As revealed in government documents of that era, control was possible only in urban settings where draining and eliminating aquatic habitats for mosquitoes, and using larvicide to kill mosquito larvae, was cost-effective. In contrast, the only real progress in poor rural areas was to screen houses to prevent mosquitoes from entering and

transmitting disease. Unfortunately, screening required rural people to spend money they didn't have.

The office of Malaria Control in War Areas (MCWA) was created in 1942 shortly after the bombing of Pearl Harbor. In time, spraying houses with DDT became established within the program, and DDT was demonstrably the most effective method of stopping malaria transmission in and around the military installations. Beginning in 1945, the MCWA extended its coverage to all malarious civilian areas. From January 1945 to September 1947, 3.2 million houses were sprayed with DDT, and millions more after that.

But Shah claims that the MCWA program was weak and contributed nothing to malaria elimination—a claim seemingly based on her assumption that malaria was not a problem by the time of this broad spray coverage. Before making this assumption, she should have perused some original sources of historical data. In 1945, for example, Arkansas reported 1,182 malaria cases. After DDT spraying of houses that year, malaria cases dropped to 849 cases in 1946.

Arkansas is one of several states with deeply entrenched rural malaria problems in the 1940s, which was attacked with spray coverage. The pesticide spraying provided other health benefits too. Missouri, for example, sprayed 85,000 homes in 1945, and by 1946, the number of cases of fly-borne diseases dropped by 66 percent.

#### Eradication Bias

Shah remains highly biased against the global eradication program throughout her review of the program's achievements. She mentions the old saw of the program eradicating malariologists, not malaria. She claims that a DDT-sprayed house smelled like chlorine—actually it doesn't. Shah falsely asserts that DDT killed chickens, cats, and so on.

Having worked for decades in many settings in various countries of the Americas, where houses were sprayed or were being sprayed with DDT, I have never heard mention of DDT being a problem for domestic animals. Perhaps there were unusual food chains and events in other areas of the world that led to such events,

but they were not a normal outcome.

Shah is correct that the agricultural uses of DDT led to problems of DDT resistance, although her description is not correct. She describes mosquitoes alighting on DDT-dusted vegetation and concludes that what didn't kill them, only made them stronger. Of course, resistance only improved chances of their survival in the presence of DDT, so it did not make the mosquitoes stronger at all. In fact, resistance could actually reduce mosquito fitness for survival away from DDT-sprayed vegetation.

Shah describes DDT resistance as a huge and growing problem for success of the global anti-malaria program, a view promoted by the anti-pesticide faction. Apparently, she does not know that the last malaria program review in 1969, found that only about 1 or 2 percent of malaria-endemic regions exhibited insecticide or drug resistance, or other technical problems.

With this misanalysis of resistance, Shah then states that the problem of DDT resistance caused countries to begin using alternative methods of control, such as mass drug administration (MDA). She illustrates this by describing Brazil's use of chloroquinized salt in the Amazon Basin. Apparently, Shah does not know that *Anopheles darlingi* is the major malaria vector there, and that after decades of DDT use, the Brazilian populations of *Anopheles darlingi* are not now, and never have been, resistant to DDT. Actually, Brazil's experiment with chloroquinized salt had nothing at all to do with DDT resistance. Shah rightly informs the reader, however, that drug resistance was sometimes the dominant result of MDA programs.

#### DDT Demonization

After her wide-ranging warm-up to the supposed failings of DDT and malaria eradication, Shah begins demonizing DDT, with the same erroneous claims used in the 1960s. Shah repeats the DDT-robin story as described by Rachel Carson in her book *Silent Spring*. More than any other part of *The Fever*, this story reveals that Shah does not know what she is talking about, or is willfully lying. The claim of DDT endangering the robin was disproved decades ago. In fact, Shah overstates Carson's story by claiming that robins were eliminated completely from the Michigan State University campus. Not even Carson made such an out-



U.S. Army

*The office of Malaria Control in War Areas sprayed millions of U.S. houses with DDT to stop the spread of malaria, contrary to Shah's claim that malaria had "nearly vanished" by the 1940s. Here, MCWA training a malaria control unit in swamp draining in Louisiana.*

geous claim, nor have others. Yet, Shah presents it as gospel truth.

In sequence, Shah quickly announces the end of the global malaria eradication program and the resultant resurgence of malaria in countries around the world. She ties all this to the ending of funds from the United States, which she reports as occurring when the five-year appropriation for the global eradication program ended, in 1965. The end of that appropriation, Shah says, was just the excuse the endemic countries needed for abandoning their malaria programs.

Again, Shah's conclusion is wrong. The internal reports of the World Health Organization throughout the 1970s document how countries struggled to continue their malaria programs in spite of declining international support, and in spite of environmental activist pressures against DDT use. Surprisingly, many countries succeeded in continuing their programs.

Even Shah's assessment that program funding ended in 1965 is wrong. The U.S. Agency for International Development (AID) and the Public Health Service actually continued funding national eradication programs at incrementally lower levels into the early 1970s.

In her closing comments about the

global program, Shah makes sweeping denunciations. She states that the global program had made malaria more vicious and harder to control than before, and that chloroquine and DDT had been rendered toothless. Without doubt, where drug resistance evolved the control programs had to switch to alternative drugs. However, in the case of DDT, its primary mode of action is as a *spatial repellent*, not as a killing agent. Hence, resistance signalled only a failure of DDT toxicity, so DDT could still exert control over ma-



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*A malaria control sign in Zambia. Shah questions the value of malaria eradication campaigns and pesticide spraying. In her view, malaria isn't a problem, and the natives aren't worried about it.*

laria through its spatial repellent action.

Last but not least, there is no evidence that the malaria parasite became more vicious as a consequence of becoming resistant to chloroquine. Shah's statement that chloroquine and DDT had been rendered toothless by the end of the program is nonsense, as the 1969 program review makes clear.

Overall, Shah criticizes malaria control methods (drugs, insecticides, and insecticide-treated mosquito nets), both past and present, as highly flawed. She criticizes organizations that work to control malaria as ineffectual. She attempts to undermine credibility of malaria control proponents by suggesting ulterior motives for their advocacy. She questions the value of the achievements of the global malaria eradication program, and proposes that programs that continue spraying houses are a waste.

The author makes no constructive suggestions about what she thinks should be done as alternative methodologies for malaria control. Additionally, she never even mentions that large and extremely well-funded environmental and anti-insecticide campaigns were the primary force in stopping malaria control programs.

### Indefensible

In conclusion, Shah's criticisms of DDT and malaria eradication are erroneous and indefensible. To question the value of the global malaria eradication program, one must trivialize the hundreds of millions of infections that were prevented, the elimination of malaria threats from large geographical areas, the prevention of millions of premature deaths, and the great reductions in maternal and infant mortalities.

As Shah herself states, life expectancy in Sri Lanka increased from 43 to 57 years as a result of the global malaria program. Just imagine: across Sri Lanka's population of 15 million, this would equate to an increase of 210,000,000 years of human life. This example is for just one small country. Even greater changes in life expectancy occurred in other countries, all as a result of spraying DDT.

How can any reasonable person seriously question the value of a program that can produce such results in just 10 years at a cost of only \$1 billion?

# Looking at Man's Role In the Universe

Oyang Teng

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## Talking About Life: Conversations on Astrobiology

by Chris Impey

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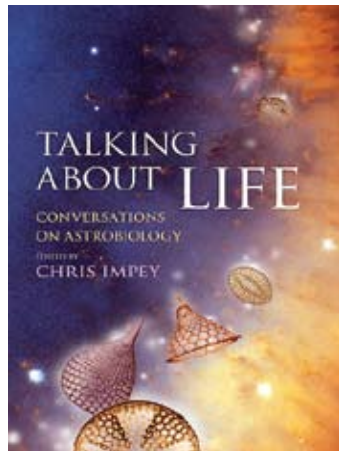
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Under better cultural circumstances, conversations on astrobiology would inspire reflections on the beauty and power of life as a negentropic ordering principle in the universe as a whole, as questions concerning the relationship of discrete organisms to larger planetary and cosmic conditions touch on the most fundamental aspects of what Vladimir Vernadsky called the harmonious cosmic mechanism responsible for life.

Alas, science today is dominated by dogmatic laws of universal entropy and statistical probability, and a pervasive pessimism respecting man's role in the universe. So, in addition to providing a broad survey of contemporary research in this important field, Chris Impey's *Talking About Life: Conversations on Astrobiology* at the same time provides a clinical view of the epistemological poverty of mainstream science today.

(Consider this gem from psychobiologist Lori Marino, on the comparison of human beings to other intelligent life on Earth: "I don't think we're qualitatively different. Though we build 747s and chimpanzees make termite sticks, these activities may not be so different on a qualitative level." Really.)

But, given the organization of the book—a series of transcribed oral interviews conducted by Impey with researchers and writers connected to astrobiology—it almost can't fail to be an interesting read, as informal shop-talk by scientists tends to be. Not surprisingly, the better selections come from people doing actual experimental research or field work: people like self-described paleo-bio-geochemo-tectono-strato-sedimentologist



Roger Buick, who gives an absorbing account of searching for signs of ancient life in ancient rocks; or Carolyn Porco, imaging team leader for the Cassini probe, who describes the thrill of trying to untangle Saturn's complex ring structure, and the almost maternal commitment required to oversee planetary robotics missions.

### The Right Questions

Aside from an obvious need for more funding, astrobiology perhaps is most in need of the right questions, questions which go beyond the painfully narrow interpretation of life as a fortuitous interplay of chemical constituents. As an example, the clearly established influence of low frequency, low-intensity electromagnetic fields on the internal regulation of living organisms is one area in need of a systematic research program in the field, especially given the pervasive action of interplanetary electromagnetic fields evident in our own Solar System.

Ultimately, it will be breakthroughs on policy, and the adoption of what Krafft Ehrlicke called humanity's "Extraterrestrial Imperative," that will drive such questions. Indeed, even more interesting than the question of where else in the cosmos we can find signs of life, is: What do we need to know to bring it there?

## Krafft Ehrlicke's Extraterrestrial Imperative

by Marsha Freeman

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From this new book the reader will gain an insight into one of the most creative minds in the history of space exploration.

Krafft Ehrlicke's contribution to space exploration encompasses details of new, innovative ideas, but also how to think about the importance and value of space exploration for society.

The reader will gain an understanding of the early history of the space program for which they have helped accomplish, and how Ehrlicke's vision of where we should be going can shape the future.

At this time, when there are questions about the path of the space program for the next decades, Krafft Ehrlicke has laid out the philosophical framework for why space exploration must be pursued, through his concept of the "Extraterrestrial Imperative," and the fight that he waged, over many years, for a long-range vision for the program.

Readers will find it a very imaginative work, and a very up-lifting story.

Krafft Ehrlicke's *Extraterrestrial Imperative* is the summation of his work on encouraging the exploration and development of space. The book contains all of his reasons why we need to get off the planet and explore space.



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