

# EIR Science & Technology

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## Dr. Robert E. Stevenson: Father Of Space Oceanography

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*In memoriam: Robert K. Stevenson recounts the fascinating career of his father, space oceanographer Bob Stevenson, who died of cancer on Aug. 12, 2001.*

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Robert Everett “Bob” Stevenson, the only child of Zella and George Stevenson, was born in Fullerton, California on Jan. 15, 1921. As a young boy and teenager growing up in the 1920s and 1930s in Fullerton (in what was then largely undeveloped Orange County), Bob and his father occasionally went to Newport Bay to fish. From the exposed seacliffs, revealing their fascinating geological history, to the rhythmic tidal surges, there was much here to arouse a budding scientist’s curiosity. And, in time, “The Marshlands at Newport Bay, California,” considered a classic, became the topic and title of Bob’s Ph.D. dissertation. Majoring in geology, Bob earned his Ph.D. in 1954 from the University of Southern California.

From 1953 to 1961, Bob served as Director of Inshore Research for the Hancock Foundation at the University, authoring many scientific papers during this time, such as: “Fog in the Los Angeles Harbor Approach Area” (1955), “A Shoreward Movement of Cool Subsurface Water” (1956), “The Marine Climate of Southern California” (1959), and “Winds over Coastal Southern California” (1960).

By now Bob had become a practicing oceanographer. For decades, oceanography had been regarded as a “backwater” science, but during the Cold War days (late 1940s to 1989), it assumed great importance. Soviet and U.S. submarines, armed with nuclear-tipped ballistic missiles, constantly played games of hide and seek, using oceanographic data to help remain hidden, or, conversely, to discover and track the foe. During his lengthy career, Bob was to make numerous

oceanographic discoveries of enormous scientific and military value.

Bob spent much of 1959 in England, researching the Yorkshire coast, under a grant from the U.S. Office of Naval Research. Resulting from this was his monumental work, “The Summer Climatic Environment of the Yorkshire Coast, England” (1961), which contained 98 figures. But it was in 1966 that Bob’s greatest scientific accomplishment was to occur—a profound new insight, which in turn generated the creation and development of an entirely new field of science: Space Oceanography.

The genesis of this insight, a product, in part, of Bob’s earlier job duties in 1951 to 1953 during the Korean War as Chief of the Photo/Radar Interpretation Section at Wright-Patterson Air Force Base, was described in the February/March, 1970 issue of *National Wildlife* magazine:

“In 1966 a color photo was shown to a scientist named Dr. Robert E. Stevenson. The photo had been taken by Astronaut Ed White during a Gemini flight. He had aimed the camera at Gordon Cooper’s favorite fishing waters off Florida, and hoped to bring back a good shot to show his fishing cronies. Cooper was disappointed when he saw the result because the Sun’s reflection was smack in the field of view.

“Dr. Stevenson, though, thought otherwise, and he was a man uniquely qualified to interpret the photo. Professionally trained in meteorology and geology, he had also served as a professor of oceanography at Florida State University. By a stroke of luck, as far as this photo was concerned, he had done

pioneering work in photo interpretation during the Korean War. And at the time he first saw the photo he was Assistant Director of the Biological Laboratory of the Bureau of Commercial Fisheries at Galveston.

“‘I honestly was flabbergasted,’ Dr. Stevenson recalls, ‘when I saw White’s photo. My first thought was that such photos could enormously increase our commercial fishing yield. No, I couldn’t actually spot schools of fish in that photo, taken from an altitude of 120 miles. But I could see everything that we were spending months to pinpoint by boat and plane — the shallows, the silt discharges, the upwellings, the estuaries, the interference currents. And these are the things that determine where fish feed. It really was astonishing; after one look at that photo, I was willing to bet I knew where schools of fish could be found.

“‘I also sensed that the biggest breakthrough of the space program might not be the exploration of the Moon, but the opportunity to hang a camera out there in space and use it to locate more food from the sea than we’d ever imagined.’

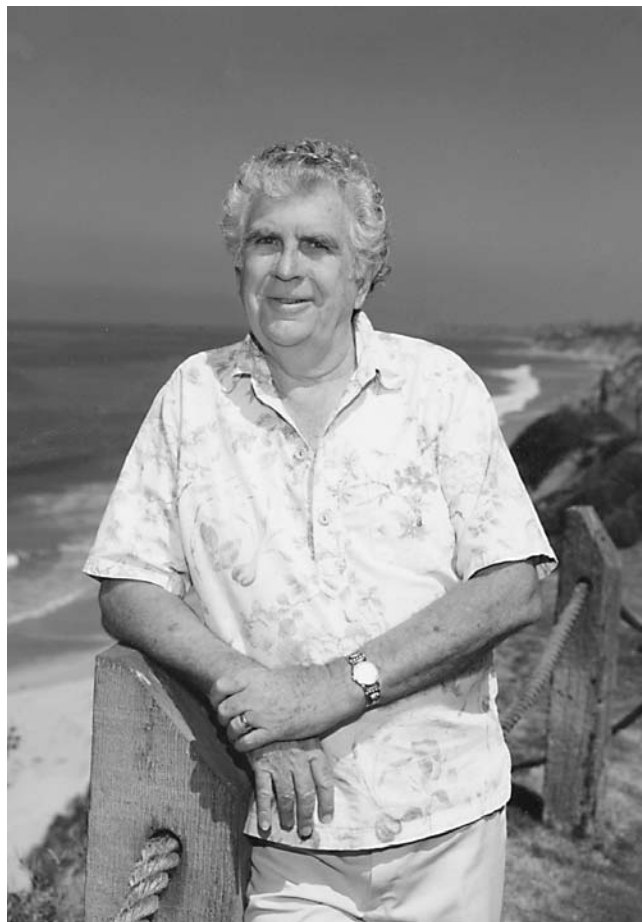
“... After Dr. Stevenson pointed out the possibilities of ‘fishing from space’ to scientists and authorities, he was asked to brief the Gemini 12 astronauts, to tell them precisely what types of photos would be the most valuable for fisheries research. Buzz Aldrin was the photographer for that space shot, and of all the missions to date, Gemini 12 yielded the most valuable ‘fishing photos.’

“‘After I saw the Gemini 12 pictures,’ says Dr. Stevenson, ‘I no longer thought we could locate big schools of fish from space; I knew we could pinpoint them.’”

## Mapping The Oceans From Space

Space photos could not only help locate schools of fish, but also reveal various ocean features of tactical interest to naval forces. From 1970 to 1988, Bob worked for the Office of Naval Research at Scripps Institution of Oceanography in San Diego, first as Scientific Liaison Officer and then as Deputy Director of Space Oceanography. During this entire period, and through 1999, Bob continued to give each U.S. space crew a lengthy briefing on ocean features as seen from space, detailing what the crew members should attempt to photograph and be on the lookout for on their particular mission.

By 1984, Bob had become known throughout the scientific community as “the Father of Space Oceanography,” having authored dozens of related scientific works over the years, such as: “View of the Earth from Space” (1968) and “Oceanography in Orbit” (1984). The U.S. Navy had gained valuable knowledge from research conducted by Bob and his space oceanographer colleague, Dr. Paul Scully-Power, who worked at the Naval Underwater Systems Center in New London, Connecticut. In order to build upon this knowledge, the Navy desired to have either Bob or Paul fly aboard the Space Shuttle. Bert Vis, in his article “The NEREUS Programme,” appearing in the October 1998 issue of *Spaceflight*, describes what happened next:



*Bob Stevenson in 1996, looking out at the Pacific, near his home in California.*

“In April 1984 word was given to Admiral Mooney that a flight had finally been set for Bob Stevenson. Paul Scully-Power would act as backup and when the latter would fly later, Stevenson would in turn serve as his backup. But fate stepped in. Shortly after being assigned to STS-41G, and even before it was made public, Stevenson decided to step down in favor of Scully-Power. His wife was terminally ill and it was obvious where he wanted to put his priorities. It turned out he had made the right decision, as his wife died the week prior to the launch.

What Scully-Power observed, which had heretofore gone unnoticed, was the ubiquitousness, particularly in the Mediterranean, of special ocean phenomena known as spiral eddies, which appear from space as giant whirlpool-like features (of generally 5 to 15 kilometers in diameter and up to 50 meters or so in depth) but which are difficult to detect from a ship. In fact, prior to 1973, and the breakthrough observations of spiral eddies by Skylab astronauts, their existence in the open ocean was unknown, let alone suspected.

Scully-Power’s flight contributed greatly to advancing the understanding of spiral eddies, allowing Bob to fine-tune his

briefings to the astronauts. Photos obtained from follow-on Shuttle missions confirmed a hunch Bob and Paul had developed. As Bob noted in his Fall 1998 cover story in *21st Century Science & Technology* magazine, "Spiral Eddies: The Discovery That Changed the Face of the Oceans":

"A dimly lit light seemed to switch on in the depths of our collective brains. Are spiral eddies common features of all surface waters, we asked ourselves? Are they everywhere in the ocean, the observations limited only by the presence or absence of surfactants, and an appropriate Sun angle?

"As the crews returned from mission after mission with photographs from nearly every ocean area that could be viewed, the answer became a comfortable 'yes.' Spiral eddies were observed in the sluggish, central gyres of the Atlantic, Indian, and Pacific oceans, the Sargasso Sea, the Caspian Sea, again in the South Indian Ocean and the slow, gentle Brazil Current. In fact, it was obvious. Spiral eddies, like the fictitious 'Chicken Man,' are everywhere! They are, essentially, ubiquitous!"

What is the significance of spiral eddies? From the military perspective, as indicated earlier, knowing their location and duration is very important, especially when it comes to hiding, avoiding, and detecting submarines. As far as science is concerned, one key ramification is that the ubiquity, nonlinearity, and quick-changing nature of spiral eddies make the construction of consistent, predictive weather and ocean models virtually impossible. Bob explained it this way in his *21st Century* "Spiral Eddies" article:

"Given the entire ocean, there are probably about 5 million (or thereabouts) spiral eddies rotating at any given time. The problem in using the energy numbers from spiral eddies is that the features are individually ephemeral, although the field of spirals may persist for days, weeks, or longer.

"Consequently, to try to separate the contributions of spiral eddies from mesoscale eddies in any General Circulation Model not only would be fruitless, but senseless.

"... At this moment in our history of scientific discovery, no one has a clue of how to make any calculation on the role of spiral eddies in any weather or climate predictive model, even though the influence must be major."

### **Almost An Astronaut**

After Scully-Power's flight, efforts were made to reschedule Bob for a mission aboard the Shuttle. By the mid-1980s, though, the Shuttle had become a junket ride for nonessential VIPs. U.S. Sen. Jake Garn, House Rep. Bill Nelson, and Saudi Arabian Prince Bandar flew on missions that the Navy had wanted Bob to be on. Finally, NASA and the Navy agreed to assign Bob to STS-61K, a Shuttle flight scheduled for October 1986. Bert Vis, in his above-mentioned "NEREUS Programme" article in *Spaceflight*, describes the plan:

"Of course, the 'lessons learned' during STS-41G would be put into practice by Stevenson. One of the biggest restrictions on Scully-Power's flight had been the impossibility to

observe and to photograph interesting sites round the clock. Not only was it physically impossible for him to be on the flight deck all the time, but 41G also had designated sleep periods, and commander Bob Crippen had made sure they were kept. It did not necessarily mean the crew members had to be asleep, but those who were awake were not allowed to make any noise to prevent others from waking up. This made it impossible for Scully-Power to use cameras in those periods. Since they automatically advance the film, they would have made far too much noise, especially in an otherwise totally quiet spacecraft.

"It was also recommended by Scully-Power to fly a complete Hasselblad camera (including the full set of lenses) on the next mission, for exclusive use by Stevenson, as well as some 5-8 extra magazines of film, and several extra audio tapes for making notes.

"Another thing was that after 41G, it was determined that it would be of importance to photograph a certain feature with as many cameras and types of film at the same time as possible. On STS-61K, which was an Earth observation mission in the first place, this could be accomplished. The European Space Agency (ESA) would be sending up a number of brand-new mapping cameras with 9x9 inch film, and when Nicollier informed ESA that Stevenson had been assigned to the crew, they immediately offered to fly up to three times as much film so there would be enough to cover the ocean sites he would want to photograph. All in all, it promised to be a perfect mission. It was scheduled for launch in October 1986 and it would have had excellent lighting conditions for the entire duration of the flight. Many North Atlantic and North Pacific regions would have been photographed for the first time and with cameras of unprecedented quality. In addition, having had observers on the flight deck around the clock would have enabled the crew to view certain locations for the first time.

"George Abbey (Chief of the Johnson Space Center's Flight Operations Division) and John Young (Chief of the Astronaut Office) had agreed that after STS-61K, Stevenson and Scully-Power would fly once again, together, on a specially selected high-inclination mission. After that flight they would give way to other Navy oceanographers, both civilian and military, although Scully-Power thought that he might want to fly a third time. So did Stevenson, but he had set an age limit of 70 for himself, stating that 'I would probably give too many bureaucrats heart attacks if I insisted on flying.'

"... In early January 1986 it seemed that Stevenson would finally get his chance. But it was not to be. On 28 January 1986, the space shuttle Challenger met with disaster during the launch of STS-51L, the very flight Stevenson had been removed from at the insistence of Hughes."

Yes, Bob had originally been scheduled to fly on the fatal Challenger mission, but had been bumped off that mission, too. Hughes, a large aerospace company, was at the time NASA's top commercial customer, and their own man, Greg

Jarvis, had been knocked off previous missions as well. So, Hughes insisted that Jarvis fly on Challenger, even though there were no real pressing experiments or duties for him to perform. Therefore, instead of becoming a dead national hero, Bob got to continue on with his life and career, although his chances to fly aboard Shuttle ended with the Challenger disaster. It would be 12 years before NASA ever flew another nonessential person on the Shuttle (77-year-old Sen. John Glenn in 1998).

## Guiding Astronauts To See The Ocean

In 1988, Bob retired from his Office of Naval Research job. But, just before retiring, he completed his masterwork, *Oceanography from the Space Shuttle*, a 200-page book published in 1989, containing approximately 90 color photos of ocean phenomena photographed by Space Shuttle astronauts. The pictured phenomena include spiral eddies, solitons, surfs, and internal waves — phenomena hard to detect and measure from a ship. Alongside each photo in this book Bob presented one or two pages of description. Nothing like this book had ever appeared in print.

*Oceanography from the Space Shuttle* had been preceded in 1987 by a related, though smaller-scale work Bob produced for the U.S. astronaut corps, titled *Astronauts' Guide to Oceanographic Phenomena*. Published in August 1988 by NASA's Space Shuttle Earth Observations Office, the *Astronauts' Guide* contains 37 color photos of various oceanographic phenomena captured by the cameras of the Space Shuttle astronauts. Importantly, the *Astronauts' Guide* provides instructions to the astronauts on how best to capture the desired images. For example, in discussing the Sun's reflection upon the ocean as seen from space, Bob made the following observations and recommendation:

"On the edge of the Sun's reflection, the golden colors change to blues. In this part of the glitter pattern, smooth water has a dark blue color (the angle of the Sun permits the light to penetrate into the sea) and roughened water has a light blue color. The glare into the lens, both eye and camera, is far less on the edge of the reflection than in the very center. Fine details of sea surface turbulence can be lost in the central glare of the Sun's reflection. Wherever the glitter pattern is complex, it is *best to observe and photograph the surface phenomena on the edge of the reflection field.*"

The photograph gracing the cover of the Fall 1998 issue of *21st Century* (containing Bob's "Spiral Eddies" article) illustrates well the above observation, as spectacularly delineated spiral eddies are easily seen on the edge of the Sun's reflection field.

Over the years, Bob received numerous awards for his enormous contributions to the field of space oceanography. Most notably, in January 1985 at a special ceremony in a packed auditorium at Scripps, Rear Adm. J.B. Mooney, Chief of Naval Research, acting on behalf of President Ronald Reagan, presented Bob with the Navy Meritorious Civilian

Service Award — this being the highest award possible for a civilian to receive from the Navy; Bob was the only Office of Naval Research employee to ever receive the award.

Now, a logical question to ask is this: What motivated this man to accomplish all that he did as a scientist? Bob provided the answer to this question, in a cover letter he sent to many friends and colleagues upon the publication of his 1998 "Spiral Eddies" article. He explained:

"As far back as I can recall any of my logical thoughts, I wanted to fly in airplanes. Lindbergh, Doolittle, Roscoe Turner, Wiley Post were my heroes. In those days of the 1930s, I read every nickel pulp magazine I could find on the aerial exploits during 'The Great War.'

"In June 1940, the government's Civilian Pilot Training program came to Fullerton, my home town. In August I had my civilian pilot's license. For the next 15 months I flew whenever I could dig up \$5 per hour for the rental of a J-3 Piper Cub. War came on 7 December 1941, while Robert Finch and I flew over the U.S. Fleet in Long Beach Harbor, wondering why the guns on the ships followed us as we crossed back and forth over anchorage.

"The next day, most of the guys with whom I'd learned to fly enlisted in the Navy Air Arm. 'Are you crazy? Fly off ships over water? Forget it!' About half of them never made it back from the Battle of Midway.

"I enlisted in the Army Air Force as quickly as possible; not to fight dastardly enemies, or to stand firm for any patriotic philosophy, or even home, Mom, and apple pie. I joined to fly! And, as an aerial navigator in those days of the 1940s, it was the most satisfying occupation I could ever imagine, or that I've ever had.

"Why do I relate these early, halcyon days of mine? Because, it was a huge step for me to become an oceanographer. *I hate ships*, especially when they are floating on the ocean. *They constantly move*. Yet, after four years majoring in geology, crawling for days on end through mountain brush and desert sands, and staring down rattle snakes, sitting on the deck of a research vessel had a certain attraction.

"For 15 years, I never participated in a research cruise during which I did not at one time or another curse the ocean, the ship, and my stupidity for being out at sea. In the late 1960s, at a chance meeting, I was introduced to photographs of ocean features taken by astronauts from manned spacecraft. I was stunned by the dynamics of the sea surface that could be evaluated by this technique. When NASA invited me in 1973 to brief the astronaut crews training for Skylab, and such briefings became part of my duties with the Office of Naval Research, the rest of my career was set.

"Since then, I have trained all of the astronauts in 'space oceanography' and prepared observational experiments for every Earth-orbital NASA manned space flight. From the eager efforts by the astronauts, details of the ocean never before imagined have been defined — examples of which are in the accompanying paper on Spiral Eddies.



When the Skylab crew first photographed ocean spiral eddies in 1973, oceanographers Bob Stevenson and Paul Scully-Power took notice. The existence of the eddies, which they hypothesized were spun off along the edges of major ocean currents, provided the necessary clue to finding the cause of the unusual acoustic signals that Bob and Paul were tracking.

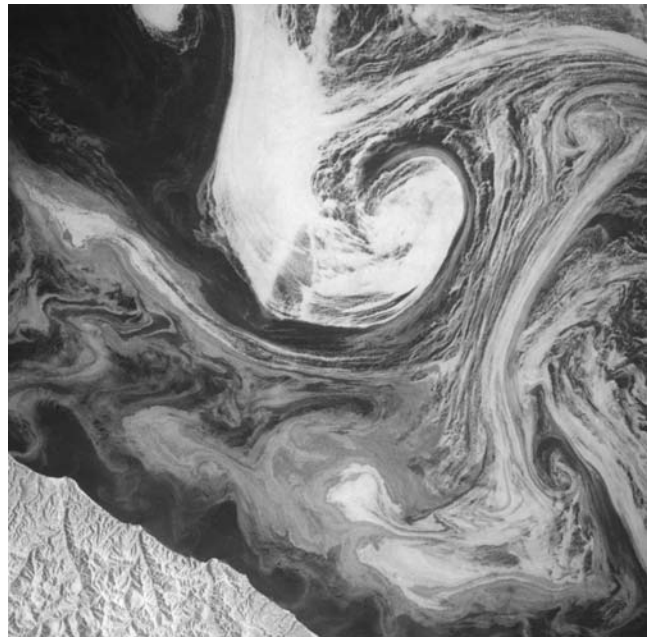
Shown here are spiral eddies photographed from the Endeavor, looking northwest across the western Black Sea toward Turkey and the Bosphorus.

“I must point out that the best part of this approach to oceanography meant that I never had to go to sea again! And, the view from space is nearly as good as from the nose of a B-17 ‘Flying Fortress.’”

### Leading International Oceanographers

In 1987, Bob was elected Secretary-General of IAPSO—the International Association for the Physical Sciences of the Ocean—an international organization comprised of more than 5,000 members, most of whom are oceanographers. He was re-elected Secretary-General, which is IAPSO’s top position, in 1991. In August 1995, Bob organized and ran IAPSO’s most successful General Assembly ever, which took place in Honolulu. Referred to afterwards by attendees as the “Sensation in Hawaii,” more than 700 oceanographers from around the world showed up for and participated in the event—to this day, still the largest gathering of oceanographers in history.

Bob’s skillful management of IAPSO’s budget over the years provided him the funds to pay for the travel and lodging expenses of several leading foreign oceanographers (many of these being Russians) who otherwise would not have been able to attend. Consequently, many useful contacts (some being of a once-in-a-lifetime nature) between oceanographers were made, with important projects by various scientists able



These dramatic eddies are near the tip of the Kamchatka Peninsula in Russia, where warming coastal waters have broken up the pack-ice, and it is caught up in upwelling plumes. The photograph was taken by Dr. Kathryn D. Sullivan, Payload Commander on the crew of the Atlantis, March 1992.

to advance as a result. At the conclusion of this week-long General Assembly, Dr. Evgeny Kontar of Russia congratulated Bob on his “triumph,” though, more precisely, it was the science of oceanography that experienced a great triumph.

Although it was his for the asking, Bob chose not to serve a third term as IAPSO Secretary-General, as the honor of holding the position did not compensate for its time-consuming nature, and time is what Bob needed to address his various other interests. One such interest of Bob’s during the last decade of his life was the global warming debate, and he became actively engaged in this controversy. Contributing articles to several publications, Bob advanced the argument that no scientifically credible evidence exists indicating that mankind is responsible for any purported global warming.

### A Polemic On Global Warming

Bob’s lengthiest, and best argued, article on the subject, titled “An Oceanographer Looks at the Non-Science of Global Warming,” appeared in the Winter 1996-1997 issue of *21st Century*. Presenting four graphs and the results of many scientific investigations to support his position that mankind “has not become a geophysical force,” Bob concluded his article with six “bottom lines,” the first two being as follows:

“(1) *There is no warming trend in the oceans, and has not been in the past 50 years.* There are places in the ocean that get warmer than other locations for periods of time up to decades, but those waters then cool as other ocean areas warm.

These periods are so close to the 11-year sunspot cycle that it is difficult not to consider a correlation. Yet, over all, there are no warming or cooling trends in any ocean, including the Southern Ocean near Antarctica.

“(2) Special attention was paid to the Arctic Ocean, when teams from the United States, Canada, and Russia occupied stations that had been visited repeatedly since 1937. The results? *There is no warming trend in the Arctic, and has been none since 1937.* Indications by the Canadian team of warmer than normal water turned out to be an intrusion of water from the Atlantic. In the past 60 years, the Arctic ice pack has neither retreated nor thinned. These data are not controversial!”

Interestingly, Bob’s last published article—another thoroughly researched one—dealt with the same subject. Titled “Yes, the Ocean Has Warmed; No, It’s Not ‘Global Warming,’” this article, appearing in the Summer 2000 issue of *21st Century*, contains 46 references and Bob’s well-reasoned position that mankind’s activities have not resulted in any global warming; any such warming, Bob maintained, “can be explained by means of intrinsic internal modes of the Earth going through their normal cycle of warming and cooling.” Bob, who had recently moved to Princeville, Hawaii (island of Kauai) with his wife, Jeani Marie Wetzel, whom he had married in June 1988, ended his article with this observation:

“Yet, here I sit in the middle of the Pacific Ocean, surrounded by papers (peer-reviewed, I guess I should add) which conclude:

“(1) For the past two decades at least, and possibly for the past seven decades, the Earth’s true surface air temperature has likely experienced no net change;

“(2) there should have been a sizable CO<sub>2</sub>-induced increase in atmospheric radiative forcing during that time, but there wasn’t. That must mean that a suite of compensatory feedbacks overwhelmed the ‘greenhouse’ impetus for warming; implying, therefore,

“(3) that the planet will not warm from any man-produced increases in CO<sub>2</sub>; indicating

“(4) any increases in temperature will likely fit the global trend of +0.048°C/decade, that is, about 0.5°C this century—the rate of warming that has existed since the Little Ice Age, centered around 1750 in Europe, South America, and China; suggesting

“(5) that the heat storage in the upper ocean takes place in the upper 100 meters, and the magnitude provides a rise in temperature at those depths of 0.5°C in the past 50 years (in those parts of the ocean for which we have data);

“(6) this global warming (and cooling) of the ocean occurs on biennial, ENSO, decadal and interdecadal period scales; thence,

“(7) the ocean thermal changes on centennial-period scales, which appear as the warming trend through the past 50 to 100 years, can be explained by means of intrinsic internal modes of the Earth going through their normal cycle of warm-

ing and cooling, independent of both radiative and anthropogenic influences.”

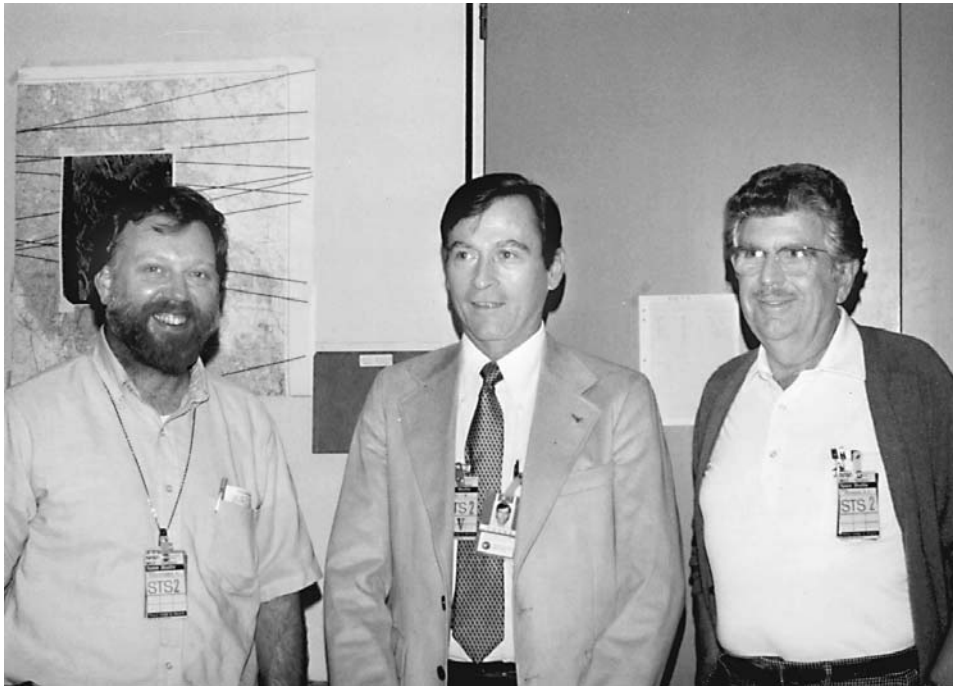
Once again, the question can be asked: What led Bob Stevenson to develop such an active interest in the global warming debate? One word explains it all: “honor”—or, more accurately, “dishonor.” For the first time in his life, Bob observed fellow scientists engage in “fraudulent or deliberately dishonorable scientific conduct,” and his sense of duty did not permit him to sit on the sidelines and not object. In a cover letter (accompanying his “Non-Science of Global Warming” article) sent to friends and colleagues, Bob detailed his concerns as follows:

“My first peer-reviewed paper was in 1947, co-authored with U.S. Grant IV, my major professor at UCLA. I could have published before ’47, but in ’42 I joined the U.S. Army Air Force to ‘save the world for democracy’; with an encore during the Korean Conflict. Since then, I’ve published annually papers, books, training manuals, and classified oceanography tactical documents for the Navy, and became an expert in space oceanography.

“My professors were all from the great universities of the early 20th Century; Harvard, Chicago, Illinois, Cal/Berkeley, Stanford. Each practiced the principle of personal ‘honor.’ Scientific honor codes were not explicitly taught in my classes, but we learned by example. Of course, about 99% of fellow students then were veterans of World War II in whom honor had been thoroughly indoctrinated. It was enhanced by our professors, and all of us understood ‘dishonor.’ Such conduct simply was not tolerated—by student or professor.

“During my career, as professor, science and institution director, oceanographer with the Office of Naval Research, and as Secretary-General of IAPSO, I met thousands of scientists, read and listened to uncountable scientific papers, attended hundreds of scientific meetings and workshops (national and international), and reviewed hundreds of research proposals. The science ranged from excellent to mundane; the papers, books, and monographs the same. Through it all, I watched the tremendous growth in our knowledge of geophysics, and the dynamics of the atmosphere, the oceans, and the solid Earth. It has been exhilarating to be part of this greatest of all possible adventures.

“In all these years, I never recognized any fraudulent or deliberately dishonorable scientific conduct—until 1989. It was then, as Secretary-General of IAPSO, that I began to hear about anthropogenic ‘global warming’ and ‘ozone depletion.’ At first, I considered these ‘doomsday scenarios’ just the usual idiotic bleatings of radical environmental NGOs. Then came the extraordinary, non-scientific Rio Summit in 1992! In the following years I observed ‘scientists’ associated with, and supporting, the IPCC [Intergovernmental Panel on Climate Change], WMO [World Meteorological Organization], and UNEP [United Nations Environment Program] practice dishonest and, therefore, dishonorable science. It seemed, too, that much of the scientific community had lost its intolerance



*Paul Scully-Power (left) and Bob Stevenson (right) with Capt. John W. Young, head of the Astronaut Office at Mission Control, Johnson Space Center, in November 1981.*

of dishonorable scientific conduct. Personal pragmatism appeared to replace honor, especially amongst those scientists supported by government funding.

*“Science is the anchor of rationality for our civilization. It cannot serve this purpose if dishonorable conduct is common and tolerated. Such conduct must be eliminated! True scientists and their scientific institutions must stand up and be counted.”*

Those who knew Bob learned soon that the pivotal moment of his life was his service in World War II—a real “character builder,” as it was for so many—flying in nearly 30 missions over “Fortress Europe” as a B-17 bomber navigator. A natural story-teller, Bob loved recounting his war experiences and the many close calls that occurred during flights, which often lasted over 10 hours, 8½ hours of which the crew spent on oxygen. In his retirement days, he joined the Confederate Air Force (Arizona wing); as a CAF “Colonel,” he relived some of his World War II thrills by participating in two summer tours of the CAF’s restored vintage planes, flying a few legs in a B-17.

In May 1999, Bob wrote a unique article—“What Happened to This 367th Plane?”—for the *306th Echoes* publication. This article was really intended for the benefit of the widow and children of Harry Gile. Gile was a crewman on a B-17G, the “Fightin’ Car barn Hammer Slaw,” which never made it back to England after a bombing mission to Berlin on Dec. 5, 1944. At the time, not even a reasonable approximation could be made of where the plane had disappeared. Employing his knowledge as an oceanographer and navigator, Bob re-created what likely happened.

Bob’s missing plane scenario no doubt provided aficionados of World War II history something new to ponder, but that wasn’t the main reason Bob went to the trouble to research the fate of the “Fightin’ Car barn Hammer Slaw.” On many occasions over the years, Bob told others that he believed one’s life could be considered a success if that person’s presence on the planet had made it a better place. Certainly, Harry Gile’s family felt that Bob Stevenson had made the planet a better place for them. As reported by Russell Strong, editor of *306th Echoes*, “one of Harry Gile’s sons,” after reviewing Bob’s re-creation of his father’s last bombing mission, “has told his mother that for the first time in 55 years he has a sense of ‘closure’ on the combat death of his father.” Harry’s widow, Shirley, experienced the same psychological relief when she took a cruise on the North Sea and convinced the ship captain to steer the ship to 52°20’N, 02°00’E—the spot where Bob had determined her husband’s plane most likely crashed. When the ship reached this particular location, Shirley tossed a floral wreath onto the ocean, and experienced the indescribable emotions that one would experience after waiting so many years for justice to a loved one’s memory to arrive.

In 1997, Bob became a member of the Scientific Advisory Board for *21st Century Science & Technology* magazine. Another feature article of his, “A View from Space: The Discovery of Nonlinear Waves in the Ocean’s Near-Surface Layer,” was published in the Summer 1999 issue of *21st Century*. This article, a masterpiece like his earlier “Spiral Eddies” article, discusses the nature of such phenomena as solitons and suloyls (phenomena difficult for research ships to detect,

but which, it turns out, are readily detectable from space), and contains outstanding photos of them taken by various Space Shuttle astronauts whom Bob had trained.

### Some Special Mentions

Bob's work was greatly aided by several people, some of whom deserve special mention:

Paul Scully-Power's teaming up with Bob to advance the cause of space oceanography has been detailed earlier. It is sufficient to note that had Paul, serving as Bob's replacement, not flown on Mission STS-41G, progress in the field of space oceanography would have been greatly retarded.

While working for the Office of Naval Research, Bob's colleague and "right-hand man" was Prof. Ben J. Cagle, a scientist noted for his unpretentiousness, quiet efficiency, and wisdom. Ben and Bob worked together on many classified projects for the Navy, and the twosome's various contributions helped shorten the Cold War. When Bob became Secretary-General of IAPSO, he naturally chose Ben to act as Deputy Secretary-General, who served him and the organization in exemplary fashion.

Marine geologist and oceanographer Gerald G. Kuhn, understudy to the legendary Francis P. Shepard, and co-author with Shepard of *Sea Cliffs, Beaches, and Coastal Valleys of San Diego County*, was like another son to Bob. Over the years, NASA sent Bob copies of all the photos taken during each Space Shuttle mission. Gerry stored, archived, and previewed these photos for Bob, frequently bringing to Bob's attention scientifically important shots which deserved the master's special scrutiny, and which would have otherwise gone unnoticed and unstudied. The two collaborated on several endeavors, such as the publication of Gerry's feature cover article, "The Impact of Volcanic Eruptions on Worldwide Weather," in the Winter 1997-1998 issue of *21st Century*, and assisted the California Seismic Safety Commission in the identification of previously unrecognized earthquake faults.

While Bob served as IAPSO's Secretary-General from 1987-1995, the "real Secretary" during this time was Bob's wife, Jeani. She assumed multiple near-impossible tasks for IAPSO—that is, preparing all the mailings, maintaining an up-to-date database of the members, preparing IAPSO's massive 518-page *Proceedings* of its 1995 General Assembly, and so on. Over the years, Jeani word-processed to professional quality standards Bob's numerous astronaut briefing documents and articles; she made her often reluctant husband computer literate, enabling him to more easily research and compose his writings, as well as interact via e-mail with all his friends and colleagues worldwide (a favorite pastime of Bob's).

In 1995, shortly after stepping down as IAPSO's Secretary-General, Bob was diagnosed as having prostate cancer. The cancer was kept under control for years with hormone therapy; eventually, though, the cancer acted like the incom-

ing tide. After a lengthy illness, in which he demonstrated the same courage that he displayed during all his dangerous World War II bombing missions, Bob passed away on Aug. 12, 2001.

### Bob's Legacy

At the moment when his health no longer permitted him to work, Bob was engaged in his greatest project, when judged from its potential positive impact for mankind. He was preparing the "Astronaut Guidelines for Ocean Observations"—a CD-ROM containing the 100 best space oceanography photos ever taken, along with pertinent instructions to the astronaut on how best to observe and photograph important ocean phenomena. In the years since Bob's 1988 *Astronauts' Guide to Oceanographic Phenomena* had been published, far superior photos of solitons, suloids, and other ocean phenomena had been captured by the cameras of the Space Shuttle astronauts. Knowledge about these phenomena had also increased significantly since 1988. The "Astronaut Guidelines for Ocean Observations" was, therefore, shaping up to be the ultimate space oceanography training tool for astronauts. One of its key advantages, was that its convenient format—a CD-ROM—easily allowed for its being taken up into space; astronauts aboard the space station or Shuttle could, whenever necessary, quickly review the CD's photos and instructions, facilitating their ocean observation duties. It is hoped that NASA will live up to its commitment to implement the "Astronaut Guidelines for Ocean Observations" project, with some of Bob's colleagues.

When one discovers and works tirelessly to develop an entirely new field of science, as Bob did, and vigorously defends and promotes throughout his career the values of ethical scientific conduct, few words can adequately describe the legacy left to us by such a man. Among all the accolades that could be made, probably the words that would satisfy Bob most to hear said of him are the following: The presence of Dr. Robert E. Stevenson, "The Father of Space Oceanography," made our planet a much better place.

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