**Houston Philosophical Society**
**Dinner Meeting Minutes**
**February 19, 2009**

CALL TO ORDER: 8:00 P.M.

President Robert Patten called to order the 628th meeting of the Society in its 88th year. After the introduction of guests, Dr. Patten introduced Dr. Carl H. Gibson, Professor of Engineering, Physics, and Oceanography at the University of California at San Diego and professor at the Scripps Institution of Oceanography and the Center for Astrophysics and Space Sciences. Dr. Gibson's research interests include theoretical and experimental studies of turbulence and turbulent mixing, measurement of oceanic microstructure, and 3-D and 2-D fossil-turbulence theory among numerous others.

Dr. Gibson introduced his long-time friend, Dr. R. Norris Keeler, the evening's speaker. Dr. Gibson and Dr. Keeler met as graduate students in chemical engineering at Stanford and Berkeley, respectfully, studying microconductivity tropes. While in graduate school, Dr. Keeler confirmed the Toor theory for diffusion controlled reactions in turbulent flow. He also invented a microprobe for measuring the fine scalar structure in a turbulent flow field. After graduate school, Dr. Keeler joined the Lawrence Livermore Laboratory as a physicist, going on to be come head of the Physics Department under Edward Teller, afterwards becoming Director of Navy Technology in Washington, DC. From there, he joined the Kaman Corporation as Director of Technical Marketing. In 1980, Keeler began a series of inventions and studies which led to Submarine Laser communications (SLC) experiments.

In 2000, Dr. Keeler began arranging the support for a large scale deployment of satellites, aircraft and ships to monitor the hydrodynamic behavior of the Sand Island, Hawaii, outflow. At the same time, he organized a hydrodynamics workshop at the Scripps Institution of Oceanography to look at some critical issues in ocean turbulence and hydrodynamics. His team consisted of groups from Russia, Canada, Germany and the US. Dr. Keeler joined Directed Technologies Inc. in Arlington, Virginia, in 2001. Subsequent experiments he directed showed that satellite optical imagery taken from space at an altitude of 680 km over the ocean surface can be analyzed to obtain detail of the hydrodynamics taking place far below the ocean surface. Most recently, Dr. Keeler has been directing a program

to predict earthquakes. He is currently working with a Russian team on methods of mitigating the effects of hurricanes.

Dr. Keeler spoke on "A Comparison of Science: East and West," addressing each of the issues in which he has been prominently involved.

In 1975, Dr. Keeler was invited to a meeting in Moscow because the head of Physics at Livermore, had a close association with Dr. Teller, and was responsible for research on the technical base of nuclear explosives, his specialty being high dynamic pressure-shock waves. All of the participants wanted to meet Lev Al'tshuer, the designer of the first Russian indigenous atom bomb tested in 151 and leader of the Russian experimental group at Arzamas-16. He remains the single outstanding investigator in the field of dynamic high pressure research. Along with Sakharov, he strongly opposed the Stalinist interpretation of science.

Historically, Russia has relied on measurements of material properties while the United States has relied on more sophisticated computer analysis. There was a lack of continuity in United States research, however, as investigators often left to pursue private sector business activities, while the original Russian team remained intact through the 1980's. An outstanding staff of young scientists are still working in Russia.

Al'tshuer left Arzamas-16 in 1966, but a new nuclear lab was started at about the same time where ultra high pressures were obtained using nuclear explosives. Throughout this period, Al'tshuler's work had no parallel in the United States.

In 1991, the United States government requested that Dr. Keeler and others contact several Russian scientists, including doctors Savin and Bondur to acquire "dual-use technology." Savin and Bondur were principals in the major Russian aerospace firm "Kometa," which specializes in satellite and remote surveillance and anti-submarine warfare. They agreed to share dual-use technology with US firms with respect to monitoring waste disposal. The team decided to study an outflow that released material at some depth below the surface. The Sand Island outflow in Hawaii was chosen because of the easy deployment of gear. The group also decided to use optical satellites to study surface effects. The experiments took place in July to September in 2002-2004, when the sky is generally cloud-free over Hawaii and the ocean has its best clarity.

The Remote Anthropogenic Sensing Program (RASP) experiments showed that the outflow leaves a clear indication at the surface as detected by two-dimensional surface spatial Fourier spectroscopy. This means that a submerged wake can be detected by an optical satellite from some 400 miles above the ocean. This also means that when a wake is created deep underwater, the effect is not isolated, but creates eddies that are detectable as modification of the structure of the surface. These results were verified by ground-truth measurements. The theory developed to describe these results had previously been dismissed by most US oceanographers. In Dr. Keeler's estimation, US oceanographers and hydrodynamicists are far behind their Russian counterparts in understanding ocean turbulence. Their models are primitive and, in some cases, wrong, and individuals in the US Navy have attempted to suppress all work that could imply that submerged submarines could be detected.

The Earthquake Remote Precursor Sensing Program (ERPS) is a congressionally mandated program to investigate and observe various precursors to earthquakes and to determine whether they could ever be viewed as reliable indicators of the imminent occurrence of an earthquake. Bondur approached the Americans with a broad proposal to pursue this work. Before deciding to proceed, the group investigated the work of Professor A.C. Fraser-Smith at Stanford. Dr. Fraser-Smith was measuring the ULF/ELF noise that might interfere with certain submarine communication frequencies. The location of his monitoring single axis magnetometers in the Santa Cruz Mountains corresponded to nearly the epicenter of the Loma Prieta, CA earthquake. The data showed critical frequency (foF2) disturbances from normal diurnal fluctuations. Upon further investigation, Bondur found that a major earthquake had followed the occurrence of the strong geographic deviation of foF2 from its normal values.

A number of earthquake precursor phenomena were chosen for evaluation under ERPS, including ionospheric tomography, the method of lineaments (introduced by the Russians), and various ground truth measurements. Using their Terra satellite and the method of lineaments, the Russians made a three-month advanced prediction of a family of earthquakes in southern California in late 2004. The predictions came as close as 10 miles and as far as 150 miles, and were as close as two weeks in timing. Dr. L.J. Nickisch had independently verified that GPS TEC profiles were in very close agreement with results from an upward transmitting ionosonde. He was asked to evaluate the accuracy of Dr. Bondur's methods of inferring ionospheric conditions based on GPS satellite signals. In studying the Parkfield, CA earthquake, he detected distinct ionospheric changes forming over

the region. In the weeks preceding the event, anomalies initially formed over the earthquake preparation zone.

Dr. Friedmann Freund studied electromagnetic precursors. Dr. Freund proposed that when rocks are exposed to extreme stress and pressure, they can turn into hole semiconductors. The positive holes spread into unstressed materials and move towards the earth's surface. The surface becomes positively charged, and currents are created by the moving charges. Dr. Freund proposed that the magnitude of the currents is enough to generate significant anomalies in the earth's magnetic field and that TEC would change as ground potential charges affect electron movement in the ionosphere. This work also led to the theory that EMF-producing currents were caused by shorting out of the polarized strat by the ubiquitous aquifers found at depth. This work provides the only credible mechanism for stress-induced EMF that has so far been proposed.

Russian and Mexican scientists have collaborated on programs to induce rainfall over the Sonoran Desert. During these investigations, they noted that the course of tropical disturbances was changing with the application of external electrical influences. This resulted in a test of a tropical disturbance and two hurricanes. The towers were able to suppress fog over an airstrip in the mountains. Ionized molecules from the tower were mixed into the air flow through a gap and onto the airstrip. However, action at a distance may not be as easy to understand.

Dr. Keeler also addressed the development of predator drones, stating that he US services were not interested in the concept of a long distance, long endurance drone. Eventually, however, they agreed to support this activity, which has revolutionized military surveillance in modern warfare and is used almost universally in all combat applications.

Dr. Keeler concluded with a reference to the role of women in western and Russian science and technology, recalling the cases of Lise Meitner, Maria Goepper-Mayer and Rosalind Franklin, all of whom were discriminated against, a situation that no longer exists in the west but is still prevalent in Russia. In Russia, the situation is bad but improving; in the US, it is good in most areas and still improving.

Dr. Keeler summed up with the observation that the Russians appear to continuoually investigate "outside the box," while timidity and a bureaucratic outlook prevail in the US government funded research so that innovative ideas are frequently avoided.

ADJOURNMENT:  9:30 p.m.