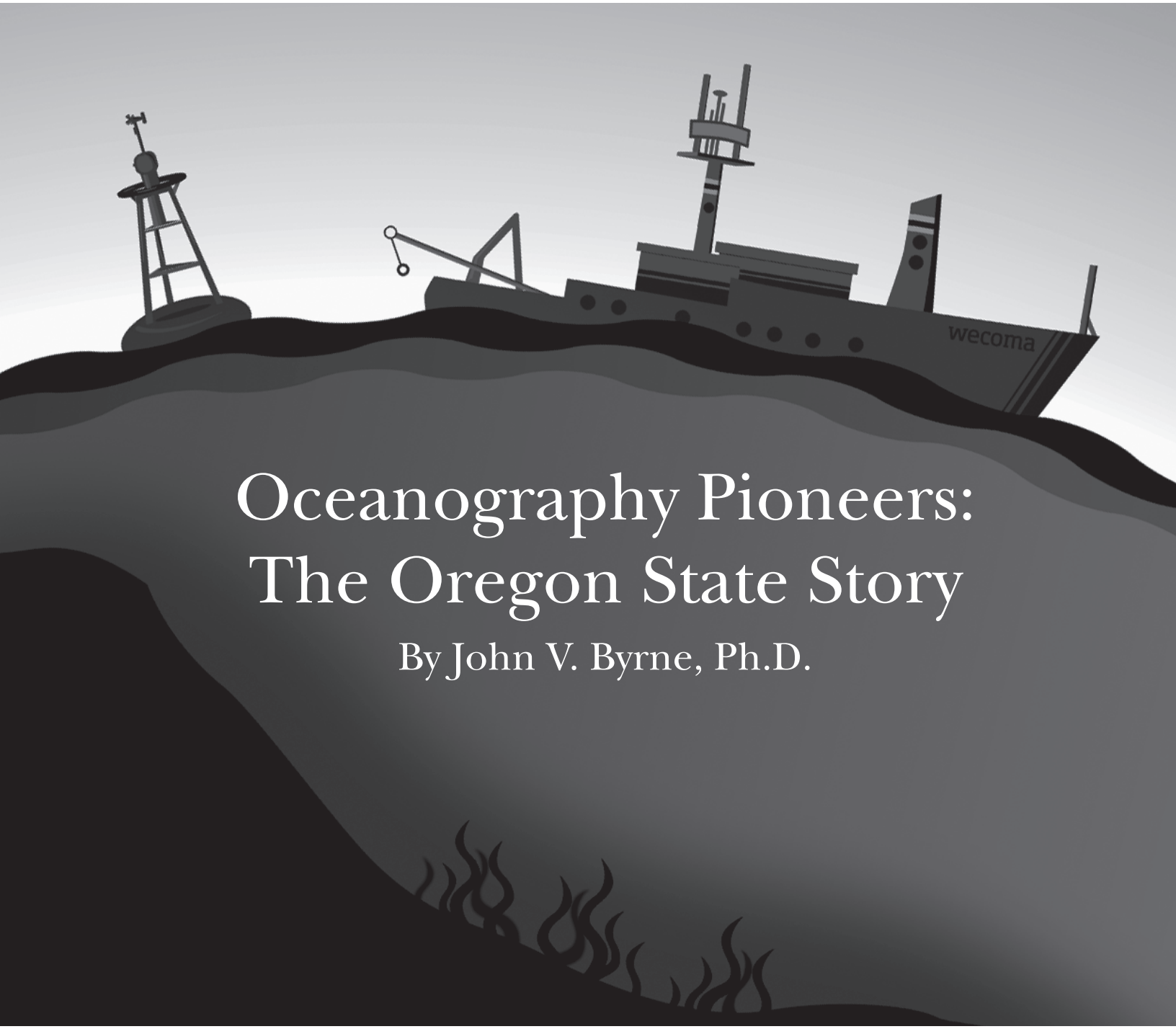

Oceanography Pioneers: The Oregon State Story

By John V. Byrne, Ph.D.

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In late 2011, Oregon State University created a new academic and research college, the College of Earth, Ocean, and Atmospheric Sciences (CEOAS), focusing on the Earth as an integrated system. CEOAS was formed by transferring the Department of Geosciences from the College of Science to the College of Oceanic and Atmospheric Sciences. The newly formed college was the latest step in the evolution of the oceanography program that started in 1954 when Wayne V. Burt returned home to Oregon. Burt, who grew up in Oregon, came back with the vision of starting an oceanography program in his home state. Before his return to Oregon there were few marine scientists in Oregon and very little was known about the waters off the Oregon coast. Now, in 2012, the new CEOAS has almost 300 oceanographic personnel (75 teaching and research faculty, 100 research associates and post docs, 105 graduate students) and brings in about $32,000,000 in grant and contract funds annually, just in the ocean sciences. In addition to its own oceanography efforts, the college has spawned strong programs in the marine biological sciences and in ocean engineering elsewhere within Oregon State University. It all started with the vision and persistence of one man at the right time.

There is a tide in the affairs of men,
Which taken at the flood, leads on to fortune;
Omitted, all the voyage of their life
Is bound in the shallows and in miseries.
On such a full sea are we now afloat;
And we must take the current when it serves,
Or lose our ventures.

Brutus to Cassius, Act IV, Scene 3, of Shakespeare's *Julius Caesar*

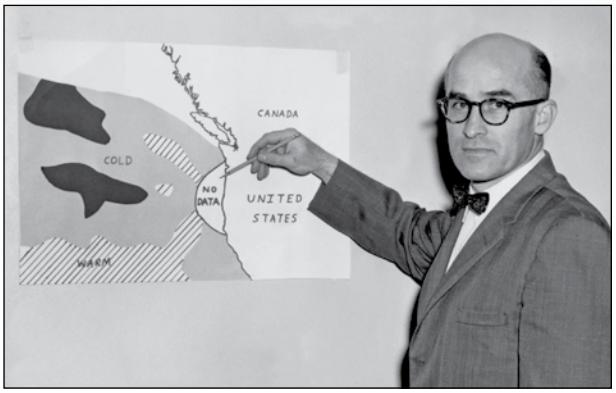
THE BEGINNING

The awakening of scientific ocean research in the United States following World War II started with the establishment of the Office of Naval Research (ONR) in 1946, followed by the creation of the National Science Foundation (NSF) in 1950. ONR took the lead in emphasizing the need for ocean research during the 1950s and began funding oceanographers at existing laboratories at the Woods Hole Oceanographic Institution, the Scripps Institution of Oceanography and the University of Washington.

Wayne Burt came to Oregon State College (OSC) in 1954. After receiving his doctorate from the Scripps Institution of Oceanography, he served as the Associate Director of the Chesapeake Bay Institute in Maryland, and then spent a year in the oceanography program at the University of Washington. But for Wayne, Oregon was home and it was in Oregon that he wished to establish an oceanography program. While at the University of Washington he contacted Francois A. Gilfillin, Dean of the School of Science at Oregon State, with a proposal: if he could get funding from ONR to support his salary at OSC, would Oregon State create a position for him? In a letter to Burt, Gilfillin responded, "If the grant is allowed, we will request the State Board of Higher Education have you appointed with the proper professorial title so you may appear on the college staff roster. This would be on an annual basis until such time as our instruction and research programs on state funds might warrant a permanent appointment." Gilfillin and Oregon State College (converted to Oregon State University in 1961) had nothing

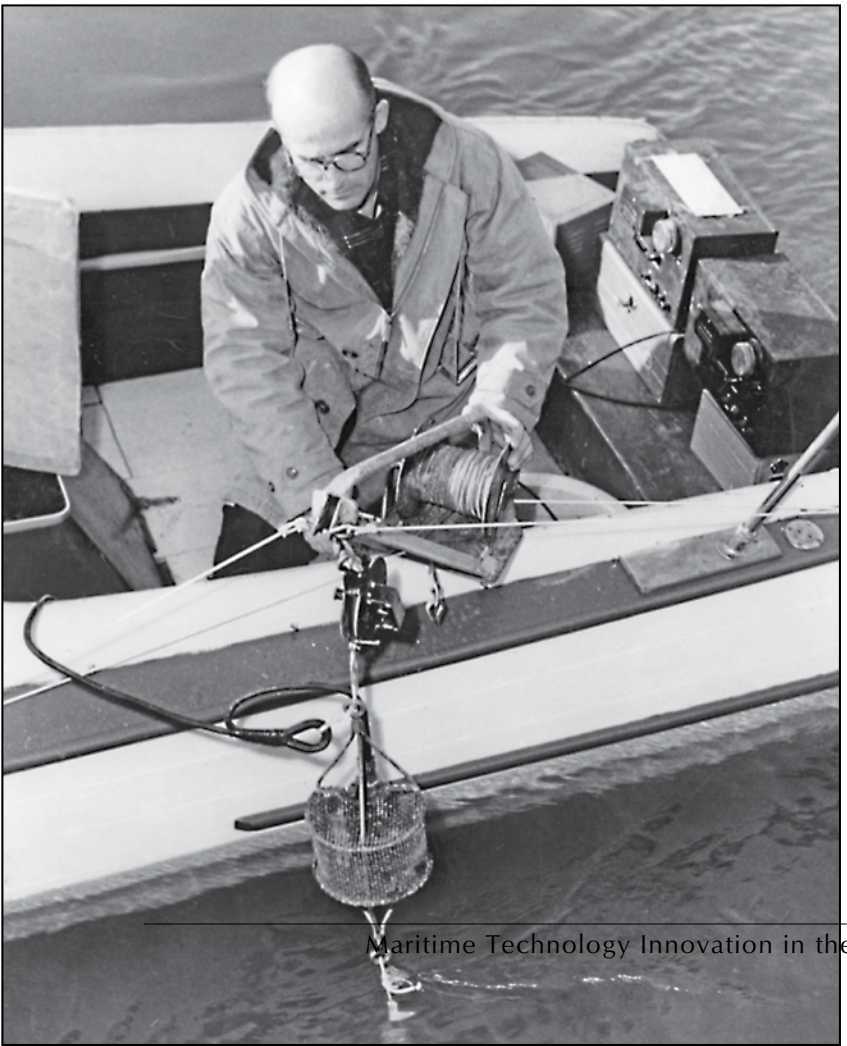
John Byrne is President Emeritus of Oregon State University. After spending three years in the petroleum industry, Byrne joined the new department of Oceanography at Oregon State University where he served as a faculty member, department Chairman and Dean of the School of Oceanography. He then moved into administration as the University's Dean of Research and subsequently as Dean of the Graduate School and Vice President for Research and Graduate Studies. During his tenure at Oregon State, he took leave twice for positions in the federal government, first as a Program Manager for Oceanography at the National Science Foundation and, later, as the Administrator of the National Oceanic and Atmospheric Administration, and United States Commissioner to the International Whaling Commission. He then served as the President of Oregon State University for eleven years. During his retirement he has been the Executive Director of the twenty-five member Kellogg Commission on the Future of State and Land-grant Universities. His academic degrees are all in geology; his Ph.D. was from the University of Southern California.

to lose and, as it turned out, everything to gain. The proposal was approved, ONR provided the grant money and, in September 1954, Wayne Burt started a project on the coastal oceanography of Oregon waters. He had an appointment in the Department of General Science in the School of Science at OSC and was paid $7,000 for twelve months employment.



Above: Wayne Burt, in 1958, with a chart of the Northeast Pacific Ocean, pointing out the absence of data off the Oregon coast.
Courtesy of OSU Archives

During the fall of 1958, the geophysics branch of the Office of Naval Research proposed a ten-year program for an expansion of Navy-sponsored oceanographic research. It was called "Project TENOC: A Ten-Year Plan for Oceanography." The plan called for Navy support of at least ten institutions of oceanography throughout the United States over a ten-year period. The primary objective would be to create knowledge relevant to naval operations through basic research. Wayne Burt, who had come to Oregon State College four years earlier, learned of the TENOC program and was excited by it. Wayne's wife, Louise Burt, in her history of the first two decades of the School of



Wayne Burt, in 1957, measuring currents in Yaquina Bay from a small motorboat.
Courtesy of OSU Archives

Oceanography, recalls: *On the evening after learning of the TENOC proposal, Wayne came home and told me about its possibilities. Perhaps even Oregon State would be one of the institutions selected. He had a restless night and the next morning at breakfast he asked me to look up the quote from Shakespeare's* Julius Caesar: 'There is a tide in the affairs of men, which taken at the flood, leads on to fortune. Omitted, all the voyage of their life is bound in the shallows and in miseries. On such a full sea are we now afloat and we must take the current when it serves or lose the venture.' *Wayne was bold enough to 'take the tide at the flood.' And it was the right thing to do at the right moment. What an appropriate quote for a physical oceanographer!* (It was indeed the right thing to do at the right time, and before the century was over it would result in OSU Oceanography becoming one of the top five or six Oceanography programs in the United States.)

RV *Acona* **at sea off Oregon, 1962.**
Courtesy OSU Ship Operations

By September 1958, Burt had been at OSC four years, teaching courses in Oceanography and carrying on ONR-funded research along the Oregon coast and in its estuaries. The total Oceanography budget for 1958 was approximately $25,000, most of it coming from the Office of Naval Research. Burt had been in frequent contact with Gordon Lill and Art Maxwell at ONR. He had convinced them that, with ONR support, an Oceanography program at Oregon State College was feasible and, with the announcement of the TENOC program, he was ready to move forward. He submitted a detailed proposal for TENOC support and at the same time indicated to the OSC administration he was confident the Navy would support a "Department of Oceanography at a significantly higher level." He had an oral agreement with Lill and Maxwell at ONR that with approval of the creation of an Oceanography Department at OSC, ONR would provide both operating funds and funds for capital improvement: $250,000 in fiscal 1960 for a research vessel, and $200,000 for the construction of an Oceanography laboratory. Wayne convinced the administration at OSC to create an academic Department of Oceanography, the administration convinced the State Board of Higher Education, and a Department of Oceanography at Oregon State College came into existence July 1, 1959.

Early Pioneers

Burt wasted no time in assembling a department faculty; programs of instruction and research were initiated and students attracted. With little to offer but opportunity and potential growth, Burt persuaded a group of scientists to join him as faculty of the new department. The department was organized according to traditional disciplines of Oceanography: Physical, Chemical, Biological and Geological/Geophysical. In 1959, Herb Frolander (Biological) and Bruce McAllister (Physical) joined Wayne Burt as faculty. McAllister was an instructor and at the same time was working on his Ph.D. June Pattullo (Physical), John Byrne (Geological) and Bill Pearcy (Biological) arrived in 1960. Graduate students, in addition to Bruce McAllister, included Bob Smith (Physical), who came from the University of Oregon, and Vern Kulm, already a geology graduate student at Oregon State, who transferred to the Oceanography Department. In 1961, Andrew Carey, Herb Curl, Jim McCauley, Larry Small (all in Biological Oceanography), Kilho Park (Chemical) and Joe Berg (Geophysical) joined the group. At the end of ten years, in 1968, there were thirty-one faculty members and a total staff of 122. From that early group, the pioneers who stayed with the Oceanography program until their respective retirements include: Frolander, Byrne, Pearcy, Carey and Small. June Pattullo, an early pioneer, died while still a faculty member. Smith and Kulm received their doctorates and then signed on to the faculty for the remainder of their careers. These individuals served as the core faculty as the department grew into a School of Oceanography in 1972, later to become the College of Oceanography in 1983, and then in 1993, after acquiring the Atmospheric Science Department from the College of Science, became the College of Oceanic and Atmospheric Sciences (COAS).

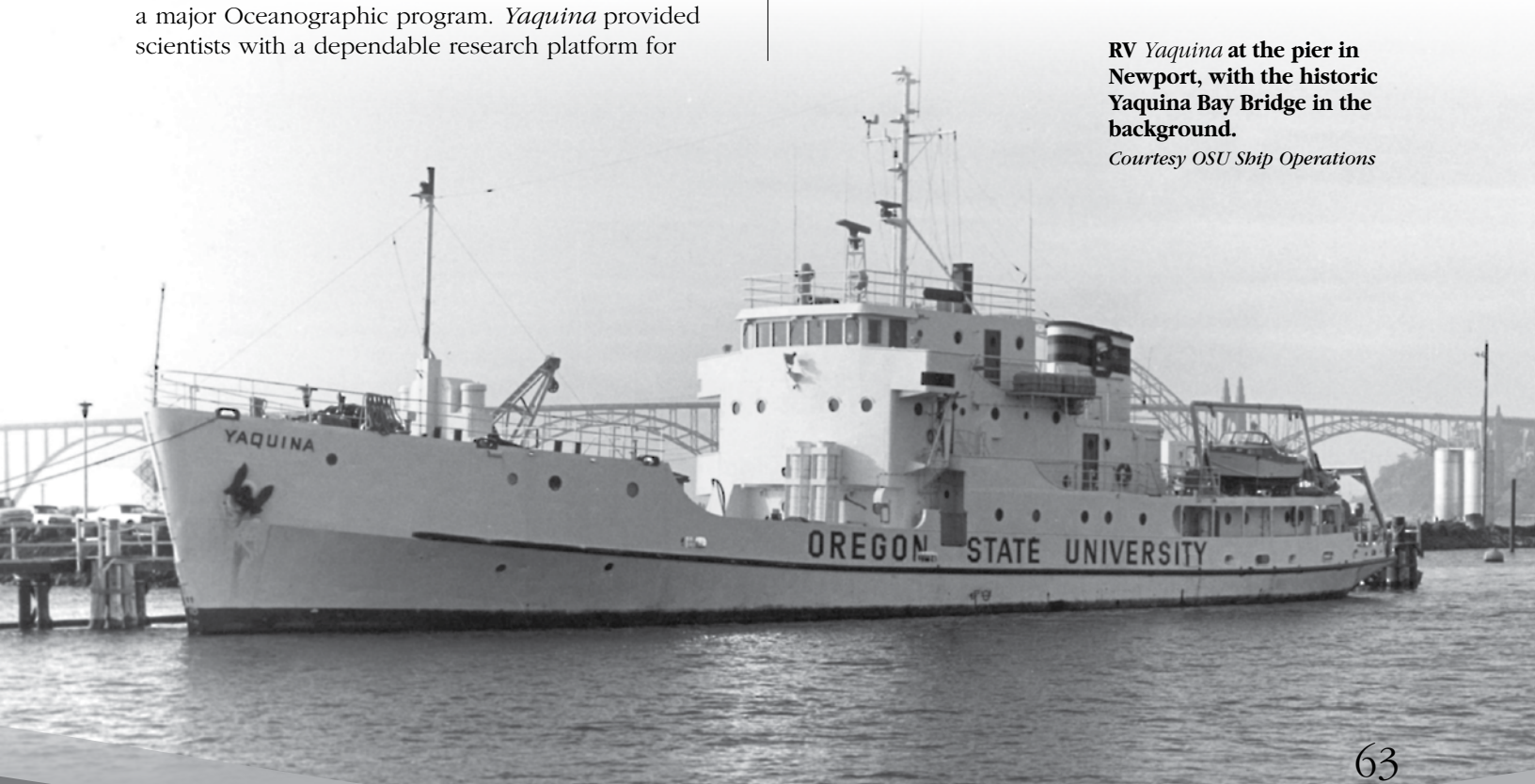
Additional faculty came and some left for a variety of reasons, often to grasp other opportunities. They all left on good terms and would spread the word of the rapidly developing, high-quality Oceanography program at Oregon State. Those early faculty members who stayed at Oregon State had the qualities of successful pioneers: vision, motivation and the courage to take risks in order to achieve their vision.

Facilities

To have a viable Oceanography program it is necessary to have ships and buildings; ships are critical. The folks at ONR made good on their promise to provide funds for a ship, a 65-footer. They didn't anticipate that Wayne Burt would manage to stretch the 65-footer into the 80 foot, 154-ton *Acona*. Launched in 1961, the *Acona* was a rough-riding research vessel that could accommodate fifteen scientists and crew. It operated off Oregon to a distance of 165 miles. The waters off Oregon served as the research ocean for all of the Oregon State scientists. Conducting ocean research in the same area helped to create a collaborative interdisciplinary approach to the oceanography efforts by Oregon State researchers. In 1964, *Acona* was replaced with the 180-foot, 800-ton *Yaquina*, a converted World War II FS with accommodations for forty scientists and crew. The *Yaquina* was capable of operating in all but the most severe ocean areas of the world and gave Oregon State a blue-ocean capability, a capability critical to being a major Oceanographic program. *Yaquina* provided scientists with a dependable research platform for twelve years before being replaced with the newly constructed 177-foot *Wecoma*. In 1968, the *Cayuse*, another new 80-foot research vessel, was added to the OSU oceanographic fleet for coastal studies. It was later transferred to the Moss Landing Research Laboratories of California State University.

In the early 1960s, with a new ship and an expanding staff, the need for land facilities was obvious. Ever in the market for new funds, Wayne approached the National Science Foundation for facilities money for an oceanography building on campus and a ship support facility at the coast. Because OSU did not have its own dock, the *Acona* was berthed in the municipal dock in Newport, for which docking fees were constantly required. Proposals were submitted, site visits organized and NSF came through with funds, but only for the building on campus, now referred to as Burt Hall #1.

A ship support facility in Newport was still badly needed. Occasionally good things happen to those who are prepared and in this case funds were provided from a surprising source. The short-lived federal Area Redevelopment Administration (ARA) recognized that Lincoln County, in which our home port, Newport, is located, was a depressed area and therefore eligible for funds to stimulate the local economy. Wayne Burt and other leaders at OSU recognized the opportunity, submitted a proposal to ARA, and obtained funds to build a coastal laboratory, complete with a public wing to attract tourists, and a



RV *Yaquina* at the pier in Newport, with the historic Yaquina Bay Bridge in the background.
Courtesy OSU Ship Operations

Aerial view of *Yaquina* and her pier in Newport, with the OSU Hatfield Marine Science Center in the background.
Courtesy OSU Ship Operations

ship support building and dock. The Marine Science Center (later named in honor of Senator Mark Hatfield) and a new dock were ready to receive and welcome the *Yaquina* when she arrived in Newport as a replacement for *Acona* in 1964.

Pioneering Research

The lack of data and knowledge of the ocean off the Oregon coast was used as a strong argument by Wayne Burt for establishing an Oceanography program at Oregon State. He felt that coastal oceanography out to a depth of 1000 fathoms had been neglected, particularly off the west coast of the United States and notably off Oregon. Consequently, much of the pioneering research by Oregon State researchers was descriptive in nature, driven by the question, "What is the ocean like off Oregon?" This question provided motivation for much of the early ocean research, be it physical, biological, or geological.

June Pattullo in her office, welcoming students and faculty alike.
Courtesy of OSU Archives

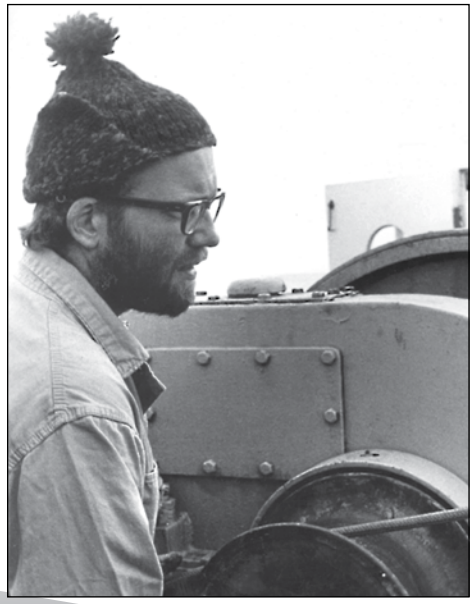
In 1961, with the newly commissioned RV *Acona*, Professor Pattullo initiated a program of systematic sampling and measurement of ocean properties regionally and with depth off Oregon. Seasonal sampling and measurement of temperature, salinity, oxygen and nutrients, begun in 1961 and continued until 1971, provided a valuable basis for future studies, including climate change related to ocean conditions. Based on the initial data, Bob Smith completed his Ph.D. dissertation in 1964 on upwelling along the Oregon coast, with June Pattullo as his major professor. In 1965, Pattullo, with graduate students Curt Collins and Chris Mooers, made the first direct measurements of currents over the continental shelf using moored current meters. Bob Smith and Dale Pillsbury continued to develop the current measurement program, which later became a major component of several international

Oceanographic programs, notably the Coastal Upwelling Ecosystem Analysis studies off Oregon, Northwest Africa, Peru, and the International Southern Ocean Studies off Antarctica.

The results of the study of the physical and chemical nature of the ocean off Oregon, started by Pattullo, were of considerable benefit to the early biological studies by Professors Small, Frolander, Pearcy and Carey. The team of biologists addressed research questions of the trophic levels of the food web. Professor Small studied the phytoplankton; Frolander, the zooplankton; Pearcy, the nekton, notably fish, squid and shrimp; and Carey studied the benthic animals.

Immediately after arriving at Oregon State, Dr. Small began to implement a Phytoplankton Ecology Program that involved course development, research and library acquisitions. He and his graduate students began the first programmatic studies of primary production off Oregon. Small's group noted the two major features of the area that affected primary production: summer upwelling and the Columbia River plume. They were the first to document in detail primary production responses to the onset and the cessation of coastal upwelling. The Columbia River Plume delivered into the ocean low-level radionuclides discharged into the Columbia River at Hanford. Small's team, together with the radiochemistry group within the department, recognized that these radionuclides would serve as acceptable tracers of biological trophic level patterns that could be tracked in space and time. This led to an investigation of biological transfer of phyto-carbon into zooplankton grazers in upwelling and non-upwelling regions.

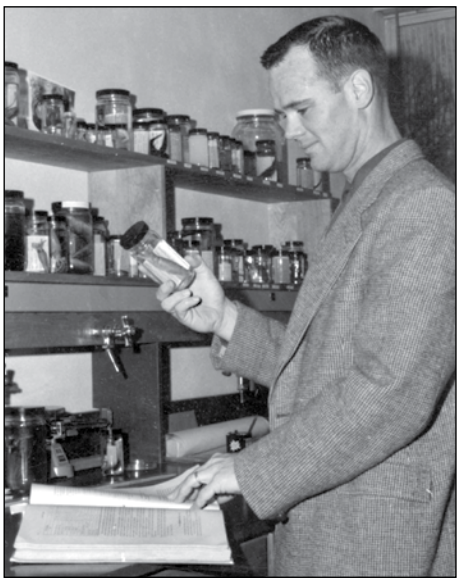
Above: Herb Frolander points out details of octopus anatomy to Portland Rose Festival princesses.
Courtesy of OSU Archives



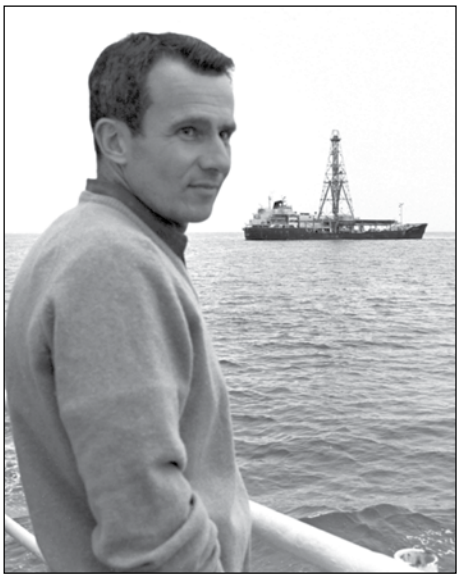
Professor Frolander initiated studies of the identification and distribution of zooplankton species in near-shore waters and their relationship to the zooplankton of Yaquina Bay. Regularly scheduled sampling trips served not only to identify daily, seasonal and long term patterns of zooplankton distribution, but they were also significant as training exercises for graduate students. The archived zooplankton samples were of value in later decisions involving location of water

Left: Bob Smith guides a mooring line during deployment of a current meter mooring from RV *Yaquina*, summer 1973.
Courtesy of Jane Huyer

intakes for the aquaria at the OSU Hatfield Marine Science Center and in research involving the landward intrusion of upwelled water. Also, much credit is due Dr. Frolander for developing the beginning Oceanography course, which brought attention to Oceanography at the undergraduate level throughout Oregon State College/University. Dr. Frolander was frequently called on by Dr. Burt to spread the word about the growing Oceanography department throughout Oregon, by means of public presentations to service clubs and other organizations.



Bill Pearcy sorts preserved fish samples, early 1960s.
Courtesy of the OSU College of Earth, Ocean and Atmospheric Sciences



John Byrne aboard RV *Yaquina* with Glomar Challenger in the background, 1971.
Copyright Gwil Evans

Bill Pearcy came to Oregon State directly after receiving his Ph.D. from Yale and immediately started a program that would continue throughout his career as an OSU Oceanographer. Little was known about the nekton off Oregon, other than the knowledge possessed by commercial fishermen. Pearcy changed that. He and his students conducted the first in-depth study of the distribution of small nekton off Oregon to 200 miles offshore and to a depth of 1000 meters. Together with Drew Carey, he researched the relationship of benthic nekton to depth and bottom sediment and rock types. Other research addressed the relationship of mesopelagic animals and sound scattering layers. He related catch rates of albacore to remotely sensed surface temperature, studied the radioecology of marine organisms, initiated submersible observation of offshore banks and pioneered research on the ocean ecology of juvenile salmonids off the west coast, demonstrating the critical importance of ocean conditions to their survival and distribution during their first year in the ocean.

When John Byrne arrived at Oregon State he set out to do two things: describe the geology of the area off Oregon and develop a curriculum of Marine Geology courses that would serve graduate students in both Geology and Oceanography. Little was known of the detailed bathymetry of the continental margin, the distribution and sources of continental shelf sediments, the subsurface geologic structure of the shelf and slope, the nature of the abyssal area beyond the continental slope, or the relationship of continental shelf geology to that of the Oregon landmass. With the help of two Geology graduate students, Vern Kulm and Neil Maloney, who had already been attracted to the Oceanography program, the Marine Geology program began to address these questions. As additional graduate students were added, attention was directed to the geology of Astoria submarine canyons and the Cascadia abyssal plain beyond the canyon. When Vern Kulm became a faculty member in 1964, he conducted the first comprehensive sedimentation investigations of a modern submarine fan and abyssal deep-sea channel off Oregon. Detailed study of these deep ocean deposits continues today. These studies have added significantly to the earthquake history of this region during the past 10,000 years. Subsequently, Kulm went on to serve as co-chief scientist of the Deep Sea Drilling leg off Oregon and later to be co-Director of the joint OSU-University of Hawaii IDOE-sponsored study of the entire lithospheric plate off Ecuador, Peru and Chile – the Nazca Plate.

The early Physical, Chemical, Biological and Geological studies off Oregon, although limited by the capabilities and the range of the *Acona*, served to establish a cooperative attitude among the scientists, leading to multi- and interdisciplinary results that otherwise would not have been possible. The sense of collaboration among OSU scientists generated in those early days continues today; cooperation is still a hallmark of Oregon State Oceanography.

A National Change of Sea State

The decade of the 1960s in the United States was marked by unprecedented attention to the sea. In 1966, the National Sea Grant College Act was passed. The United Nations convened the U.N. Law of the Sea Convention that would continue for years. Passage of the Marine Resources and Engineering Development Act created the National Council on Marine Resources and Engineering Development, with Vice President Hubert H. Humphrey as its chair. That same act called for a fifteen-member Advisory Commission on Marine Science, Engineering and Resources, chaired by Julius Stratton that henceforth was known as the Stratton Commission. Oceanography would be shaped by the Stratton Commission report, "Our Nation and the Sea," released in 1969. In March 1968, President Lyndon Johnson endorsed an "International Decade of Ocean Exploration (IDOE)" for the 1970s and, in December 1968, the United Nations General Assembly formally welcomed the proposed Decade. The national posture regarding the oceans was changing rapidly.

Vern Kulm emerges from the submersible after diving off the Oregon coast, September 1988.
Courtesy of David L. Stein

Changes were also taking place at Oregon State University. In 1967, Wayne Burt resigned as Chairman of the Oceanography Department and assumed the role of OSU's Associate Dean of Research for Oceanographic Programs; he continued as Principal Investigator of the ONR contract. Herb Frolander filled in as interim department chairman, until John Byrne was appointed Chairman of the Oceanography Department in 1968. During that same year, OSU received one of the first Sea Grant College awards and Professor Frolander was appointed coordinator of the Sea Grant program. In 1971, OSU was officially named one of the nation's first Sea Grant Colleges.

Expansion of the OSU Oceanography Department continued. In 1968, eight new faculty members were added; in 1969, five more; and in 1970 another five. Many of these faculty members were transferring from other established Oceanography programs. In 1970, there were 150 faculty and staff and over 100 graduate students. OSU's Oceanography program was growing and so was its reputation.

In the early 1970s, two major changes at a national level would affect the manner in which ocean research was conducted: United States funding for the IDOE (International Decade of Oceanographic Exploration) and UNOLS (University National Oceanography Laboratory Systems). OSU oceanographers were not exempt from the impact of those changes.

IDOE was assigned to the National Science Foundation and would support major multi-disciplinary, multi-institutional programs, with OSU oceanographers participating and providing leadership for a number of the programs. The IDOE Coastal Upwelling Experiment (CUE) conducted off the Oregon coast addressed the physical aspects of coastal upwelling. Led by Bob Smith and James O'Brien of Florida State University, it included researchers from Florida State, Woods Hole, the University of Washington, Pennsylvania State University and the University of Chicago, as well as OSU. It was the precursor to the Coastal Upwelling Ecosystem Analysis (CUEA) studies off Oregon, Northwest Africa and Peru, which included investigators from ten U.S. institutions, including Oregon State, and institutions in twelve other countries. The IDOE Seabed Assessment Program included the Nazca Plate project off South America led by Vern Kulm, and the Galapagos Rift study during which deep-sea hot vents and their unique faunal communities were first discovered by OSU scientists. The decision to participate in the Seabed Assessment Program was not taken lightly, for it would mean the *Yaquina* would be away for months at a time, precluding its use at home. Other IDOE projects that Oregon State researchers participated in included the Geochemical Ocean Sections (GEOSECS) program and the Climate Long-Range Investigations Mapping and Prediction (CLIMAP) program. Big science

had arrived at Oregon State. Participation in IDOE was significant in elevating OSU's Oceanography program to a national level.

The second major change in the way oceanographic research was conducted resulted from the adoption of the University National Oceanography Laboratory System (UNOLS) in 1972. Prior to UNOLS, ships were operated by each oceanographic institution for its own scientists. After the adoption of UNOLS, all ships operated by universities were scheduled jointly in a collaborative manner. The system made efficient use of vessels, standardized basic equipment and created uniform safety requirements and resulted in the cooperative use of the nation's entire oceanographic fleet operated by academic institutions. It meant that OSU's vessels would sometimes operate without an OSU researcher aboard, and that OSU oceanographers would sometimes conduct their research from another institution's ship. The UNOLS concept was adopted following almost two years of vigorous debate between the laboratory directors and leadership at NSF; it has operated successfully since 1972. John Byrne was one of the five laboratory directors who drafted the original proposal; he served as the first chair of the UNOLS council, which monitored the program. Both IDOE and UNOLS fostered a cooperative approach to the conduct of ocean research to the benefit of all United States oceanographers.

Coffee break during the meeting of the international Scientific Committee on Oceanic Research (SCOR) Working Group on Coastal Upwelling Processes in Corvallis, March 1973. OSU's Larry Small (left) and John Byrne (2nd from right) are shown with Konstantin Federov from the USSR and James O'Brien of Florida State University.

Leadership at OSU

Strong leadership at Oregon State was a hallmark of the Oceanography program from its beginning. Each department chair and dean moved the program forward in terms of personnel and budget, and each added innovative programs and approaches to the challenges and opportunities presented. The oceanography presence at Oregon State also had a profound effect on other programs at the University, increasing the scope of the Fisheries and Zoology programs and creating new dimensions for Engineering programs. Without a strong oceanography presence at OSU, it is doubtful that the Oregon State University Hatfield Marine Science Center would have become a major multi-agency facility in Newport, Oregon. The O. H. Hinsdale Wave Research Laboratory might not exist, nor would the first supercomputer in the state of Oregon (located in the Oceanography Complex on campus). The International Oceanography Educational Program and the Marine Resource Management Program are further testimony to oceanography leadership.

The story of Oceanography at Oregon State is a story of vision, persistence, dedication and cooperation by intelligent people who have common goals. It is a story of the scientists who came to Corvallis, saw the opportunity to create a program, were persistent in pursuing that opportunity and left a history of what is possible. It is a story of pioneers who sought new knowledge, succeeded and dedicated their careers to leaving things better than they found them.

OREGON STATE UNIVERSITY	Oceanography Leaders
Department Chairs and Deans	
Wayne V. Burt	Chairman (1959-1967)
Herbert Frolander	Interim Chair (1967)
John V. Byrne	Chairman (1968-1972), Dean (1972-1976)
George Keller	Interim Dean (1976-1978)
G. Ross Heath	Dean (1978-1984)
Douglas Caldwell	Dean (1984-1993)
Lawrence F. Small	Interim Dean (1993-1994)
G. Brent Dalrymple	Dean (1994-2001)
Mark Abbott	Dean (2001-present)

Epilogue

W. BURT - Wayne Burt, who had initiated the Oceanography program, stepped down as department head in 1967, and continued to provide leadership as the University's Associate Dean/Vice President for Oceanic Research. In 1991, he died of a heart attack while fishing off Newport, Oregon.

J. BYRNE – John Byrne left the Oceanography program in 1976 to become the University's Vice President for Research. In 1981, he left the University to become Administrator of the National Oceanic and Atmospheric Administration, returning to OSU in late 1984 to serve as University President for eleven years, before retiring from Oregon State at the end of 1995.

A. CAREY - Andrew "Drew" Carey, a scientist dedicated to advancing the knowledge of benthic communities in the Pacific and Arctic Oceans, continued his research on the ecology of benthic faunal communities throughout his career and beyond his retirement from Oregon State in 1987. After retiring, he donated extensive collections of invertebrate specimens from the deep sea and the Arctic to major West Coast museums.

H. FROLANDER - Herb Frolander, a teacher both on a research vessel and in the classroom, initiated a number of the early courses in Oceanography, received awards for his teaching excellence and on his retirement created the Frolander Graduate Teaching Assistant Award, given annually for excellence in teaching by graduate student teaching assistants. During his career as an oceanographer, he became the first Director of the Oregon Sea Grant Program. An avid gardener, Dr. Frolander says he has "enjoyed retirement on 'our farm' since 1986."

V. KULM - LaVerne "Vern" Kulm was the first graduate student of John Byrne. He dedicated his oceanographic career to Oregon State University, serving as co-director of the IDOE Nazca Plate Project, co-chief scientist on the Glomar Challenger deep sea drilling leg off Oregon and Alaska in 1971, and leading the research effort on fluid expulsion zones and active faults on the Oregon-Washington continental margin. He retired in 1997 and continues to serve as a lecturer to school groups, senior citizen groups and civic organizations, to which he provides expert advice on marine geological problems.

J. PATTULLO – June Pattullo, one of the first woman oceanographers, received her Ph.D. from Scripps Institution of Oceanography on studies of global sea level under Professor Walter Munk. She earned a reputation as a world authority on sea levels and their dependence on heating and cooling of the world ocean. Professor Pattullo was a dedicated teacher and researcher, until her career was cut short by death early in 1972.

B. PEARCY – Bill Pearcy continued to teach and do research on the nekton of the Pacific Ocean past his retirement from Oregon State in 1990. He is best known for his contributions to the understanding of aspects of northeast Pacific salmon during their marine phase. In 2003, the North Pacific Marine Science Organization (PICES) presented him with the Warren Wooster Award for his studies of the fish and squid of the North Pacific. He presently serves as a consultant to fisheries groups and operates a small farm in western Oregon.

L. SMALL – Larry Small and his group were involved in a number of major multi-institutional projects designed to understand the relationships between phytoplankton and zooplankton. One example is the CABS (California Basin Studies) DOE-sponsored multi-institutional program established to understand the flux of energy-related materials into the coastal environment with unique bathymetry. He served as the editor of the final volume of research papers that summarized the results of the research. Small served as Associate Dean of the College of Oceanography (1984-1992), and subsequently as Acting Dean of the College of Oceanic and Atmospheric Sciences (1993-1994). He retired from OSU early in 1995.

R. SMITH – Bob Smith was the first Ph.D. student of June Pattullo (1964). He left OSU in 1965 for a post-doctoral fellowship in England, and then worked as a science officer of the Office of Naval Research (1969-1971) before returning to Oregon State, where he studied coastal upwelling and eastern boundary currents. He was co-editor of the international journal *Progress in Oceanography* from 1985 until 2003. He retired from teaching in 1997, but continued research as an emeritus professor until 2009.

Acknowledgements

Oceanography in the twenty-first century is a cooperative venture. Researchers and their technical assistants from different agencies and universities often work together on multidisciplinary research projects. So too, is the preparation of a paper such as this one a cooperative venture. A number of scientists provided information included herein. For this and much more, special thanks are extended to Bob Smith, one of the oceanography pioneers, who edited the manuscript, provided information on himself and on June Pattullo, and served as the principal contact for Oregon State University with the Maritime Museum of San Diego editor.

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