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Positioning Ocean Exploration in a Chaotic Sea of Changing Media

Jerry R. Schubel – Aquarium of the Pacific

DISCUSSION PAPER

Jerry Schubel, Ph.D. has been president and CEO of the Aquarium of the Pacific since 2002. He is president emeritus of the New England Aquarium, and from 1974-1994 was Dean of Stony Brook University's Marine Sciences Research Center. For three of those years he served as the University's provost. He has a Ph.D. in oceanography from Johns Hopkins University and received an honorary doctorate from the Massachusetts Maritime Academy. He has published more than 200 peer-reviewed papers, and authored, co-authored, or edited seven books. He is a past member of NOAA's Science Advisory Board and is a member of the Science Advisory Team for California's Ocean Protection Council and the California Ocean Science Trust. He co-chaired the first national forum on ocean exploration, Ocean Exploration 2020: A National Forum in 2013, and presented one of the keynote addresses at the 2015 national forum in Baltimore.. He recently chaired a National Academy committee on the "Value and Sustainability of Biological Field Stations, Marine Laboratories, and Natural Reserves in 21st Century Science, Education, and Public Outreach" (2013-14), and numerous other panels. At the Aquarium of the Pacific he established and directs the Marine Conservation Research Institute, the Aquatic Academy, and the Aquatic Forum. The focus of all of these initiatives is to bring together experts with policy-makers and stakeholders to explore alternative solutions to complex and often controversial environmental issues.

Positioning Ocean Exploration In A Chaotic Sea of Changing Media¹

Jerry R. Schubel
Aquarium of the Pacific

This is an essay: an exploration of an idea from a personal point of view. It begins with a brief description of why we need a strong national program of ocean exploration, then turns to a discussion of the seascape of changing media, and concludes with a brief discussion of how to design and position an ocean exploration program to survive in this new media world of sea state 9.

The Growing Need for a National PROGRAM of Ocean Exploration

With a global population on track to increase by as much as 50% before the end of the century, it is inevitable that in the next few decades humans will look to the ocean for more food, more energy—both renewable and non-renewable, more pharmaceuticals, more minerals, more water—more fresh water, more shipping and transportation, and more recreation. With the World Ocean covering more than 70% of Earth, and less than 10% of it having been explored, it is clear that our environmental intelligence of the largest single component of Earth's major life support system is severely lacking. Ocean exploration plays a singularly important role in raising our IQ of the ocean and its role in sustaining life on Earth. Throughout history, great nations have been exploring nations. The United States was founded as a maritime nation. More

than 50% of it is submerged under the ocean in the EEZ, and that percentage grows every year. It's time we reclaim our maritime heritage and set the same example in ocean exploration that we have in space exploration.

The nation needs a diverse and robust ocean exploration program, a Program with a capital "P". As the Ocean Exploration Advisory Board stated in a memo to the NOAA Administrator in 2016: "America's future depends on understanding the oceans. We explore the oceans because their health and resilience are vital to our economy and to our lives: climate, food, shipping, national security, medicine, and natural resources." A Program is more than a collection of projects, no matter how excellent and important those projects are. NOAA's Office of Exploration and Research should be the go-to place for finding out what the latest priorities, programs, and discoveries have been in the entire domain of ocean exploration, but it has neither the staff to do it nor the budget to hire the necessary staff. The efforts remain fragmented.

Ocean exploration is an important part of a comprehensive national program of ocean research. When so little of the ocean has been explored, ocean exploration helps identify and define problems for more intensive research and in-

1. This essay benefitted from the wise counsel of Margaret Schubel, as has everything I have written in the past half century. I also appreciate helpful comments from Jesse Ausubel and Paul Gaffney.

dicates where in the ocean hypothesis-driven research may yield the most important results. For example, the first hydrothermal vents were discovered in 1977 not through hypothesis-driven research, but through exploration. Cold seeps? They too were discovered through ocean exploration.

NOAA and Ocean Exploration

NOAA has the mandate to develop and lead a national program of ocean exploration that involves other federal agencies and the private sector. Some of the most visible ocean exploration programs are outside of NOAA, both in other federal agencies and in the private sector. Robert Ballard's *E/V Nautilus* and Ocean Exploration Trust and the Schmidt Foundation's *R/V Falkor* expeditions are examples from the private sector. And the U.S. Navy has long been a leader in ocean exploration, although it carries a different label. Today's ocean exploration and research communities rely heavily on tools, many of which were the result of decades of investment by the Office of Naval Research.

A major challenge for ocean exploration that makes it different from space exploration is the lack of coherency of the various projects. In the aggregate, the nation's ocean exploration activities do not rise to the level of a program.

While NOAA does not have a formal mandate in education like NASA, it's clear that a robust program of education would help it achieve its mission. The NOAA Office of Education has brought coherency to the education efforts across NOAA, but opportunities remain, perhaps most notably in the public education domain. One of those is in ocean exploration, particularly in the live feeds from *E/V Okeanos Explorer*. These feeds take on added value when delivered to classrooms, science centers, aquariums, natural history museums, and other entities that provide opportunities for facilitated

group discussions. Such discussions promote social learning—learning that takes place in a social context—and overcome the often ironically isolating quality of much of today's social media. When *E/V Okeanos Explorer* is streaming, the number of hits on the OER website goes up dramatically. NOAA plays an important and greatly understated role in STEM and STEAM education. It should officially embrace its commitment to education and declare it enthusiastically.

A growing challenge is to craft messages that get traction in the rapidly changing world of mass media.

The Shifting Mass Media Landscape

The mass media landscape is chaotic and changing rapidly and dramatically. Traditional print media are on the decline and Internet and social media² on the ascendancy. These changes have important implications for coverage of the ocean and ocean exploration.

The Decline of Newspapers and Coverage of the Ocean by Traditional Media

According to a 2015 report from the Pew Research Center, "Steep revenue and circulation declines across the newspaper industry have left many newspapers struggling. Over the past decade, weekday circulation has fallen 17% and ad revenue more than 50%. In 2014 alone, three different media companies decided to spin off more than 100 newspaper properties, in large part to protect their still-robust broadcast or digital divisions." Since 1999 almost 90% of daily newspapers in the U.S. have been actively using online technologies to search for articles and most of them also create their own news websites to reach new markets. Over the past decade, a number of prominent national journalists who traditionally covered the ocean have retired, or have been reassigned. Kenneth Weiss whose 2006 *LA Times* five-part series "Al-

2. Internet media comprise: email, social media sites, websites, and Internet-based radio and television.

Social media are computer-mediated tools that allow people, companies and other organizations to create, share, or exchange information, ideas, and images in virtual communities and networks. Wikipedia <http://www.journalism.org/2015/04/29/newspapers-fact-sheet/>.

tered Oceans” won the 2007 Pulitzer Prize for explanatory reporting told me several years later that since that time he would have been unable to devote the time and resources needed to produce such a series. Juliet Eilperin of the *Washington Post*, a long-time correspondent with the ocean as her beat now covers Capitol Hill. After nearly 15 years reporting for the *New York Times*, Andrew C. Revkin left the staff at the end of 2009. He continues to write his *Dot Earth* blog that has been moved from the news side of *The Times* to the Opinion section.

In 2013 the *New York Times* dismantled its Environment Desk created in 2009 and assigned its seven reporters and two editors to other departments. According to a 2013 report of *Inside Climate News*, “Once the *Time’s* environmental desk is dismantled, the nation’s top five newspapers by readership—the *Times*, the *Los Angeles Times*, the *Washington Post*, *USA Today* and the *Wall Street Journal*—will have about a dozen reporters and a handful of editors among them whose primary responsibility is to cover the environment.” The *LA Times* is the only one of the five to have a dedicated environment desk; one that covers the entire environment, not just the ocean.

We are fortunate that a number of outstanding environmental journalists continue to write about the ocean, for example William Broad and Cornelia Dean both of the *New York Times*, Chris Mooney of the *Washington Post*, and a number of others at regional newspapers, but the era of thoughtful investigative series about ocean issues appears to be over, at least for now.

The two international weekly science journals, *Science* and *Nature*, provide perhaps the best, most accurate, coverage of ocean issues and ocean exploration, but they are not read by the general public. *American Scientist*, *Scientific American*, *Science News*, and *National Geographic* cover a variety of ocean topics, including ocean exploration, and are more widely read.

Of these, *National Geographic* has devoted more coverage, including outstanding photography, to ocean exploration than the other three. It’s uncertain whether that will change with the new ownership.

Episodic coverage of the ocean such as that by *Mother Jones* and *The Economist* usually focuses on our ocean in crisis, and fail to capture the excitement and benefits of ocean exploration and research. The Woods Hole Oceanographic Institution’s (WHOI) *Oceanus* magazine is an excellent source of information, with its focus on what WHOI scientists are doing.

The Rise of Social Media

Over this same period as traditional media were declining, Internet and social media were rising dramatically in the number of platforms and users. In 2010 the UN University reported in its publication *Our World* that 300 million people spent more than five hours each day on social networks, and about 200,000 videos were uploaded each day. Six years later these numbers are significantly higher.

Social Media Statistics for 2015 reported that in July of 2015 there were 2.3 billion active social media users—nearly one in every three people on the planet. According to their statistics, the most popular social media were Facebook (1.65 billion users), Wechat (1.12 billion), YouTube (over 1 billion), Weibo (600 million), Instagram (400 million), Twitter (320 million), and Google+ and LinkedIn (each at 300 million). Their data indicate that Google processes 100 billion searches a month, for an average of 40,000 search queries every second. Google accounts for nearly 90% of all Internet searches. Of the major social media, only Google has a systematic search capability to identify trends in searches for different topics such as ocean exploration, and it is the only one with the capability to compare trends in searches, ocean exploration with space exploration, for example.

It's clear that Internet and social media now dominate communication media and that the number of hits is huge and growing. But the majority of those hits are glancing blows, the equivalent of elastic collisions that have little impact. In 2015 YouTube reported that 300 hours of video were uploaded every minute and that 3.25 billion hours of video were watched every month, with an average of 1 billion mobile video views every day. More than 80% are from outside the U.S. In 2015 Facebook reported that the average (mean) number of friends of Facebook followers was 338, and that the median was 200. No matter how many 30-second interactions you have, it's difficult to form a strong, stable relationship, or to dive deeply into an important issue. "Friendship" and "scholarship" have been redefined by Internet and social media.

Nicholas Carr, author of *The Shallows: What the Internet Is Doing to Our Brains*³ sees the Internet as "chipping away at the capacity for concentration and contemplation." He goes on to point out that "The ability to focus attention consistently on something of interest, to hold it in memory, to dissect it in reflective, conscious awareness, and further to analyze its meaning is a talent of mind that the modern human has built over millennia. Today, in thrall to the Web's 'technology of the intellect,' we are busily dissipating such capacities. When reflexive habit and imitation replace memory and imagination much is lost in the reflective realm."

Can we harness social media to work to our advantage to increase awareness about the ocean and the importance of ocean exploration? In a workshop on the role of social media in ocean science and conservation⁴ Miriam Goldstein, Andrew Thaler, Rick MacPherson, and Holly Bik pointed out that social media platforms have made it possible to access and disseminate information quickly, bypassing gatekeepers and providing a powerful tool for reaching many people directly. They pointed out that these

tools for education, outreach, and activism have drawbacks. Without the quality control provided by editors and fact checkers, misinformation can be rampant and credibility compromised. Complicated messages can be difficult to deliver and there are few metrics for success.

In Wikipedia's entry on ocean exploration in the section from "The Age of Exploration to the Present" the last entry is for 1969: "The *Ben Franklin* (PX-15) drifts submerged for 30 days in the Gulf Stream." Clearly, the ocean exploration community is not keeping this entry current. The Wikipedia entry for deep sea exploration is more current, illustrating again the challenge of selecting the right search terms.

Wikipedia is the largest and most popular general reference work on the Internet and is ranked among the ten most popular websites. It consists of more than 40 million articles in more than 250 different languages. It could be our go-to place for bringing ocean exploration to a vastly larger audience. To do it will require some organization to take the lead in developing and maintaining coherent coverage of ocean exploration, and it will require more of our ocean explorers to contribute articles in a timely way. This is an impressive opportunity. In a search on August 15, 2016, of inquiries I thought were relevant to ocean exploration these are some of the responses I found. These are actual statements from Wikipedia.

The page "Undersea gliders" does not exist.

The page "Undersea submersibles" does not exist.

The page "Ocean explorers" does not exist.

The page "Live transmissions from ships of exploration" does not exist.

The page "Ocean telepresence" does not exist.

The page "Undersea robots" does not exist.

Searches for individual submersibles, individual explorers, etc. do yield results, but this requires some knowledge by the person doing the search. We need a user-friendly system that cap-

3. Carr, Nicholas (2010): *The Shallows: What the Internet is Doing to Our Brains*. Norton New York, 280 p.

4. Ocean Sciences 2012 workshop: EVM07: The Role of Social Media in Ocean Science and Conservation (Workshop). <http://science-social-media.wikispaces.com/>

tures the interests of those who psychologists might refer to as in a state of “pre-conceptual innocence.” Creating such a system might be an appropriate goal to pursue between the 2016 Ocean Exploration Forum and the 2020 Ocean Exploration Forum, and participants in the 2016 Forum could set the example by adding pages to Wikipedia.

While the democratization of information can be valuable, we would do well to remember the late Nobel Laureate Richard Feynman’s admonition: “You don’t improve the quality of a technical decision by asking a lot of uninformed people.” For much of Internet and social media, perhaps most, there is no peer review, no editing, at least in the short-term, and no quality control. Every voice can be heard. Everyone is an expert on everything.

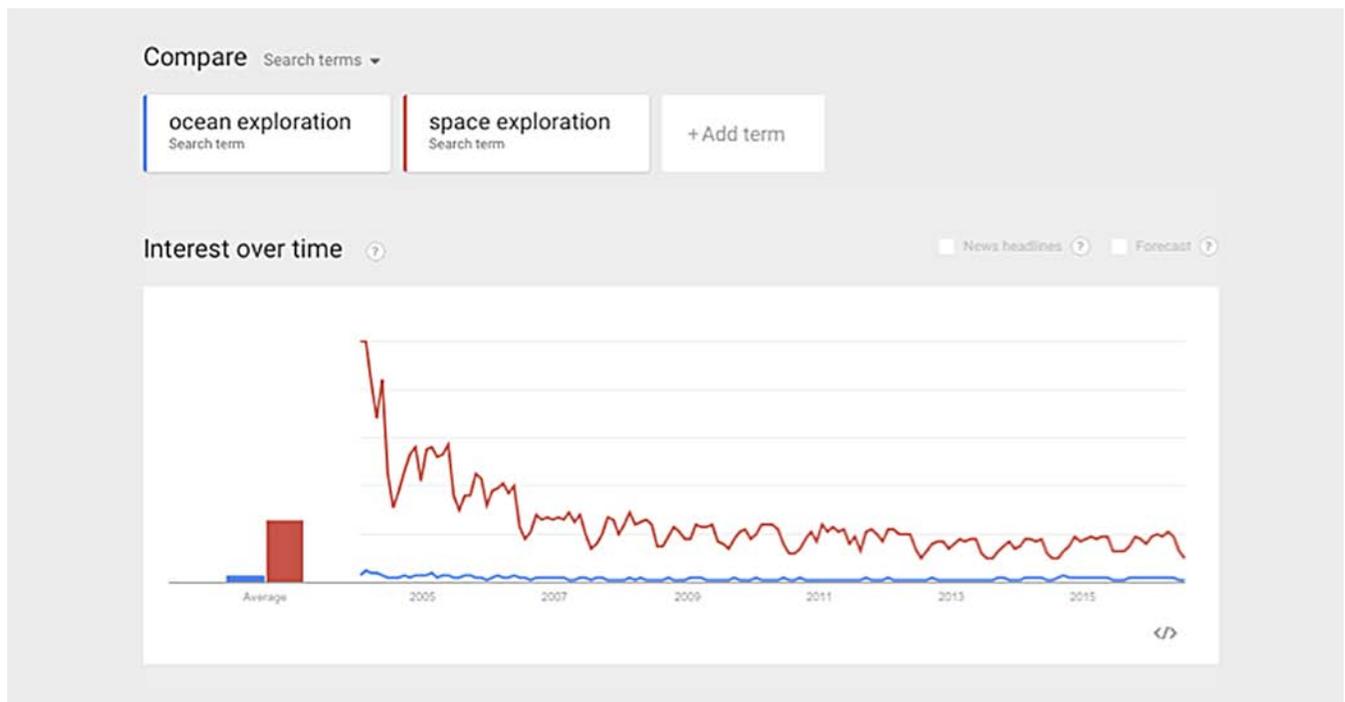
A recent (July 7, 2013) report from the Pew Research Center for Journalism & Media states that fewer than 4% of U.S. adults trust (a lot) the information they get from social media and 30% have some trust. The levels of trust for local news organizations are 22% (a lot) and 60% (some).

Searching the Internet often is akin to mining low-grade ore. Everyone can be a prospector, but fools’ gold often is confused with the real thing.

Coverage by the Media of Ocean Exploration and Space Exploration

“Not everything that counts can be counted, and not everything that can be counted counts.” Einstein

Tracking coverage of ocean exploration in the traditional media was relatively easy compared to trying to track coverage by most social media. Google dominates the search domain and has a relatively powerful tool, Google Trends, for comparing the “intensity” of searches for up to five different topics at a time. On July 5, 2016, Googling “Ocean Exploration” yielded 1,190,000 results in 0.62 seconds. Googling “Space Exploration” yielded 4,560,000 results in 0.48 seconds. Using Google Trends to compare the number of searches for ocean exploration with space exploration since 2004 when the program was launched, anyone passionate about the ocean can’t help but be disappointed (see figure below).



In preparing this essay, I was asked to answer the following questions:

1. What have been the 5-10 biggest OE stories of the past 5 years?
2. What has been the balance of interest among history/archaeology, biology, geology, other?
3. Who are the most frequently quoted or pictured explorers?
4. What publications, channels, websites, etc. are the places that provide the most OE coverage?
5. Qualitatively, who seems to do the best coverage?
6. What performing institutions or programs are mentioned in coverage?
7. What sponsoring institutions or organizations are mentioned?
8. What ships, if any, are mentioned by name?
9. What controversies, if any, are mentioned in the coverage?

I added a tenth question: What theatrical ocean film captured the most attention in the past decade? While these questions appear to be simple and straight forward, finding “the” answers even in the traditional media is not. And finding “the” answers in social media is virtually impossible, since there is no general search engine for social media. Finding answers is easy, but what do they tell us? My best attempts at answers to these questions are summarized in Appendix A. The reader will have to determine what they mean.

At the present time reporting statistics on references to ocean exploration in the social media is a little like the sports announcer’s reporting of partial baseball scores: “It was the N.Y. Yankees 12.”

The ocean-related stories that typically receive the greatest coverage by the media—both traditional and social—are disasters, both those caused by nature and those by humans. The Indonesian Earthquake and Tsunami (2004), Katrina (2005), Sandy (2012), Typhoon Nepartak (2016), and the Deepwater Horizon blowout in

the Gulf (2010) are examples. And the searches for downed aircraft, e.g. Indonesian aircraft (2015) also capture the interest of the media and the public. Among pure ocean-related topics, according to Google Trends, the public has far greater interest in marine life, particularly bizarre marine life, than in physical oceanography, marine archaeology, marine chemistry, or marine geology (See Appendix A).

Even with Google Trends, results are very sensitive to even slight changes in the words one chooses to describe the search topics. The search filters are narrow band-pass filters.

Clearly space exploration has dominated ocean exploration in searches over the period of record. Does the discrepancy represent only differences in interest by the public, or are there other confounding factors also at play? I think it may be the latter.

Space exploration is a program, one led by a well-branded federal agency, NASA; a program made up of multiple well-defined projects called missions. There is coherency to the space exploration portfolio. Oh yes, SpaceX and a couple of other private companies are players, but their roles to date are minor in the overall enterprise.

So little of space has been explored and we know so little about it that all space research is associated with space exploration. In contrast, little of ocean research is associated with ocean exploration, even though we have explored less than 10% of the world ocean and every ocean exploration cruise reveals how little we know about the ocean, what lives there, and what we are doing to it.

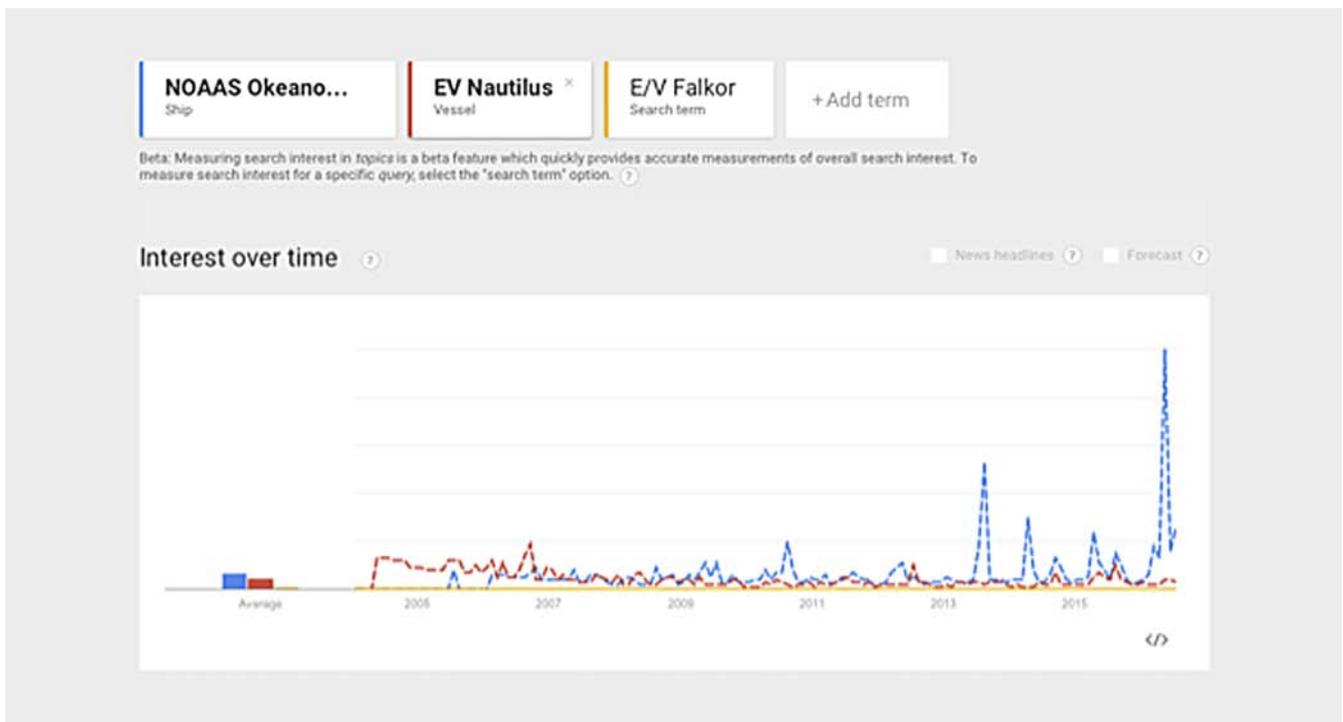
In searches for ocean exploration one of the issues is that as a community we define ocean exploration too narrowly—one misses, for example, the entire Census of Marine Life enterprise including the tagging of marine animals (TOPP and POST), clearly prominent members of the overall ocean exploration portfolio. Indeed, the

Census of Marine Life was perhaps the most ambitious sustained program of ocean exploration ever, lasting a decade and involving more than 80 nations and nearly 3,000 scientists. It discovered more than 6,000 new species.

Searches for trends among ocean exploration ships (*E/V Nautilus*, *E/V Okeanos Explorer*, and *E/V Falkor*) are confusing when compared with individual searches for these vessels. On July 10, 2016, googling revealed that the *Nautilus* received 1,060,000 references, *Okeanos Explorer* 31,600, and the *Falkor* 12,200. Looking at Google trends reveals a different answer. To complicate

took astronauts about three days to reach the moon, nearly 240,000 miles away. Mars can be as far away as 250 million miles from Earth, as close as 34 million miles, and averages about 140 million miles away. It will take 39 days to reach Mars on its closest approach, and 280 days on its farthest approach. And it took spacecraft *Juno* five years to reach Jupiter in July 2016.

The ocean is right in front of us. Flat, sometimes with a wrinkled surface. In the clearest ocean waters you can see into it perhaps a few hundred feet. Its maximum depth is only about 7 miles, and only three people have ever been



matters further in interpreting the figure above, the *E/V Okeanos Explorer* was not christened until 2008.

Reframing The Case for Ocean Exploration

For many, ocean exploration can't match space exploration for excitement. Perhaps we need a new approach. There is a mystery and excitement about space exploration that is hard for ocean exploration to match. Space is vast, limitless. On a clear night when you look up, you can see other worlds millions of miles away. It

to that depth. In contrast, 12 astronauts have walked on the moon. The average depth of the world ocean is less than 2.5 miles, about the average daily commute of the typical U.S. worker. It took James Cameron about 1.5 hours to reach the bottom in the deepest part of the ocean—the Marianas Trench. It often takes me that long to get from Long Beach to LAX Airport. For many, exploration of the ocean is in the horizontal dimension and that was pretty well completed several hundred years ago.

Maybe it's time to focus on the importance of the ocean to the future of life on planet Earth, how little we know about the ocean, and the role that ocean exploration could and should play in a comprehensive national program of ocean research. Understanding life on other planets may help us understand the origins of life in the universe, but it can't match the relevance and importance of ocean exploration to the future of life on this planet.

The opportunity side of the ocean and ocean exploration and the benefits to be derived from greater understanding seem to have gotten lost in the great ocean lament that is so popular with many environmentalists and much of the media. Marketers tell us that although gloom and doom attract media attention, they do not change attitudes and behaviors. We need to combine the gloom and doom and what we could lose because of our lack of understanding of the ocean with the untold opportunities the ocean holds for humans and all life on Earth through proper stewardship.

We might be more successful arguing that ocean exploration is an important element of a comprehensive national program of ocean research than trying to make the case for the excitement of exploring our unknown ocean. The arguments for understanding the ocean better, what lives there, the minerals and pharmaceuticals it holds, and how we humans are compromising our national security and the single most important component of Earth's life support system we all depend upon for our survival are compelling enough. And exploratory research makes a singular contribution to the portfolio of hypothesis-driven ocean research.

Our Most Visible Ocean Explorers

We have been fortunate to have a number of high-visibility explorers for decades: Jacques Cousteau, Don Walsh, Bob Ballard, and Sylvia Earle top the list. If one uses Google Trends to look for trends in searches for ocean explorers since 2004, although Cousteau died in 1997 he

continues to dominate searches. Ballard, Earle, and Walsh track each other closely. Walsh spikes in 2012 when he accompanied James Cameron on the mother ship for Cameron's dive, and again in 2016, although the cause of that spike in interest is less clear. Perhaps it was his appearance on *Cupcake Wars*. If one adds to the mix James Cameron, an occasional explorer, he dominates the others, but his greatest number of hits come not for his solo dive to the deepest part of the ocean, but for the release of his film, *Avatar* in December 2009. Our most visible, dedicated ocean explorers have been members of the AARP for more than two decades. It's not clear who will succeed them. Our next visible ocean explorers may include those who design and build a variety of new undersea ROVs, as well as those who go into the ocean.

Two Other Necessary Elements in a Strategy for Success

There are two other elements we need if we are to have a sustained program of ocean exploration at the scale needed. First, we need a chorus of strong endorsements of the importance of ocean exploration by leaders in NOAA, Congress, and the Executive branch. Second, we need a larger budget.

If It's Not On The Agenda, It Doesn't Get Noticed

John Kingdon (Kingdon, 1984) wrote what has become a classic textbook on policy: *Agendas, Alternatives, and Public Policies*. According to Kingdon, policy-making is a process that includes: (1) setting the agenda, (2) identifying and assessing policy alternatives from which a choice can be made, (3) making an authoritative selection among the alternatives, and (4) implementing the decision—the policy. Kingdon points out that the first challenge is to get an issue on the agenda. He defines the agenda as the list of issues to which government officials, and people outside of government closely associated with those officials, are paying some serious attention at any given time. Kingdon observes that if an issue isn't on the agenda, it doesn't get

noticed. He points out that it is elected officials and their appointees who are most important in setting the agenda.

It's clear that the ocean and particularly, ocean exploration, are not on the national agenda, and haven't been since 2000 when Bill Clinton was President. Perhaps Internet and social media could help us get them on the agenda, but it will require a simpler, bolder, more comprehensive, cohesive, and compelling story of the role the ocean will play in determining the future of our nation and our species: one that captures and keeps the attention of large numbers of people; a story that goes viral and becomes a national pandemic.

Getting ocean exploration on the agenda will require strong statements by leaders.

Statements of Support from Governmental Leaders

On May 25, 1961, President John F. Kennedy announced before a special joint session of Congress the dramatic and ambitious goal of sending an American safely to the Moon and back before the end of the decade. There were strong political and national security forces behind this statement at the time, but its impact changed forever our nation's relationship with space.

In the last decade of State of the Union addresses starting in 2006 and continuing through 2016, the President of the United States has mentioned NOAA a total of once (in 2015), the ocean a total of three times, twice in reference to terrorism and once to "rising oceans." Ocean exploration has never been mentioned. Not once in the last 11 State of the Union Addresses. Clearly the last two presidents have not shared the ocean exploration community's perception of the importance of the ocean to our nation.

In a commencement address at the U.S. Coast Guard Academy on May 2015, President Obama stated, "We're witnessing the birth of a new ocean—new sea lanes, more shipping, more ex-

ploration, more competition for the vast natural resources below." Unfortunately, this statement has never been translated into action, and is rarely seen or quoted. It reminds me of a remark someone once made that about as many people go to a commencement to hear the speaker as go to a major league baseball game to hear the Star-Spangled Banner.

On June 21, 2016, the White House released a report entitled: *IMPACT REPORT: 100 Examples of President Obama's Leadership in Science, Technology, and Innovation*-- a list of 100 examples of the profound impact that the President's leadership has had in building U.S. capacity in science, technology, and innovation and bringing that capacity to bear on national goals. A search of this impressive list of accomplishments revealed that while many of NOAA's programs to enhance resilience to extreme weather events and to climate change were pointed out, along with its National Weather Service, NOAA was not mentioned by name. Here's the count: NASA was mentioned 10 times, NOAA 0 times, space exploration 4 times, ocean exploration 0 times. Ocean and oceans were mentioned 7 times. Clearly, NOAA is not well branded. In Washington, DC, branding matters.

Budget:

"If you compare NASA's annual budget to explore the heavens, that one year budget would fund NOAA's budget to explore the oceans for 1,600 years."
Robert Ballard

The nation's ocean exploration program is woefully underfunded. NOAA's Office of Ocean Exploration and Research (OER)—originally called the Office of Ocean Exploration (OOE)—was established in 2000 in response to President Clinton's Panel on Ocean Exploration chaired by Marcia McNutt. The panel recommended an annual funding level of \$75 million, excluding operational costs. It was not until 2009 that NOAA's ocean exploration program was established in law when PL 111-11 directed NOAA to develop and lead the nation's program of ocean

exploration. Over most of its history of nearly 16 years, the NOAA budget for ocean exploration has hovered between \$20-\$30 million/year. PL 111-11 did little to increase the budget. In a letter earlier this year to the Administrator of NOAA, the Ocean Exploration Advisory Board and its chairman, Paul Gaffney, recommended an annual budget of \$75 million per year. The chances of this happening in the next few years are small.

Concluding Statement

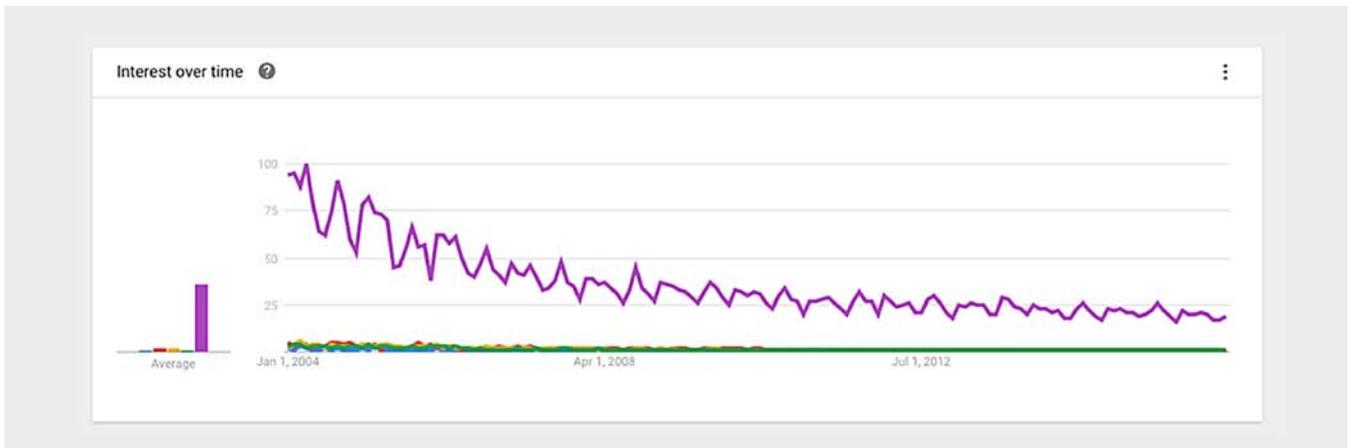
As a community we have failed to capture the attention of the public and decision-makers to communicate the importance of the ocean to the welfare of humanity and to the success of our nation, and of the importance that ocean exploration should play in a comprehensive national program of ocean exploration and research. Key indicators to support this conclusion can be found in the NOAA budget for ocean exploration; in the paucity of coverage of ocean exploration by traditional and social media; and in the lack of statements of strong support from leaders of NOAA, Congress, and the Executive Branch. Job 1 is to get ocean exploration on the national agenda.

Appendix A

With
Nico Amatullo
A Citizen of the World of Social Media

In preparing this essay, I was asked to answer the following questions, which have been only slightly modified from the original questions. While the questions are simple and straightforward, finding the answers is not. The 10th question is mine. The conclusions presented here are the result of a synthesis from a systematic search process in news reporting media website outlets and specialized digital science publications (e.g. *Smithsonian.com*, *National Geographic*, *The Scientific American*, *Christian Science Monitor*, etc.); targeted outreach of organizations such as NOAA that include an “Ocean Explorer” page for questions and inquiries. The search process also included scanning for relevant hashtags and popular Twitter users that promote ocean exploration (e.g. *E/V Nautilus*; NOAA Ocean Ex-

plorer that promotes the ship #Okeanos which carries the *Hercules* ROV, a remotely operated vehicle for ocean exploration, and related stories that capture the public’s attention). This search also included analysis of how the public is reacting and tracking information on key Facebook pages such as the Aquarium of the Pacific’s. This consisted in charting over a week the number of “likes” of the page and the sharing of its content. Finally the overall search was driven by a strategy of using trending keywords and open-source sites such as Google Trends to assess knowledge of key topics, relevance, and popularity. Google Trends was one effective site for example to track numbers and peak popularity of themes and key questions over time (i.e. How much life is in the world’s ocean? How



much of the ocean have we explored?). These are my attempts to find answers with a large assist from Nico Amatullo, who is much more comfortable wading into the swamp of social media than I am.

1. What have been 5-10 of the biggest OE stories of the past 5 years?
2. What has been the balance of interest among history/archaeology, biology, geology, other?
3. Who are the most frequently quoted or pictured explorers? (Also addressed in text)
4. What publications, channels, websites, etc. are the places that provide the most OE coverage? (Also addressed in text)
5. Qualitatively, who seems to do the best coverage?
6. What performing institutions or programs are mentioned in coverage?
7. What sponsoring institutions or organizations are mentioned?
8. What ships, if any, are mentioned by name?
9. What controversies, if any, are mentioned in the coverage?
10. What ocean-related theatrical film received the greatest coverage over the past decade (2006-2016)?

1. What have been 5-10 of the biggest OE stories of the past 5 years?

- July 2011: The ICESCAPE expedition, (Impacts of Climate on EcoSystems and Chemistry of the Arctic Pacific Environment discovered extensive algal blooms beneath the ice.
- March 25, 2012: First Solo Dive to the deepest part of the ocean, the Mariana Trench, by Hollywood director James Cameron.
- August 2012: Seasurfing 'wave glider' robot tracked white sharks in real time in the Pacific
- July 2015: Explorers discover deep microbial life in coal-bearing sediment down to ~2.5 km below the ocean floor
- 2015: OBIS—Ocean Biogeographic Information System website is launched.

- September 2015: Sangeeta Mangubhai colleagues explored the Carondelet Seamount in PIPA.
- April 2016: Severe reduction in thermal tolerance projected for Great Barrier Reef

2. What about balance of interest between history/archaeology, biology, geology, other?

A comparison of trends in searches for marine archaeology, marine geology, physical oceanography, chemical oceanography, and marine biology shows dramatically that interest in marine biology totally dwarfs interest in other marine disciplines. In the figure on the previous page, the purple line represents searches for marine biology since 2004. Searches for all the others are "smushed" together.

3. Who are the most frequently quoted or pictured explorers?

- Robert Ballard: Oceanographer, explorer, geologist and underwater archaeologist, first person to discover the wreck of the *RMS Titanic*.
- Sylvia Earle: Leader of over 70 expeditions, logging more than 6,500 hours underwater. Known for her conservation work to identify and protect "hot spots" of biodiversity.
- James Cameron: Canadian film director, and occasional deep sea explorer who made the first solo dive to the deepest part of the ocean.
- Don Walsh: Oceanographer, explorer, one of first two, with Jacques Piccard, ever to descend to the deepest part of the ocean, the Mariana Trench in 1960.

4. What publications, channels, websites, etc. are the places that provide the most ocean exploration coverage?

- *National Geographic*
- BBC
- EurekaAlert!
- NSF Ocean Observatories Initiative
- NOAA's OER website

5. Qualitatively, who seems to do the best coverage? (Best is defined by being readily available and accessible to the general public.)

- *National Geographic*

6. What performing institutions or programs are mentioned in coverage?

- Woods Hole Oceanographic Institution
- Scripps Institution of Oceanography
- NOAA Office of Exploration and Research
- NOAA Vents Program, 1983 to 2013: Thirty years of ocean exploration and research
- Ocean Exploration Trust
- Nautilus Live 2016 Nautilus Expedition; search results skyrocketed when the Nautilus discovered “ the purple orb ”

7. What sponsoring institutions or organizations are mentioned?

- NOAA’s Office of Ocean Exploration and Research
- Woods Hole Oceanographic Institution
- Ocean Exploration Trust
- Alfred P. Sloan Foundation

8. What ships, if any, are mentioned by name?

- *R/V Neil Armstrong*
- *E/V Okeanos Explorer*
- *R/V Atlantis*
- *E/V Nautilus*

9. What controversies, if any, are mentioned in the coverage?

- Implosions, risk of fire, freezing, going adrift, seafloor communications entanglement, were just a few of the dangers that James Cameron had to face in his deep sea dive in 2012.
- During Walsh and Piccard’s 1960 descent in the *Trieste* it kicked up so much sediment that it was hard to see anything on the ocean floor and, their sub’s window actually cracked due to the intense underwater pressure, which Mr. Cameron took into account when creating and building the *Deep-sea Challenger*.

- Example of Controversial Coverage: Radio Canada International → Thru → *The Huffington Post*, a liberal American online news aggregator and blog that has both localized and international editions founded by Arianna Huffington, Kenneth Lerer, Andrew Breitbart, and Jonah Peretti, featuring columnists that feature discussion with top scientists on the latest news in spaceflight, brain/body research, evolution and the influence of science on culture.

1. What ocean-related theatrical film received the greatest coverage over the past decade (2006-2016)?

- The only true theatrical ocean film that I could identify was *Oceans* (2009) – a French-American documentary film. U.S. rights were purchased by Disney, which shortened the film and released it on Earth Day in 2010. The U.S. version of the film received positive reviews from critics, but was not as highly praised as the original French version. It closed in the U.S. after only 85 days, earning \$19,422,319 domestically. It was successful financially only because the original version earned \$63,229,120 overseas. The film was budgeted at about \$80 million. It is instructive to contrast *Oceans* with *The Martian*. 20th Century Fox released “The Martian”, an American science fiction film in the U.S. on October 2, 2015. It received positive reviews and grossed over \$630 million worldwide and was the tenth-highest-grossing film of 2015. NASA was featured prominently in the film. Perhaps we need a film about ocean exploration that features NOAA.