Creating Spaces for Indigenous Voices within Planetary Science - Part 1

Input for the Planetary Science and Astrobiology Decadal Survey 2023-2032

Topic: State of the Profession

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To start this paper off, I want to discuss the need I felt in responding to this call for the Planetary Science and Astrobiology Decadal Survey 2023-2032. ***A huge part of this effort was predicated by the fact that I have grown up in a culture that greatly emphasizes the kuleana (responsibility) that one has to their loved ones and their community.*** Through interactions with other Indigenous people such as Native Americans, American Indians and Alaskan Natives, I have come to see that kuleana is a value at the core of many, if not all, Indigenous cultures. Thus, as a Native Hawaiian planetary scientist and astronomer who uses the observatories on Maunakea to conduct my research, it is almost impossible to ignore the crying need for change that my community has so strongly vocalized. Some of these cries for change are not new, nor are they all that distinct from my own desire to see change within academia. Thus, when I finally became aware of the Decadal call, I began to think about what changes I truly wanted to see, especially as they relate to planetary science and exploration. In essence the goal of this response is to highlight the ways we can further build inclusion within planetary science by including the voices and perspectives of Indigenous experts and knowledge holders within our academic community. Thus, I reached out to Chad (Kālepa) Baybayan, an expert in traditional navigation, and Brittany Kamai, a fellow Native Hawaiian astrophysicist who shares many of the same concerns within her specific field.

As I thought about my own research, part of which is in support of future human space exploration efforts, I could not help but think about Kālepa and the role that our Indigenous explorers and navigators have in this journey. After a series of virtual meetings and some wonderfully rich conversations, we agreed to address this call by composing a pair of papers to reflect our personal stories and how they come together to highlight the ways in which we can make a positive change within this field as well as broader academia. ***In this particular paper, I will share my experiences and path to indigenizing my academic practices in both research and teaching. Folded within this paper are Kālepa's experience in becoming a traditional wayfinder so as to highlight his value and the value of other Native Hawaiian navigators within space exploration.*** Following our stories, we list a set of recommendations to aid the committee in its aim to improve the state of our profession.

My Story

In academia, I would describe myself as an astronomer and planetary scientist who is keenly interested in the questions posed by astrobiology, most specifically those that seek to understand the origin of our oceans. However, this introduction does little to highlight the Native Hawaiian perspectives that are folded within the way I view my research today. ***What I recognize now is that the origin of our oceans is not just an intriguing question as I once viewed it to be, but a question that is instead deeply personal to my own story and culture.*** When I reflect back on my journey to this point, I realize the motivation to pursue my career today is very different from the that first led me to it.

When I first began my journey towards a career in astronomy, it was not something I thought of as an extension of my Hawaiian identity. Astronomy as a career and as a science was for a long time quite foreign to me. My first introduction to astronomy was accidental and only occurred because of enrolling in an introductory course during my first year of college in order to meet my

general education requirements. Although I was fascinated by the subject and eventually chose to pursue a degree in the field, I rarely saw an overlap between the subject area I was studying in the classroom and my own Hawaiian identity. As an undergraduate, Gary Fujihara was my Native Hawaiian mentor in public outreach, and the one individual who introduced me to Hawaiian perspectives about Maunakea. While these perspectives had a physical commonality with astronomical research, I still was unable to see how Hawaiian perspectives were present within my academic field. ***This perceived lack of overlap between my two growing identities essentially continued through graduate school until I was asked to participate in a study of Native Hawaiian students pursuing PhDs in STEM.*** A graduate student from the Department of Education Foundations at the University of Hawai‘i at Mānoa asked me a series of questions that directly addressed the relationship between these two identities. These questions forced me to think about my identity in ways I had never thought to before, questions such as ‘do you see yourself as Hawaiian or an astronomer’ or ‘do you see yourself as both’. I could not stop asking myself what it meant to be an astronomer, and whether that part of me was indeed separate from my Hawaiian identity. Only after this interview, did I really start to look at myself and question how much of my research interests reflected the traditions and practices of my culture.

After taking the time to consider the traditions of my family, was I then able to see that my scientist and Hawaiian identities were not as separate as they initially appeared to be. Now when I think of why I have such a passion for studying water on Solar System bodies, I see that it begins with my family’s traditional ocean practices and my birth here in Hawai‘i. My father and his ‘ohana (family) were born and/or raised near the ocean and much of their lifestyle was rooted within it. Thus, when I was born, my piko (umbilical cord), a traditional symbol of connection to one’s ancestors, was traditionally placed within the ocean to ensure that I too would continue this familial connection with the ocean. By taking the time to acknowledge my family’s practices and relate it to my work, I realized that I had strong familial ties to the very water I was studying. ***Once I started to view astronomy from the perspective of my family’s traditions, I began to realize that being an astronomer was an extension of my Hawaiian identity.*** I now recognize that my study of water is a journey into understanding an intimate part of my own story and a new way to continue the studying my family’s genealogy.

After returning to teach at my alma mater, the University of Hawai‘i at Hilo, I was once again asked to look at ways in which Hawaiian culture was reflected in the material that I was now teaching. In 2012, the [Hawai‘i Papa O Ke Ao](#) committee developed a set of system-wide initiatives to help the University of Hawai‘i become a model Indigenous serving institution. As a result of colonization, many traditional Hawaiian practices including fluency in our native language were lost. While I have been a faculty member at UH Hilo, I have been given the opportunity to regain knowledge about my Hawaiian culture and our traditional practices through these Hawai‘i Papa O Ke Ao initiatives. The aim of these programs is to train faculty in ways that foster an Indigenous place-based approach at UH Hilo. ***By transforming my academic practices to better align with my own cultural practices, I now can help transform my classroom into a Hawaiian place of learning.*** One of the ways I do this is to connect our ka‘ao (legends) to concepts that I teach in class. In trying to connect the story of Maui and his capturing of the Sun in order to slow its passage across the sky, I quickly realized that this ka‘ao was correctly describing the slowing of Earth’s rotation rate over time. In this moment, ***I was***

able to fully appreciate the ways in which the tradition of oral storytelling was in fact a way of preserving knowledge. This childhood legend was no longer just one of Maui's feats, but a story that also carried scientific significance. *A huge part indigenizing my academic process is that I now see traditional storytelling as a part of science and science as a part of traditional storytelling.* To further highlight the relevancy and value of our personal stories within planetary science and human exploration, Pwo Navigator Kālepa Baybayan also shares his own journey below.

Kālepa's Story

In 2007, a recognized student of Mau, I was one of the 5 Hawaiian honorees, initiated in the Pwo ceremony on Satawal island. Under the thatched roof of a traditional canoe house, 16 men, 11 from the tiny Carolinian atoll of Satawal, and 5 having traveled 3,500 nautical miles from Hawai'i, gathered in a circle on plaited mats on the sandy beach floor. In the center of the circle were the tools that would be used in a spiritual initiation ceremony, pieces of coral, a woven bracelet, bird feathers, special leaves from selected trees, a bowl of food, and coconuts. For 3,000 years, on the tiny atolls of Micronesia, oceanic navigators have recognized their most experienced mariners by initiating them into the Order of Pwo, to become Palu, Oceanic Wayfinders. The ceremony is being conducted by our teacher, Master Navigator Mau Piailug, the last surviving navigator on Satawal atoll. The spiritual process is laden with cultural protocol, song, dance, prayer, reverence, and celebration. Students participating in the ceremony recite star directions to distant neighboring atolls embedded in chant to test their competency. The ceremony lasts for three days, and on the final night at around 1 AM, when the navigation stars are high in the sky, the Hawaiian initiates along with their Satawal colleagues, participate in navigation school taught by Master Mau. In the lamp lit darkness of the canoe house, Mau chants out the sailing directions to distant atolls, their respective courses, and the guiding stars that lead you to land. Mau is occasionally respectfully interrupted by the Satawalese students asking for clarification and confirmation of specific instructions. *Volumes of knowledge are stored orally* and committed to Mau's immense memory vault, he gently rolls his eyes back searching for answers that clarify and reassure his students. The final lesson shared with the new initiates is Mau's explanation of the purpose of Pwo. *He said that the Pwo challenged you to be a light to your community, to provide leadership and command on the canoe, to be a good steward of people and your culture, to provide nourishment to the islanders, and to protect and serve the island by being a resource that they can rely on.* We walk to the beach and welcome the rising sun.

In 1976, 31 years before the Pwo initiation ceremony, I was introduced to Mau on the sandy shore of Honolua Bay on the island of Maui. Mau was recruited by the Polynesian Voyaging Society to participate in an experiment in archaeology, he was invited to navigate a design accurate replica of a traditional Polynesian double-hulled voyaging canoe named Hōkūle'a. The voyage took 33-days on a south-southeast course crossing 37 degrees of latitude, guided only by the stars and navigated completely without instruments, the vessel held up over the 2,200 nautical mile reach to Tahiti. Despite the success of the navigation experiment and the marine trial of the vessels' sea-worthiness, there were human failures in the social experiment which tested the 17 person crew's ability to live and work harmoniously on the small open deck of a

voyaging canoe. Before arrival in Tahiti, tensions boiled over into a physical confrontation. In Tahiti, a disappointed Mau abandoned the project, refusing to navigate the canoe back to Hawai‘i and the trip had to be completed with the aid of a sextant and compass.

Onboard the 1976 return trip to Hawai‘i, a 23-year old young Hawaiian, Nainoa Thompson, serves as Watch Captain. He is intelligent and curious about Mau’s navigation system and regrets Mau’s departure. After Nainoa arrives in Hawai‘i, he returns to school at the University of Hawai‘i at Mānoa with the intention of reengineering the art of non-instrument navigation. Over the next four years, he designs a system of non-instrument navigation based on mathematics and science. He plans a voyage back to Tahiti in 1980, but is plagued with the mental and spiritual challenges of such an endeavor. In a conversation with his father addressing the stress of the challenges he faces, his father offers a solution, ‘go find Mau and invite him back to Hawai‘i to complete your training’. Nainoa locates Mau on Saipan, flies there, and on a beach next to Mau’s canoe they meet. Nainoa opens the conversation with apologies for the behavior of the crew in 1976 and Mau adds his apology for his early departure. Nainoa shares his plan for navigating Hōkūle‘a to Tahiti and back to Hawai‘i and he invites Mau to Hawai‘i to help him prepare for the voyage and to complete his training. Nainoa leaves Saipan with no commitment from Mau to assist in his training. Months pass when he receives a phone call from a customs agent at Honolulu International Airport. The agent says that he has a Mr. Mau Pailug with him and requests that Nainoa come and pick him up. Mau shares that he has come to Hawai‘i to help train him in navigation and to teach him how to sail so that the crew will be safe at sea and cared for. Mau becomes Nainoa’s mentor, many others will follow, and in a generation wayfinders will once again rise in service to their communities.

Mau’s training routine involves watching the sunrise and sunset on the coastline, learning how to read weather using the clouds, spending enormous amounts of time on Nainoa’s fishing boat studying the sea swells, their direction, and the underlying current, studying the night sky, familiarizing oneself with the star path to Tahiti. ***Nainoa’s math-science system and Mau’s oceanic wayfinding system are remarkably alike. Nainoa explains that his math-science system grounds and makes understandable Mau’s traditional wayfinding system.*** In March 1980, armed with renewed confidence and Mau’s agreement to sail as part of the crew, Nainoa prepared for a port of Hilo departure. The 14 member crew includes 12 men and 2 women, most mature 40-50 year olds. At 23-years old, I am the youngest. The crew has a sense of mission and purpose, they are committed to not repeat the events of 1976.

On the 1980 voyage, I was a novice, I knew nothing about navigation or the stars. I relied on my young energy and my strengths, my ability to steer the canoe and to learn quickly. On the trip from O‘ahu to our departure point, Hilo on Hawai‘i Island, 6 crew members sailed the canoe. The crew was shorthanded and it required that we all work together. Nainoa was to meet us in Hilo, so Mau served as Sail Master and Navigator. At night he would stand next to the railing clad only in a light rain jacket, facing the ocean he would chant to himself, the spray from the ocean would soak his body and face and Mau would simply wipe the salt ocean out of his eyes. The rising moon would illuminate the silhouette of the swells as it rolled toward the canoe and standing alongside Mau I would ask him what direction they were coming from. “This one east, this one northeast, this one southeast” he would reply. I stared towards the sea and began to

recognize patterns, the way the swells crossed, intersected, crested, as the waves approached the canoe. Conjuring up enough courage I pointed towards the swells and began calling out their direction to Mau, “this one east, this one northeast, this one southeast”. Mau nodded his head and smiled, he looked back at the sea and continued chanting. The crew finally departs Hilo and crosses the open ocean between Hawai‘i and Tahiti in 30 days, the return trip is done 6-days faster. The navigation experiment is successful and the voyage opens the door to many more voyages. To date, Hōkūle‘a has sailed over 160,000 nautical miles, and has been all around the Pacific, including Japan and Alaska. In 2017 they circumnavigate a 47,000 nautical mile voyage around the world stopping at over 150 ports and visiting 23 countries. What started out as a local grassroots project in experimental archeology has now grown into an international endeavor with a compelling environmental mission. Mau provided me my first lesson in navigation, and he inspired me to keep on learning, so late in life, I entered the university to get my undergraduate and graduate degrees.

My 45-year career as sailor, navigator, and captain has brought me into contact with many other compelling homo-sapiens who possess interesting stories of their own. As a mariner working in the field of traditional oceanic exploration and navigation systems, I am often asked to contribute to conversations around inter-planetary settlement and human expansion into space. In 1995, I presented on a panel alongside Tony Taylor, a NASA/JPL mission specialist working on the Voyager Program. We had an engaging conversation about the problems and challenges confronted with the planning, design, and execution of missions and intentional voyages of exploration. The discussion was wide ranging from technical and logistical issues to human and social concerns. There were points in the conversation where similar aspects were reflected in both voyages. Aspects such as important mission relevant equipment like communication platforms and solar power systems, with redundancies built in and the ability to service equipment while on a mission requiring replacement parts to be readily available. Human physiology and psychology would need to be tested prior to extended missions, issues dealing with isolation and compatibility pose interesting problems. There were ethical questions as well, what responsibility does our species have for preventing the spread of unacceptable human behavior.

When discussing the preparation of the crew, the most important issue confronting a voyaging crew of 14, all new canoe voyagers, is the frame of mind they bring with them, their attitude, and the way they think about mission, participants, and healthy relationships. As a rule each member of the crew must be aligned with the mission, values, and intentions of the voyage. The way we do this as voyagers is we host numerous conversations with perspective crew in a two-way dialogue learning from each other to get at the core of mission, values, and intent. From top to bottom, from captain throughout the crew, everybody on board the canoe has to be aligned with the voyages objectives. As captain, I share with the crew that we are a collection of individuals brought together by a unique mission, in the process of becoming a team. ***The process of the voyage and the challenges we will collectively face will lead us to becoming an effective team*** as long as we are willing to work together.

Today, there are 10 Polynesian Pwo navigators residing in Hawai‘i, New Zealand, and the Cook Islands. Twice monthly we get together on a Zoom call to discuss the hopes and vision we have

for the respective communities we serve. Our continued mission is to inspire our community to be like our mariner ancestors, to be bold explorers who settled the vast expanse of the Pacific, guided by stars, faith, and confidence in themselves. It is a narrative that the navigators control and share, by doing something we discovered a long time ago that we are good at, exploring and sharing that story. As humanity pushes the horizons of exploration to the inter-stellar frontiers of our universe, mankind has to constantly remind ourselves of the human necessity to export only the best traditions of our humanity. ***Mankind has to challenge itself to be better explorers and settlers in our quest to continue the spirit of exploration, a tradition grounded in oceanic history of a people who left the safety of the shore, explored, learned, and discovered the stars along the way.*** To be a light in service to your community is a truly aspirational mission, it speaks to human relationships, and connects you to a larger mission by making mankind better through your participation.

Recommendations

The conversations between myself, Kālepa and Brittany each highlighted the value of creating spaces for indigeneous perspectives and voices within planetary science and space exploration. Thus, we have created a set of recommendations to support this Decadal committee as they review the current state of the profession within planetary science. Overall, we see that ***our academic spaces need to enable and cultivate authentic and meaningful collaboration between Indigenous leaders and planetary scientists.***

Recommendation 1: Identify authentic ways to recognize the value of Indigenous perspectives and their contributions to planetary science.

Activities like invited speakers at conferences or panel discussions alone do not lead to meaningful collaborations in which these individuals can fully contribute to the scientific process. Too often, many of our efforts aimed at inclusion only minimally engage those that we are trying to include in our research activities. These superficial interactions can result in the appropriation and tokenizing of individuals rather than honoring the collaboration that we are aiming for.

Meaningful conversations and collaborations between Indigenous leaders and scientists need to happen if we are truly going to represent the efforts of humanity in space exploration efforts. NASA's Artemis program boldly states that this mission represents humanity's return to the Moon. However, while this mission is meant to represent humanity, some of our most experienced explorers on Earth are not even a part of this conversation. Kālepa's invitation to participate in panels alongside JPL mission specialists highlights the wealth of his knowledge and experience, as well as its relevancy to space exploration. To hear Kālepa's story is to see that human space exploration is really an extension of our Native Hawaiian traditions. Despite their relevant expertise and ability to contribute to these efforts, our Indigenous navigators are not included in these human space exploration projects.

Funding specifically targeted at community engagement and outreach should be prioritized for projects that push to create long term and meaningful relationships with the community members they engage. The NEOCam mission team is working with our Native Hawaiian led

non-profit organization PUEO to create engagement programs which serve students with whom mentoring relationships have already been built. A Hua He Inoa is a program that creates authentic collaborations between astronomers and members of our indigneous community by including students fluent in ‘Olelo Hawai‘i in the naming process for discoveries made with Maunakea observatories. These two programs represent important examples for building inclusivity within planetary sciences and serve as the type of engagement programs that should be supported.

To truly honor inclusion in its intended sense, our Indigenous students and knowledge holders should be involved in all aspects of the scientific process, such as helping to direct the science questions that we are choosing to pursue. The latter being especially pertinent for research activities in areas highly valued by our Indigenous communities. As the result of the lease agreements between the observatories on Maunakea and the University of Hawai‘i, the University has established a committee review process to select which proposals are awarded time and which are given preference. An example of a way in which we can further build inclusivity within our academic process is to invite Native Hawaiian stakeholders with a vested interest in Maunakea to participate in the selection process and help prioritize which science programs should be conducted on Maunakea.

Recommendation 2: Increase the value of science within our Indigenous communities.

Often times within academia, the contextualization of our research through our personal stories is seen as taking away from the integrity of our research rather than adding to it. These personal perspectives within academia are thought to be better suited for outreach efforts and in speaking with non-academics. However, there should be no such distinction when speaking with our colleagues and speaking with those outside of academia, as *our research should not be separated from our humanity and those qualities that define us.* If it were not for my eventual realization that my research was actually an extension of my cultural identity, I likely would not have continued to pursue a career in academia. Despite the fact that I obtained my bachelors and PhD both here in Hawai‘i, I did not often see Hawaiian perspectives as valued by my teachers and mentors. We cannot expect students, especially those with different ways of navigating science, to value our discipline if we do not provide them the opportunity to see how their own stories fit within it. Initiatives like Hawai‘i Papa o Ke Ao highlight the need for this change of perspectives within our academic culture and serve as a model of how to help us recognize the strength of our personal stories as a way of doing science. **If we are to expect our Indigenous communities to see the value of planetary science within their lives, we too need to see the value of Indigenous perspectives within our discipline.**

These recommendations, as well as those made in our partner paper are just some of the ways we can ensure that Indigenous voices are recognized as part of this scientific community, and that the work of this scientific community is done in such a way as to increase its value within Indigenous communities. At this point, I would like to direct the reader to the second paper in this series titled “Creating Spaces for Indigenous Voices within Planetary Science - Part 2” by Kamai, Baybayan and Kaluna. *We would like to say mahalo nui to the committee members and readers for taking the time to hear our voices.*