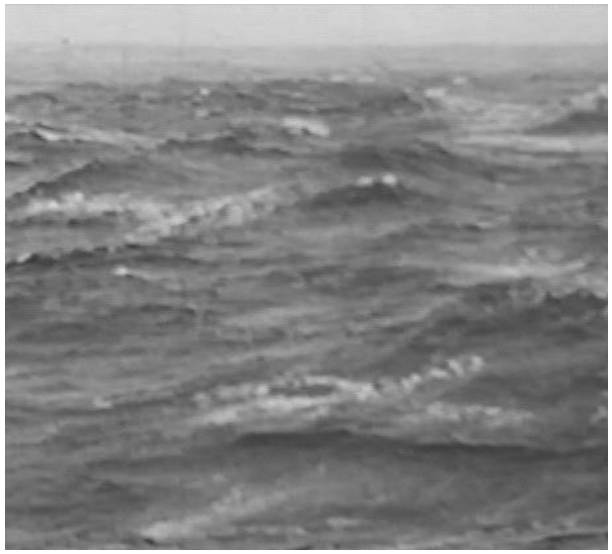
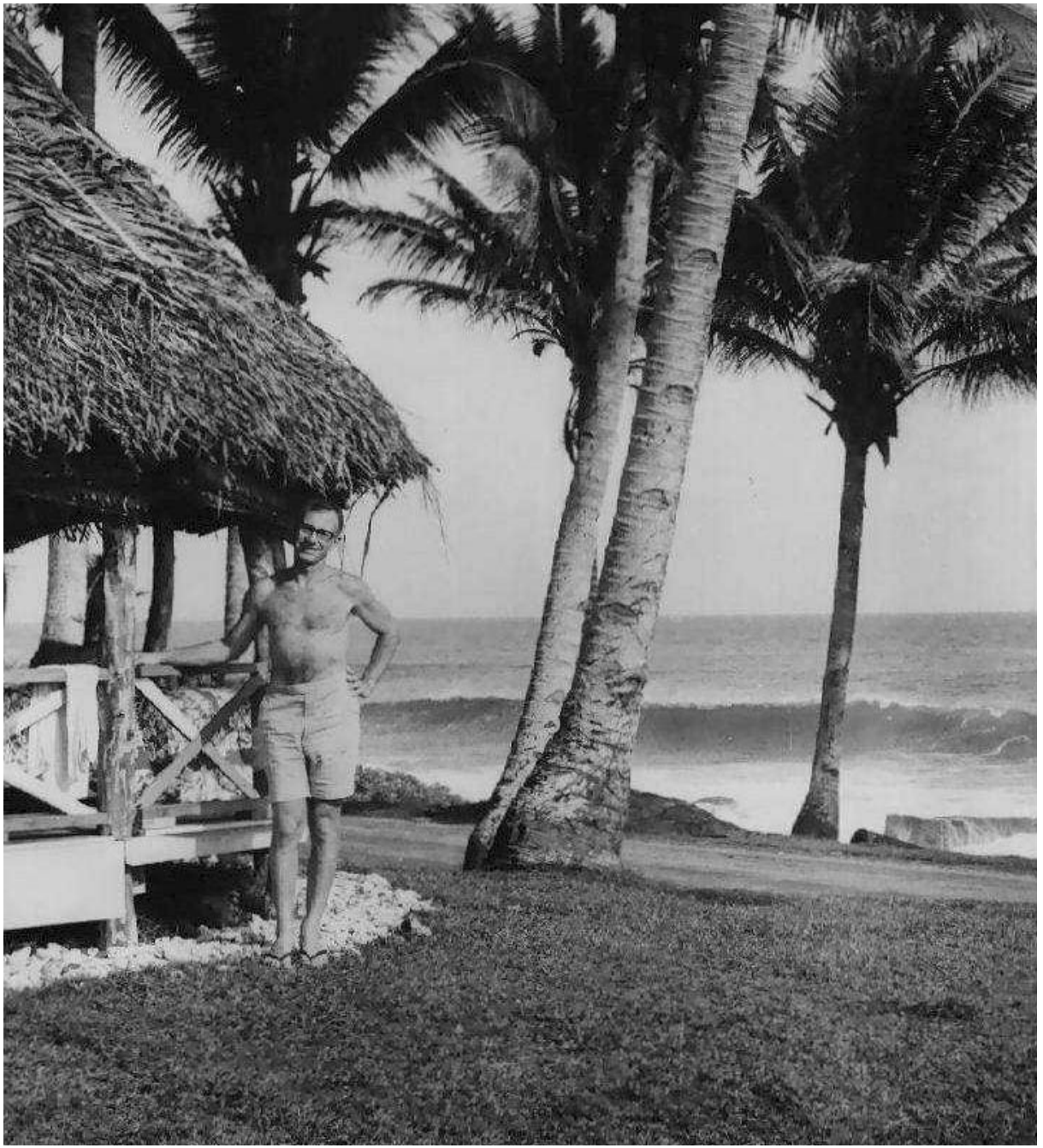
Meteorology

Dr. Walter Munk

The Father of Surf Reports

by Brock Rosenthal





Today, instant surf reports have commodifed waves to fit the convenience-conscious crowd in modern surfing. But here in the Meteorology section we want to stop and think of a time when waves were a mystery - when nobody really knew where they came from or when they would appear. It was within living memory of today's first generation modern surfers that swells just seemed to appear - and surf spots were traditionally surfed during certain seasons.

Now, of course, you can get surf reports everywhere, and if you want you can have your session timed practically to the hour days in advance.

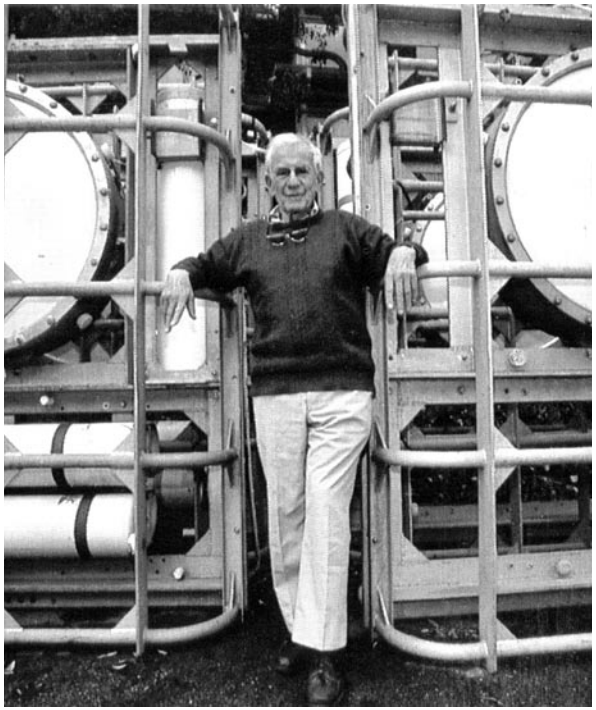
Where did all this start?

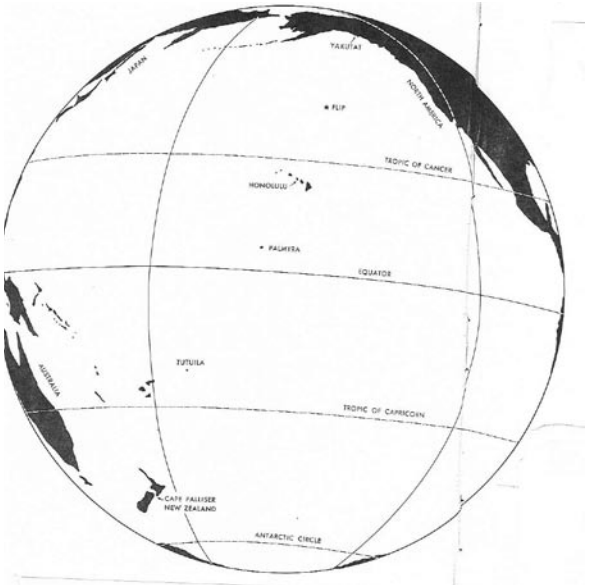
At the first Surfing Arts, Science and Issues Conference, we were honored to include a special presentation by Brock Rosenthal of La Jolla, California. The presentation was entitled, "The Father of Surf Reports", and this was the first time surfers were given the opportunity to learn the extraordinary story of Dr. Walter Munk. Brock not only presented a great lecture, but also showed clips from "The Longest Day" before running the landmark 1963 film, "Waves Across the Pacific" for a crowded room.

It was Dr. Walter Munk's research that prevented the great loss of life that would have occurred if military planners in WW II had simply said "go for it" and found themselves in the middle of a 17', 8-10' swell that would have swamped landing craft and drowned the men being ferried to land.

In this article, Brock re-tells the storyof how a man set out decades ago to uncover the science of waves, wave trains, and long distance groundswells. And he did it for a very specific reason: saving lives.

So maybe modern surf reports take something away from the raw experience of riding waves. But that is no reason to be any less in awe what Dr. Walter Munk did decades ago. And in fact, we would all do well to pause and consider just what it meant for him to say, so many years ago, "Hmm, I wonder where these waves come from?"

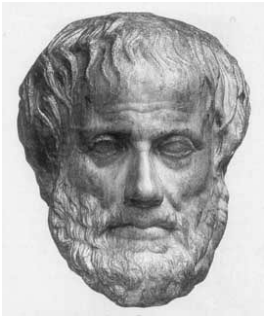


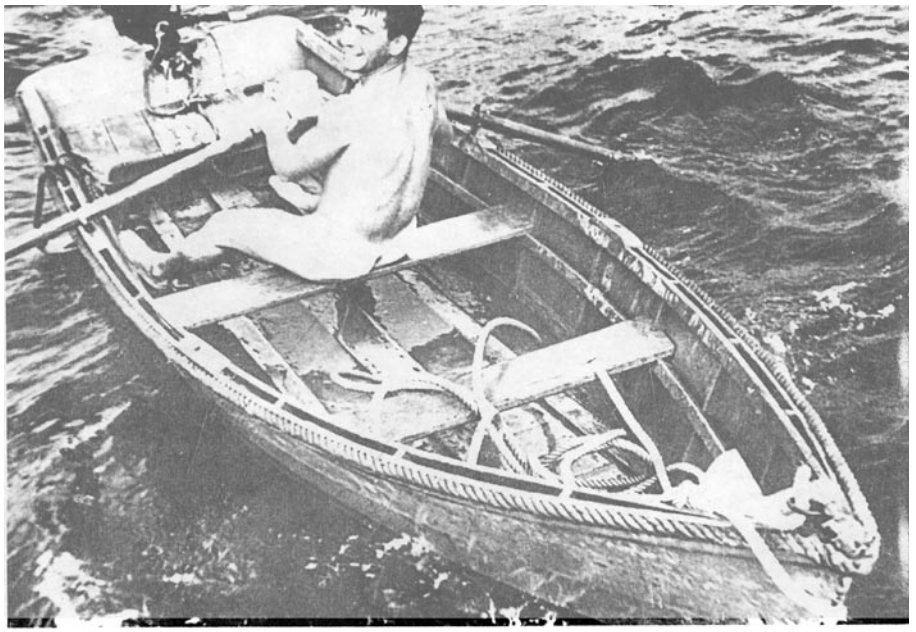


WAVE ACTION IN WAR AND PEACE

Amphibious landings of Allied troops during World War II, including the D day invasion of Normandy (below), were possible because scientists such as Walter Munk learned how to predict wave conditions. Now at Scripps, Munk (left) tests global warming theories by documenting ocean temperatures. Sound from the underwater speakers travels faster through warm water than through cold.

Dr. Walter Munk
The Father of Surf Reports





Aristotle and da Vinci wanted to know where waves came from.
So did Walter Munk, shown on his first oceanographic "expedition" in 1940.

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There's more to the history of surf reports then "you should have been here an hour ago". Historically, the origins of ocean waves were poorly understood. Although it was always known that waves came from storms, it was impossible to forecast them as there was no way to collect weather data from distant places. Through out the ages, the mystery of waves has inspired great thinkers.

Aristotle contemplated tides and waves in a book he wrote in about 330 BC. Legend has it that he was so distraught about not solving the riddle of tides that he threw himself in the sea and drowned. He would not be the last one to be frustrated by the mysteries of the ocean. Julius Caesar's lack of understanding of waves and tides cost him two fleets during the Roman invasion of Britain.

Leonardo da Vinci left a legacy of notebooks, some filled with drawings showing the various stages of waves breaking (it sounds a lot like my high school notebooks!). If Leonardo lived in an area with better waves I'm sure he would have been inspired to invent a way to surf.

Christopher Columbus is considered to have made the world's first hurricane prediction. On his last voyage to the new world, he predicted a violent storm based on his previous observations of long period swells and cloud formations. After his political rival, the Governor of Hispaniola refused his request to seek shelter in the harbor of Santo Domingo, he took evasive action and escaped from harms way. Unfortunately, the Governor ignored his warnings and sent 30 ships to Spain. Two days later 24 of them sank with a loss of 500 lives.

And it was Ben Franklin who was the first to figure out that storms track in directions other than the direction of their winds. He came to this realization when his plans to view a lunar eclipse in Philadelphia were ruined by the clouds of a northeaster - a storm with winds from the northeast. He was surprised to learn a few days later that his friends in Boston, to the northeast of him, viewed the eclipse under clear skies.

So, over time, bits and pieces of information were added to the pool of knowledge but forecasting continued to be stymied until there could be a way to collect weather data from a long distance away. This barrier was finally broken in the late 1800s with the installation of telegraph lines. Later with the advent of radio, ships were able to report observations at sea. Still no one had come up with an accurate theory of wave formation to use as a basis of prediction. That would have to wait for Walter Munk to come around.

Walter Munk was born in Austria, ironically a country without an ocean. In 1934, at the age of 16, his parents sent him to New York to work in the family business of banking. After a few years of this Munk had enough and decided to get as far away as possible from New York and banking. He bought a car and drove to Southern California where the brash teenager convinced Caltech to take him in without bothering with the typical application process. Munk's life took a turn when he became attracted to a girl who lived in La Jolla. Upon graduation with a degree in physics in 1939, he promptly applied to the Scripps Institution Oceanography so he could be near her. During a bleak interview with Professor Harold Sverdrup, the eminent director of Scripps tried to discourage Munk by telling him he couldn't think of any job in oceanography that would open up in the next 20 years. Munk's ambitious reply was "I'll take it,"

Today, 64 years later, Dr. Munk is still there.

During World War II, Munk was sometimes

Walter H. Munk
Professor of Geophysics, Emeritus
Institute of Geophysics and Planetary Physics

Walter H. Munk is a professor of geophysics with the Institute of Geophysics and Planetary Physics at UCSD's Scripps Institution of Oceanography. His research includes physical oceanography and geophysics leading to the understanding of ocean currents and circulation, tides, wave propagation in solid and fluid bodies, and the wobble of the earth's axis during rotation. He has pioneered the use of high-speed computers for analyzing geophysical data.

Munk was born on Oct. 19, 1917, in Vienna, Austria. At age 14 he moved to New York and later studied physics at Columbia University. He became a United States citizen in 1939. He attended the California Institute of Technology and received a bachelor's degree in physics in 1939 and a master's degree in geophysics in 1940. He attended Scripps Institution of Oceanography and received a Ph.D. in oceanog- raphy from the University of California in 1947.

During World War II, Munk and Harald U. Sverdrup, then director of Scripps Institution, developed a system for forecasting breakers and surf on beaches, a technique of crucial importance in military amphibious landings. Munk served for a year in the United States Army Ski Battalion, for a year as an oceanographer with the University of California Division of War Research, and as a meteorologist for the Army Air Force.

During the 1946 testing of nuclear weapons at Bikini Atoll in the southern Pacific Ocean, he participated in analysis of the currents and diffusion in the lagoon and the water exchange with the open seas.

In 1947 Munk became an assistant professor at Scripps Institution. In 1954 he became a professor of geophysics and also was named a member of the UC's Institute of Geophysics, based in Los Angeles and, in 1960, he established a branch of the institute on the Scripps campus in La Jolla. The new unit was established to study the earth, its atmosphere, oceans, and interior, using methods of experimental and mathematical physics. Until 1982, he served as director of the Scripps branch and as an associate director of the university wide institute, which was renamed the Institute of Geophysics and Planetary Physics (IGPP).

In 1963, Munk led a study of attenuation in ocean swells generated in Antarctica. The program measured fluctuations with pressure sensing devices lowered to the ocean floor. Measurements also were made at six Pacific Ocean locations and from FLIP, the Floating Instrument Platform. He operated the recording station on American Samoa during the three-month project.

In 1969 he began measuring tides in the deep sea, using highly sophisticated pressure-sensing instruments he developed that were dropped to the ocean floor and retrieved by acoustic release. With co-developer Frank E. Snodgrass, Munk received the first award for ocean science and engineering given by the Marine Technology Society.

Munk also played a lead role in developing a new method for tracking long-term changes in climate associated with global warming as part of the Acoustic Thermometry of Ocean Climate (ATOC) project. The idea behind ATOC is to send sound signals from underwater speakers and track how long it takes them to reach receivers moored to the floor of the Pacific thousands of miles away. Because sound travels faster in warmer water than cooler water, a long-term series of tests that recorded increasingly faster travel times would indicate the ocean is warming.

Munk was elected to the National Academy of Sciences in 1956 and to the Royal Society of London in 1976. He has been a Guggenheim Fellow three times. In 1965 he received the Arthur L. Day Medal from the Geological Society of America and in 1966 he received the Sverdrup Gold Medal of the American Meteorological Society and the Alumni Distinguished Service Award from the California Institute of

Technology. He received the Gold Medal of the Royal Astronomical Society of London in 1968 and was named California Scientist of the Year by the state-operated California Museum of Science and Industry in 1969. He received an honorary Ph.D. from the University of Bergen, Norway in 1975 and, in 1976, he received the first Maurice Ewing Medal sponsored by the American Geophysical Union and the U.S. Navy. In 1977 he received the Alexander Agassiz Gold Medal of the National Academy of Sciences and a professional Achievement Award from the UCLA Alumni Association. In 1978 he was honored with the Captain Robert Dexter Conrad Award from the U.S. Navy. In 1981 he was awarded a Fulbright Fellowship.

Munk was honored with the 1999 Kyoto Prize in Basic Sciences for his fundamental contributions to the field of oceanography. This was the first time the prize was awarded to an oceanographer. He is a member or fellow of more than a dozen professional societies. He has served on many university, national, and international committees. Since 1968 he has been a member of JASON, a prestigious panel of military advisors. He has written more than 200 scientific papers.

The Navy League of the United States has honored Walter Munk, IGPP research professor of geophysics at Scripps, with the 2001 Albert A. Michelson Award. Bestowed in honor of Michelson, the first American

Nobel laureate, the award recognizes scientists whose research has significantly improved the nation's maritime forces or the U.S. industrial technology base.

"Munk has served the Navy for over fifty years as one of the founding greats of modern oceanography," the Navy League noted in the award announcement. "His improvement of the bathythermograph during

the 1940s revealed that the ocean's temperature profile was not smooth, and he saw the importance this fact held for underwater acoustic propagation and the entire field of submarine and antisubmarine warfare."

The award announcement also recognized Munk's contributions in Project Cabot, the Heard Island experiment, Project Mohole, and the Acoustic Thermometry of Ocean Climate project.

He lives in La Jolla with his wife Judith.

referred to as the student body, as he was the only graduate student in residence. As an oceanographer, Dr. Munk's contributions toward the war effort were invaluable. He became interested in forecasting waves when he learned that practice landings at the Army training camp in North Carolina were suspended whenever the surf was more than five feet because such waves caused the landing crafts to broach [ie turn sideways - like surfing without a fin]. He also knew that the waves along the European Atlantic coasts often surpassed 5 feet so this was a big challenge for the military.

But how could this problem be solved? Dr. Munk realized that to forecast surf, you need to look at the entire process of how waves are made. There are three parts to this process: storms, swells, and local beach conditions. Offshore storms impart wind energy into the ocean, swells deliver this energy to the shore, and local beach conditions such as reefs, subsea canyons, and beach direction determine how the waves break.

Dr. Munk and his mentor, Sverdrup, came up with the formulas that related wave size to wind speed, duration, and fetch. They were the first to include the affect of fetch. Munk took his theoretical understanding of waves and came up with some very practical methods for forecasting surf. He looked at the isobars on weather maps to determine wind speed and the length of the area across the wind was blowing. If multiple maps were available he could determine how long the wind was blowing. These gave him the inputs to calculate initial swell size. He then applied a factor for the drop in swell height depending on how far a distance they traveled. This was modified by whether there were additional winds blowing with or against the swell. The effects of local bathymetry on swells as they turned into breakers was determined by examining aerial photos. It was a rather painstaking process which today is done by computer based models.

During the War, Dr. Munk taught these techniques

S.I.O. Wave Project
Report No.3

WIND WAVES AND SWELL

Theoretical Basis of Diagrams Used in Forecasting

by

H. U. Sverdrup and Walter Munk

This summary is prepared for use by aerologists when they attend the course in sea and swell forecasting at the Scripps Institution of Oceanography.

Scripps Institution of Oceanography
February 24, 1945

Report No. 37 -8-

Using (17):

$$p = -g\rho(z - \eta e^{kz}) \qquad (24)$$

Thus, for depths greater than L/2 the pressure approaches the hydrostatic pressure under undisturbed conditions, $p = -g\rho z$.

The energy of the wave is in part kinetic, in part potential. The average kinetic energy per wave length is

$$E_K = \frac{1}{L}\int_0^L \int_{-\infty}^{0} \frac{1}{2}\rho(u^2+w^2)\,dxdz$$

Here the depth is assumed to be infinite but the equation also holds if $h > L/2$. We obtain:

$$\frac{1}{2}(u^2+w^2) = \frac{1}{2}a^2\sigma^2 e^{2kz}$$

and

$$E_K = \frac{1}{2}\rho a^2\sigma^2\frac{1}{2k} = \frac{1}{4}\rho a^2 C^2 k$$

Using (20):

$$E_K = \frac{1}{4}\rho g a^2 \qquad (25)$$

The potential energy of the entire body of water below $z = -a$ remains unchanged. In any given locality the energy used to lift or depress the water equals

$$\int_0^{\eta}\rho g z\,dz = \frac{1}{2}\rho g\eta^2$$

The average potential energy per wave length is

$$E_P = \frac{1}{2}\rho g\frac{1}{L}\int_0^L \eta^2\,dx$$

Substituting (17) and carrying out the integration,

$$E_P = \frac{1}{4}\rho g a^2 \qquad (26)$$

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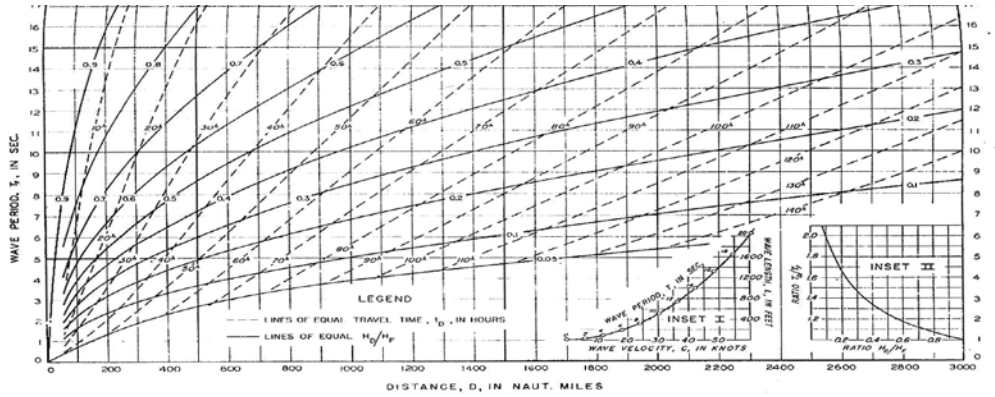

Plate VI. Decay of waves. Ratio between wave height at end of distance of decay, Hp, and at end of fetch, HF, as functions of wave period at end of fetch and distance of decay.
Inset I. Wave velocity and length for different periods.
Inset II. Ratio between period at end of distance of decay, T_D, and at end of fetch, T_F, as function of ratio H_F/H_D.

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Plate VI

This means that we can find the wave age, or the wave velocity since $\beta = c/U$, as function of x if we know the relationship between δ and β. Knowing this relationship and $\frac{d\beta}{dx}$ we can find H because

$$H = \delta L = \delta \frac{2\pi}{g} c^2 = \delta \frac{2\pi}{g} \frac{c^2}{U^2} U^2$$

or

$$H = \frac{2\pi}{g} \delta \beta^2 U^2 \qquad (51)$$

Equation (50) can be solved by numerical integration, using the empirical relationship between δ and β, or it can be solved analytically by making use of the empirical conclusion that if the fetch x increases with x:

$$\frac{1}{U}\frac{dc}{dx} = \frac{d\beta}{dx} > 0 \qquad (52)$$

Using (52) it follows from (50):

$$\frac{1 \pm \frac{s}{2\gamma^2}(1-\beta)^2}{5 + 2\frac{\beta}{\delta}\frac{d\delta}{d\beta}} > 0$$

Over a large range the empirical data in fig. 7, H.O. Misc. 11,275, are satisfied by putting

$$\frac{1 \pm \frac{s}{2\gamma^2}(1-\beta)^2}{5 + 2\frac{\beta}{\delta}\frac{d\delta}{d\beta}} = r(1 \mp (1-\beta)^2 \qquad (53)$$

where $s = 0.012$ and $r = 0.44$ and where the upper sign applies to $\beta < 1$, the lower sign to $\beta > 1$. This is equivalent to assuming that constant fractions of the amounts of energy transferred by

tangential and normal stresses go toward increasing wave energy and wave velocity, respectively, or:

$$\frac{c}{2}\frac{dE}{dx} = (1-r)\, R_T \pm (1+r\frac{2\gamma^2}{s})\, R_N$$

$$\frac{E}{2}\frac{dc}{dx} = r\, R_T \mp r\frac{2\gamma^2}{s}\, R_N \qquad (54)$$

The sum of these two equations equals (49) and the last of them equals (50) after substituting (53):

$$\frac{d\delta}{dx} = 4\gamma^2 \frac{\rho'}{\rho} g\, U^{-2} \beta^{-3}\, r(1 \mp (1-\beta)^2) \qquad (55)$$

The statement that (53) satisfies the empirical data requires some amplification. Eq. (53) gives a curve characterized by $\beta \to 0$ for $\delta \to 0$, and a maximum of δ for some intermediate value of β. These features are not consistent with experience (fig. 7, H.O. Misc. 11,275, p. 17) and we are therefore forced to conclude that (53) is valid only for values of β equal to or greater than that for which $\delta = \delta_{max}$. Let this value be $\beta_o = 0.48$. We therefore assume:

For $0 < \beta < \beta_o$: $\delta = \delta_{max}$

For $\beta > \beta_o$: δ given by the integral of (53) with the above stated numerical values of s and r.

The above procedure appears arbitrary and can as yet be justified only by the fact that it leads to results in close agreement with observations.

From (55) we obtain β as function of x for any constant value of U, and knowing β and δ we find H as function of x for any constant value of U, using (51). Thus, the problem is solved for the steady state.

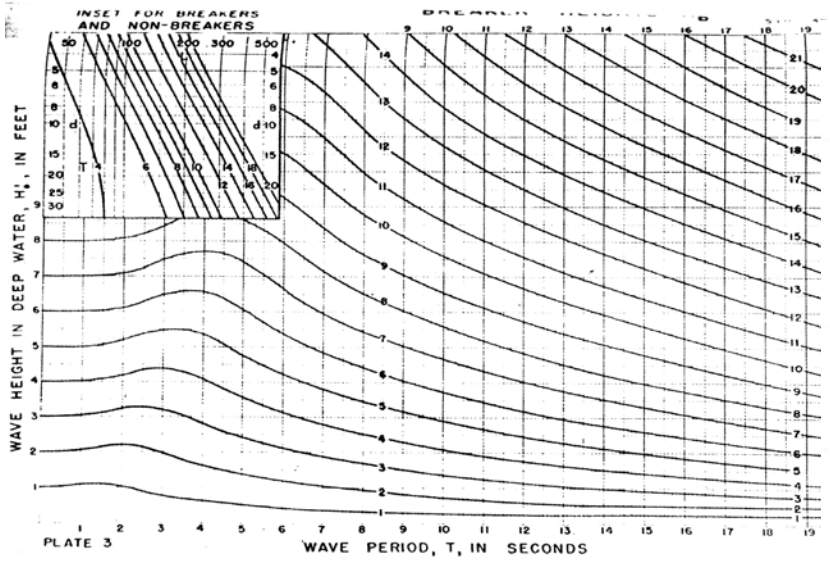
my is not known.

Example 4. Figures 18 and 19 are two photographs from a run taken at a time interval of 6.15 seconds. To determine the period, crest A is measured from the beach wall along line 1 in figure 18 and this measurement is transferred to figure 19. The following crest has practically reached this point in a time interval of 6.15 seconds, and the period is taken as 6-7 seconds.

Crests B and C are measured from shore along lines 2 and 3 in both photographs, and the differences between these two sets of measurements are computed. These differences, converted into feet at the scale of the photographs, represent the distances traveled by the crests during the time interval, 6.15 seconds, prior to breaking. Dividing by 6.15 gives the breaker velocities. Plate IV is entered with these velocities, and the depths at breaking read off.

Breaker heights and wave heights in deep water are calculated exactly as before.

Line No.	Symbols	Units	Numerical Value		Source
(1)	Scale	---	1/11960		Given
(2)	Time interval	Seconds	6.15		Given
(3)	T	Seconds	6-7		Figs. 18 and 19
(4)	Distance from Shore	0.001 foot	46	58.5	Figure 18
(5)	Distance from Shore	0.001 foot	37.5	49.5	Figure 19
(6)	Difference	0.001 foot	8.5	9.0	(4) minus (5)
(7)	Travel distance	Feet	101.7	107.6	(6) times (1)
(8)	c_b	Feet/sec	16.5	17.5	(7) divided by (2)
(9)	d_b	Feet	8.75	10.1	Plate IV, using (8) and (3)
(10)	H_b	Feet	6.7	7.8	(9) divided by 1.3
(11)	H_o'	Feet	5.8	7.2	Plate III, using (3) and (10)



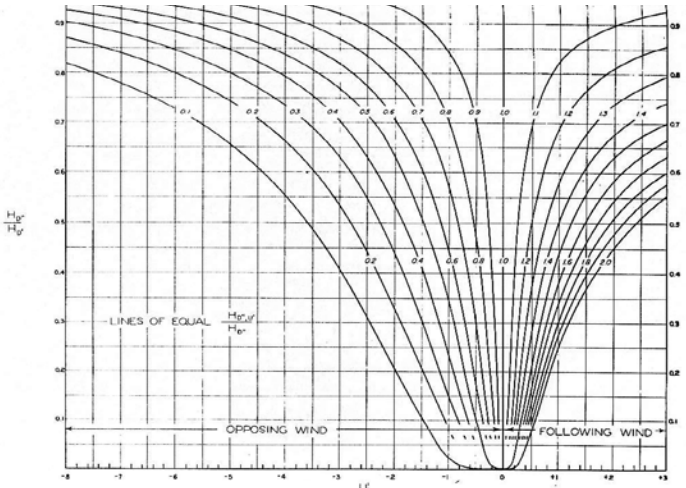


Plate VII

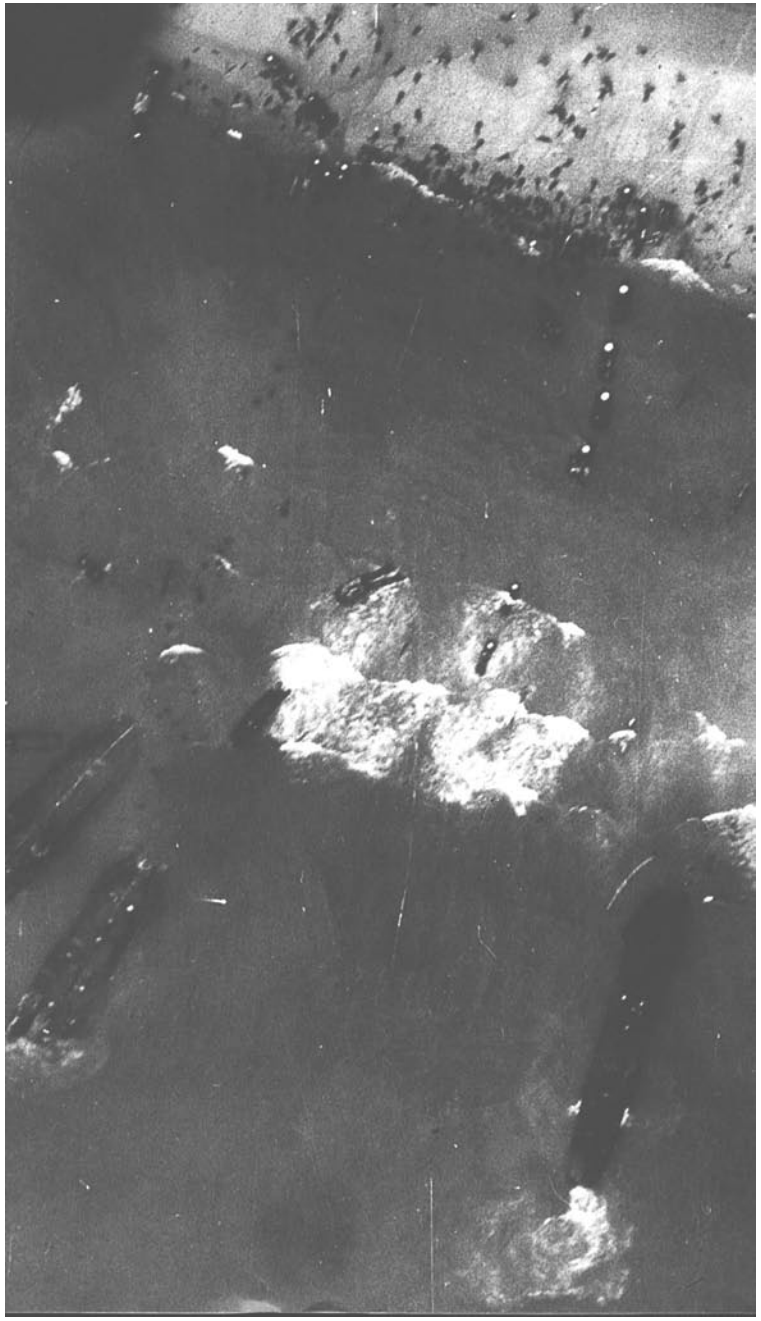
From the article in Oceanography, Vol. 15, No. 4/2002

Plate VII. Change in height of swell due to following or opposing winds.

to over 200 United States, Navy and Marine Corps weather officers. They successfully predicted conditions for amphibious landings at Sicily, Saipan, Guam, Tinian, Palua, the Phillipines, Iwo Jima, and Okinawa. Munk and Sverdrup's system was so valuable that it was classified top secret. For a long time Dr. Munk could not read his own publications as he did not have the proper security clearances. More on this later.

Probably the most important surf forecast of all time was for the Allies D-Day invasion of Normandy. The military planners of that operation feared they would lose the element of surprise if they came in on a clear, calm day. They wanted to land at a very high tide so the landing boats could float over the barricades the Germans had put in the surf. Unfortunately the next period of highest tides came during a period of stormy weather with 18-20 knot winds and waves up to 6'. One of Dr. Munk's students correctly forecasted that the conditions would start to calm down at midnight on June 5th. The next day the invasion was launched in manageable 2-3' surf waves and caught the Germans completely off guard. And of course, the rest is history.

After the war, Munk measured waves for the atomic testing the U.S. carried out in the South



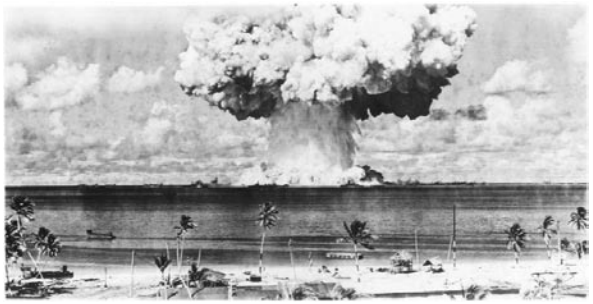
Invasion troops, who have just waded ashore from landing boats in the background, take cover behind enemy beach obstacles. These men were firing upon Nazi positions located just back of the beach. The first day was the critical period for our landing forces, when our men were required to battle the Nazis from exposed positions on the open shore. Here our troops suffered the greatest percentage of their casualties.

Above left From the movie, "The Longest Day"
Above right Aerial shot of the landing - with no surf
Left Imagine this scene - the day before - with 5' sets
Below left From a landing craft - and no surf to speak of.
Below Casualties were heavy
Bottom But it could have been much worse: a steel pier destroyed by storm surf just two weeks later.

isted wreckage of a beachhead bridge on the coast of Normandy juts out into the channel. is American installation was irreparably damaged, shortly after it was assembled, by the vy storm of June 19, 1944. Consequently, only one of the two prefabricated harbors ught from Britain could be used to land men and supplies necessary for operations.

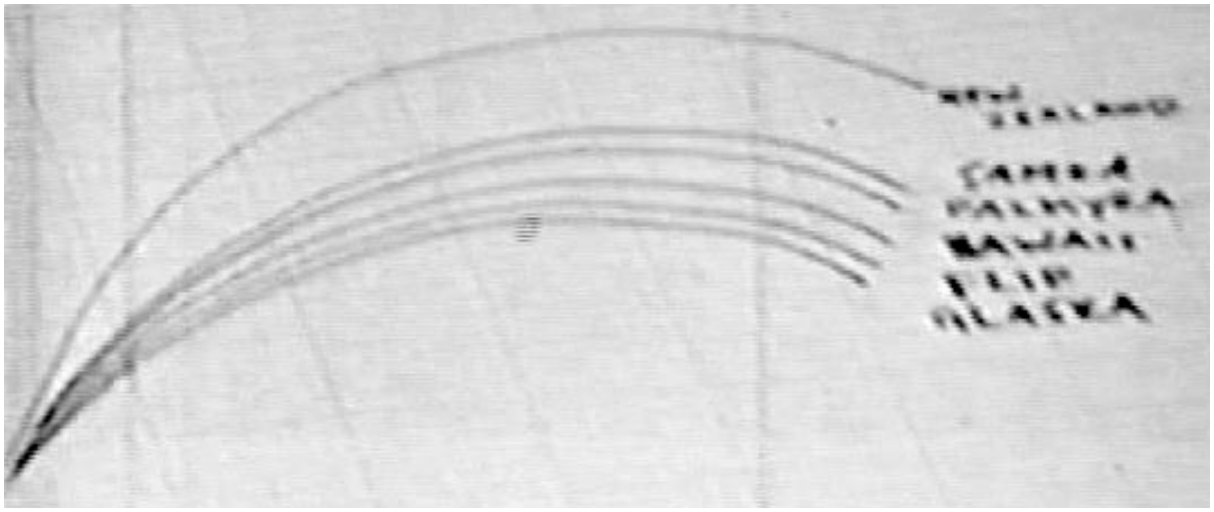
Pacific atolls of Bikini and Entewtok. The largest of them was a 20 megaton device which was a thousand times the force of the bombs used in Japan. So you could say that Munk measured the largest artificially produced waves ever made. Thankfully no one has tried this method of making waves for surfing parks.

While he was standing on the reefs of Bikini watching waves, Munk noticed that the coral reefs

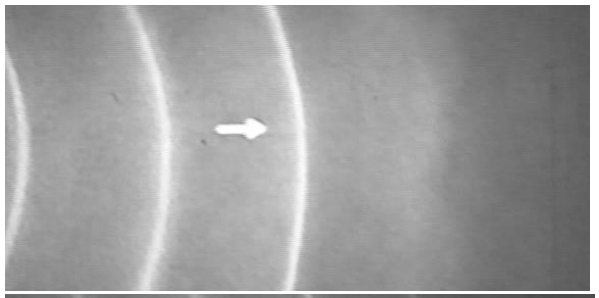
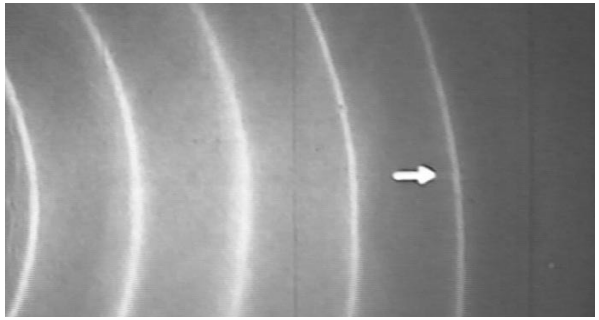
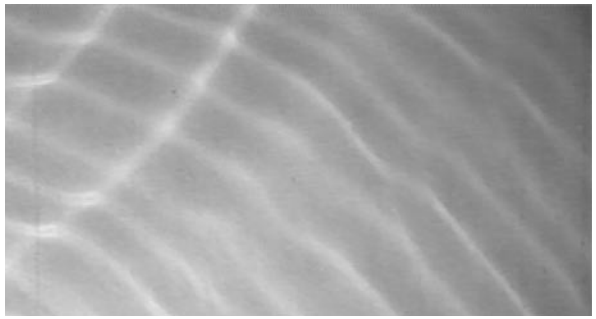
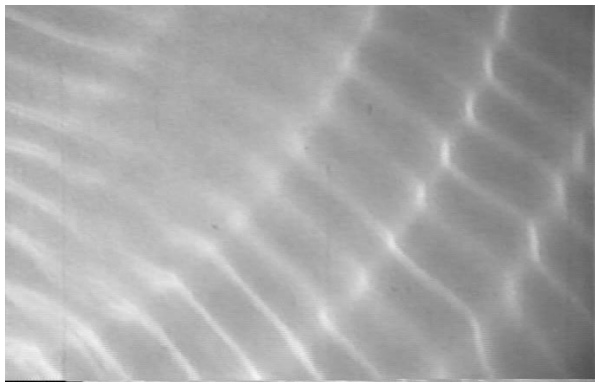
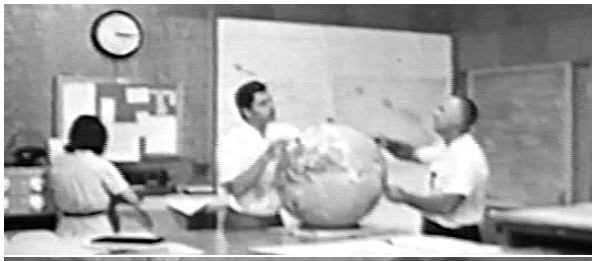


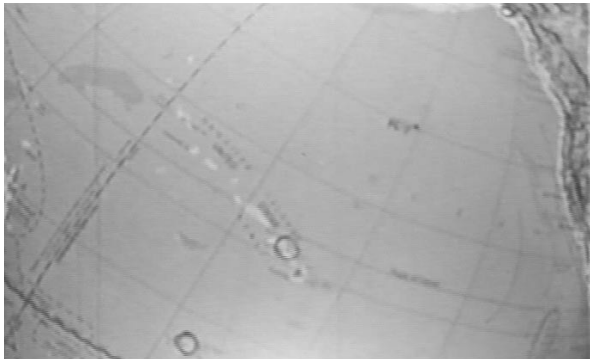
are tuned to the predominant swell direction and period. He worked out the math to show that the size and shape of the surge channels are such that they maximize the exchange of water on the upper reef. I liken this to a "Coralhenge" wave observatory pointing out the direction and distance to storm centers. According to big wave rider and coral expert Ricky Grigg, Munk may have been the first and only one to look at this. I think this example epitomizes the quintessential Munk. He used his gift of mathematical analysis and keen power of observation to develop new insights that others did not see.

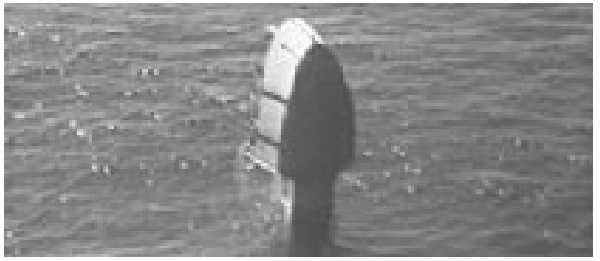
During the War Dr. Munk had wondered where the source of the long period south swells was as, in this era before weather satellites, there was little information about what has happening in the Southern Ocean. In the early 1960s, Munk had an opportunity to conduct a test to find out. Inspired by techniques used in radio astronomy, he installed a triangular array of wave recorders off San Clemente Island and waited for a big south swell. He was able to determine that



Surfers take the "Southern Hemi" predictions for granted these days. But it wasn't so long ago that they were a mystery. Waves across the Pacific - from New Zealand to Alaska - were the subject of a pioneering study that started with theories based on tank testing at Scripps. Dr. Munk and colleagues then proposed an experiment that would track waves starting at a lighthouse in New Zealand, north through Polynesa and Hawai'i, and on to Alaska, with an extra mid-ocean data station, the unique FLIP platform.




the wave sources were coming from a direction of 210 to 220 degrees. This heading points to an area between New Zealand and Antarctica. We all now know that huge storms are common there and it is the source of our great southern hemi swells.

With these results in hand, Dr Munk wanted to better understand how much waves diminished as they traveled across the ocean. So in 1963 he established a string of six wave monitoring stations from New Zealand to Alaska. He was then able to track storm-generated waves for two weeks as they crossed the ocean and measure their decay. A documentary film of this experiment was made called "Waves Across the Pacific". Many of you may recall seeing this in your high school science class.

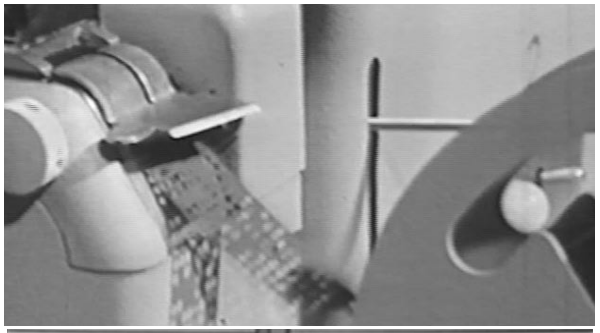
Before Waves Across the Pacific, it was thought that waves attenuated, or diminished, at some constant rate. It turned out that after a distance about equal to the diameter of the storm area, there is very little loss of wave energy, most of which is due to geometric spreading but not resistance to air as was originally speculated.

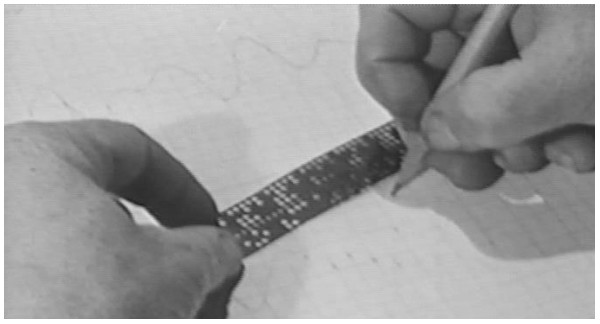
At the time of the experiment, Dr. Munk remarked that he could predict the surf in Hawaii several days in advance, but from what he knew of this group, this would be of little value. It would take 35 years for Sean Collins and others to prove him wrong on this.

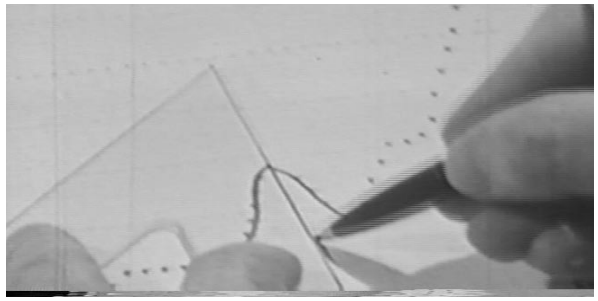
Dr. Munk's discoveries have won him just about every award possible in the field of oceanography. Today at age 85, he is still going strong. A favorite quote from him is "If one wishes to have a maximum impact on the rate of learning, then one needs to stick one's neck out at an early time." As Americans and as surfers, we are grateful he followed his own advice.

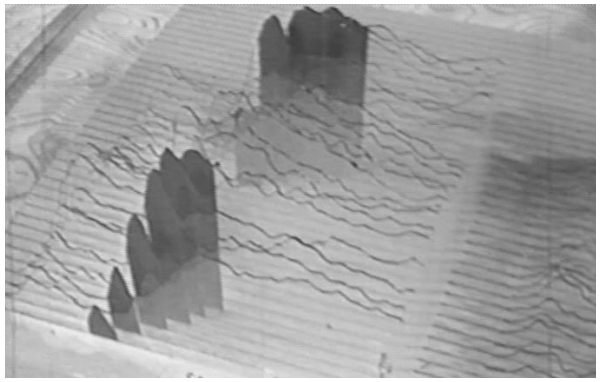
EPILOG

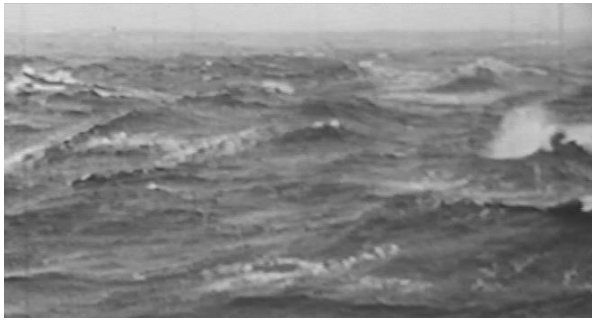
When Glenn first invited me to write this piece, we were under the popular misunderstanding that

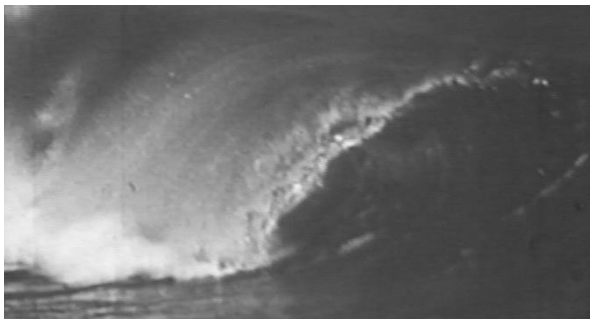


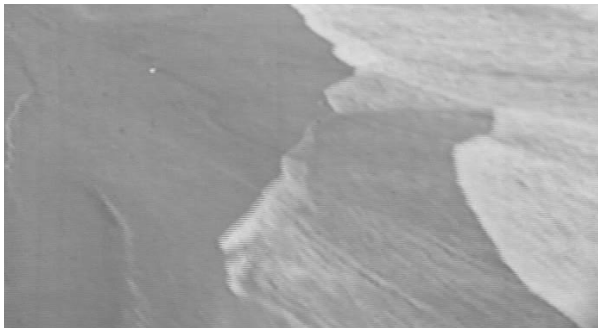




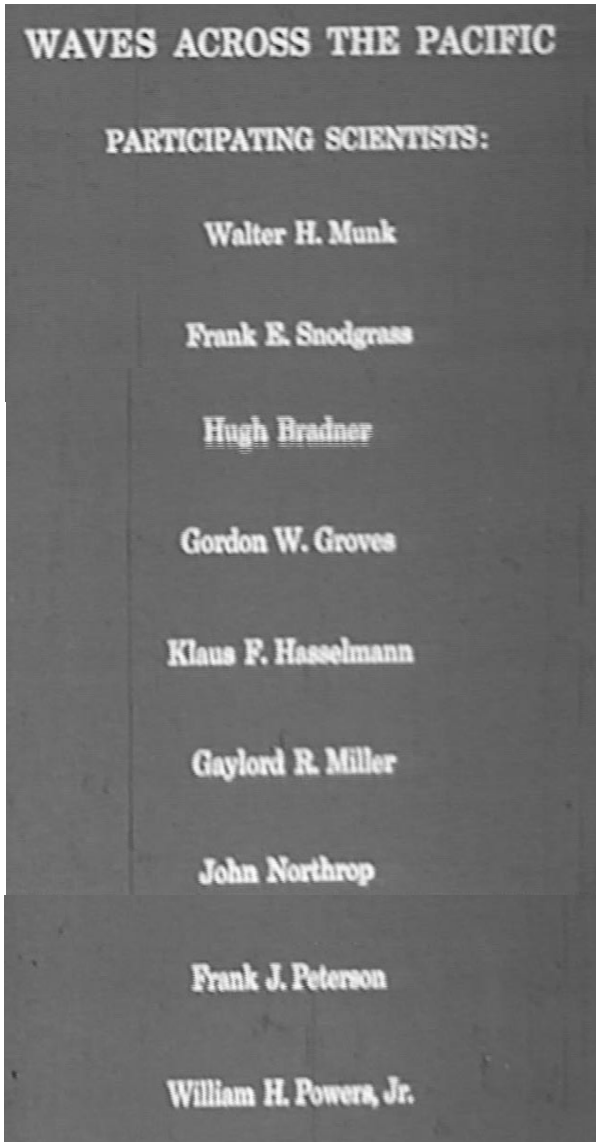








From the all the data stations across the Pacific, punch tape was generated as the swells traveled north. The tapes were then analyzed, and Dr. Munk and colleagues were able to, for the first time, understand one of the wonders of the natural world: the raw energy of the open ocean transformed into waves that can travel thousands of miles.



Federal Bureau of Investigation

United States Department of Justice

1435-37 K Street, Northwest

[redacted] b7C

Washington, D. C.

65-3739

October 27, 1942.

ALL INFORMATION CONTAINED
HEREIN IS UNCLASSIFIED
DATE 7-1-91 BY 1545 [redacted] b7C

Director 321,195
Federal Bureau of Investigation
Washington, D. C.

Attention: Mr. E. A. TAMM

RE: WALTER HEINRICH MUNK;
HAROLD ULRIK SVERDRUP
ESPIONAGE - G

Dear Sir:

With reference to the captioned individuals, agents of this office conferred with Major General [redacted] of G-2 and General [redacted] Chief, Technical Services, Army Air Corps. General [redacted] advised that subjects, MUNK and SVERDRUP, are employed in the Weather Division of the Army Air Corps and have access to information of great importance. Mr. MUNK has been so employed for some three months and Mr. SVERDRUP for only a few days. General [redacted] stated that Major [redacted], a well-known authority in Oceanography, was in charge of the work of these men and has been given a more or less free hand in choosing his associates. SVERDRUP's services have been furnished by virtue of a contract entered into by the War Department with the University of California and he is in Washington in a temporary capacity. Messrs. SVERDRUP and MUNK, in their capacity as Oceanographers, have come into possession of information concerning impending military operations which are to take place within the next two weeks. The information in the possession of these individuals is said to be of such a nature that disclosure of said information to enemies of this country would be disastrous.

General [redacted] stated in substance "if they are wrong, the damage has already been done". He inferred that Dr. SVERDRUP had once been in the Navy employ and that it was largely through Navy protests that the current investigation had been instituted. He advised further that Major [redacted] appears to be a very close friend and associate of the subjects of this case. [redacted], according to the General, has been checked by G-2 because investigation had disclosed he had studied in

[redacted] CONTINUED IN FILE

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FOR VICTORY BUY UNITED STATES DEFENSE BONDS AND STAMPS

Neil Morgan

Papers detail WWII loyalty controversy at Scripps

After 60 years, declassified FBI files are unraveling the mystery of false wartime charges that cast two pioneering Scripps oceanographers as Nazi sympathizers.

Both scientists were foreign-born and spoke fluent German. They also were at the core of a faculty schism on the future of Scripps Institution of Oceanography.

One scientist is long dead, the other long alive:

■ Harald Sverdrup was an Arctic explorer and author. As Scripps director from 1936 to 1947, he is today revered for taking the institution into the oceangoing research that has helped make it a leading laboratory for weather and climate research. After retiring from Scripps, he died in his native Norway in 1957.

■ Walter Munk, 85, now an icon of science around the world, was a Viennese-born junior scientist at Scripps in 1942 when FBI director J. Edgar Hoover ordered an investigation of the two men. Sverdrup had brought Munk from Caltech in 1940 as a graduate assistant.

Both men's security clearances to work with the Navy were revoked in 1942, even as Sverdrup consulted with the U.S. Office of Strategic Services on the then-unprobed science of wind and wave forecasting, widely used later in U.S. military landings. The Army Air Corps continued working with Munk.

After a nightmare year for both scientists, the Navy and the War Department reversed themselves.

Records of the government's 1942 investigations of Sverdrup and Munk were sought in 1993 by Scripps archivist Deborah Day

SEE **Morgan, B2**

Walter Munk (left) and Harald Sverdrup spent a year having to clear their names after being labeled Nazi sympathizers and losing their wartime security clearance. *1947 file photo*

▶ **MORGAN**
CONTINUED FROM PAGE B1

Scientific schism may have led to loyalty doubts

through the Freedom of Information Act, at the urging of Munk's wife, Judith. But Munk deferred bringing public attention to the blacklistings, he says, until after the deaths of four academic colleagues who informed against him and Sverdrup.

FBI records reveal the four as the late Stanley Chambers, Denis L. Fox, Francis Shepard and Claude ZoBell.

Munk says:

"They were only doing their wartime duty as they saw it then."

The investigation

Sverdrup was in a car pool of four Scripps scientists who, even before the Pearl Harbor attack in 1941, commuted each morning by Chevrolet from their La Jolla homes to the Point Loma Navy Laboratory.

They reported with their lunch sacks at 0730, assigned to work on submarine detection under the aegis of the Navy and the University of California Division of War Research. Their goal was to improve acoustic monitoring of Nazi submarines, which were sinking U.S. cargo ships and their crews as they supplied Allied Forces across the Atlantic.

On Jan. 8, 1942, FBI director Hoover, acting on information from the U.S. Navy, wired the San Diego office of the FBI to investigate Sverdrup "as a security threat." By March 1, the Scripps director was notified that his security access to U.S. military facilities was canceled. "He was so upset," the late Scripps researcher Gene LaFond told the marine geologist Francis Shepard that morning as they drove to Point Loma without Sverdrup, "that he's given me his ID card to turn in."

The Sverdrup family was stunned. Ironies flooded in on them. Eighteen months earlier, Sverdrup, his wife, Gudrun, and daughter, Anna, had applied for U.S. citizenship (which they later received). That same year, two of Sverdrup's sisters, Marie and Helga, were arrested and imprisoned by the Nazis in Norway. His younger brother, Einar, died leading a joint British/Free Norway commando raid in Spitsbergen. Still, Sverdrup persisted in offering his science to the U.S. war effort.

By July, Munk also had lost Navy security clearance and was barred from the Navy's Point Loma lab.

Yet, one month later, he was at the Pentagon working with the Army Air Corps on plans for an amphibious assault by U.S forces on the northwest coast of Africa in the following November. The Navy's sudden ban on the two scientists, Major H.R. Seiwell assured Munk, would not be recognized by the Army Air Corps.

Back on the Scripps campus, Sverdrup and Munk continued to help train a succession of more than 200 officers from the Army, Navy and Marine Corps in weather and wave prediction. These officers later participated in the planning and execution of American military landings in the Pacific, including Iwo Jima, Okinawa and the Philippines, and subsequently in landings at Sicily and Normandy.

Yet, in November 1942, Munk was "terminated with prejudice" from government work on the "basis of reports of military intelligence."

A reversal

The government investigation took another sharp turn two months later through the intervention of scientist Roger Revelle, who years later would succeed Sverdrup as director of Scripps.

Revelle, then on active duty as a Navy commander, asked the War Department to review Sverdrup's security clearance. Soon the War Department withdrew all objections and restrictions on his work with the U.S. military.

In June 1943, the Navy, which had instigated the probe through the FBI, also withdrew its objections. Sverdrup's clearances were restored, although not as fully as before the investigation.

Munk also was reinstated. Finally, the War Department concluded he had no pro-Nazi sympathies nor had he engaged in subversion.

Polarizing dispute

So what had this confused nightmare been about?

In those formative years at Scripps, faculty schisms were widely known. Scientists were divided, according to their interests, over whether the mandate of Scripps founder William Ritter in 1909 had been to make Scripps a land-based biology laboratory or a more diverse oceangoing one.

Over time, the division came to center on Sverdrup, who had accepted the directorship of the institution with a promise to UC president Robert Gordon Sproul that he would take Scripps to sea. Revelle supported him in the determination to make Scripps a dynamic seagoing institution.

Both men were opposed by Scripps faculty members who did not favor such expansion.

The flood of documents that resulted from the FOIA request for records of the government's investigation of Sverdrup and Munk, despite numerous blacked-out details, illustrated the hostilities that grew from the schism over the future of Scripps.

The documents reveal a sorry record of unfounded wartime suspicions, actively invoked against colleagues. This may have been a desperate effort to change the course of a public institution of science through intimations of traitorous disloyalty by its leader, Sverdrup, and his young ally, Munk.

Learn more

The FOIA files are accessible to researchers in the Walter Munk Papers, Scripps Archives, UCSD. A paper titled "Harald U. Sverdrup and the War Years," by Munk and Day, appears in the December issue of the journal *Oceanography*, a publication of the Oceanographic Society.

What was said

Lieutenant Eckman, a G-2 intelligence officer at Camp Callan, reported interviewing Stanley Chambers who "states emphatically that subject (Sverdrup) is pro-Nazi, and that Mrs. Sverdrup had made comments sympathetic to the Nazi movement in front of him and Mrs. Chambers. The informant felt . . . that Sverdrup should not be trusted with information vital to this country's defense because of his decided sympathies with Germany and the Nazi movement."

Agent Ruge, also of G-2, recommended that Munk be removed from work on secret and confidential projects. His report was forwarded to the Office of Naval Intelligence.

Ruge cited an interview with Scripps' Denis Fox about Sverdrup: "He stated that he knew nothing definite to discredit subject's loyalty, but that he 'kept his fingers crossed' concerning him."

Agent Ruge interviewed Claude ZoBell a second time: "ZoBell refused to give the agent the names of the staff members who considered Munk pro-German because Sverdrup 'had told him to forget it.'" Ruge concludes, "ZoBell fears for his position (and had the) impression ZoBell doubted the loyalty of both Munk and Sverdrup . . . (He) said that other members of the staff considered Munk pro-German, and (concluded) that ZoBell knows considerably more about subject than he is willing to divulge."

In reading the documents obtained by the FOIA request, Munk found some lesser embarrassments.

Reporting on an interview with Munk's landlady, Agent Ruge says Mrs. C.F. Cole "vouched for his loyalty, integrity and discretion, but said she wouldn't rent a room to him again because of his extreme untidiness."

Ruge also interviewed Chambers, who gave him a list of Munk's friends and associates and said he doubts Munk's loyalty "because he appeared to avoid military service." In fact, Munk had enlisted in the U.S. Army, serving with its ski troops in 1940. He was discharged as a corporal in November 1941 to work as a civilian oceanographer at the Point Loma laboratory from which he was later barred.

Citing an interview with a Scripps janitor, Owen Martin, Ruge reported Martin "believed that Munk was not loyal to the United States . . . and that subject kept an office at Scripps Institution and he frequently brought girls out to the office at night. Most of these girls spoke with a German accent."

The documents also show the FBI and government security agencies received positive support for the two men in statements from such war-serving scientists as Vannevar Bush, Ernest O. Lawrence and UC's Sproul.

Sverdrup to this day is regarded by oceanographers as "the father" of their science. He was author of "Six Years in the Arctic" and co-author of "The Oceans," a seminal work for oceanographers.

Munk, who has remained at Scripps throughout his career, survived the smears to receive honors that range from the National Medal of Science to the Kyoto Prize, Japan's highest private award for lifetime achievement for a scientist. He recently signed over his $438,000 Kyoto Prize check as an endowment for Scripps to underwrite "daring" science.

Scripps director Charles Kennel calls Munk "the world's greatest living oceanographer . . . . He isn't really confined by any disciplinary boundaries."

Munk's other honors include a wry concession of his loyalty to the United States, his appointment to the "Secretary of the Navy Chair in Oceanography" at UCSD.

Neil Morgan can be reached by e-mail at neil.morgan@uniontrib.com.

Munk himself made the D-Day forecast. Because of his problems with obtaining security clearances, Munk was at times distanced from direct involvement in military operations. Thus, Munk trained Army, Navy and Marine Corps meteorologists in his wave prediction methods, and they in turn, made the forecasts for the military.

Now, with de-classified documents recently released under the Freedom of Information Act, new light has been shone on Dr. Munk's security clearance problems. It seems that several of Sverdrup's poltical rivals at Scripps participated in a loyalty investigation of him by the FBI. Munk, by association, was drawn in, despite his good service record with the Army. Baseless suspicions voiced by colleagues caused a nightmare of problems for the wave researchers. See the article above for the complete story.

Munk wrote of his experiences in a recent issue of the journal Oceanography. He graciously does not blame the four "informants" from Scripps who may have felt they were only doing their patriotic duty. In fact, he had the Scripps archivist delay filing of the FOIA request until the last of them had passed away – presumably to spare them any embarrassment.

Being the last man standing does have its advantages. His opinion of the agencies responsible for judging the statements of the "informants" is different. By weighing the vague statements made against him over the abundance of evidence and testimonials to the contrary, the security agencies were depriving the country they were trying to protect from the needed talents of several individuals.

Sverdrup's and Munk's termination from government work was eventually reversed due largely to the persistent efforts of Roger Revelle, a Scripps scientist then serving in the Navy. Munk ultimately had a life long association with the Navy culminating in an appointment as Secretary of the Navy Chair in Oceanography.

Above The story of Dr. Munk, accused of espionage in 1942.
Below Honored by the President in 1985.
Bottom Researching the groundswells of the Roaring 40s traveling across the Pacific.