FIFTEEN YEARS OF THE PACIFIC INTERNATIONAL TRAINING DESK: TRAINING IMPACTS IN THE ISLANDS

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1. INTRODUCTION

In 2016, the Pacific International Training Desk (PITD, or Pacific Desk) turned fifteen years old. In that time, nearly 130 participants from the World Meteorological (WMO) Regional Association V (RA-V) have completed the training program and returned to their home countries to apply their training to their work, be promoted to forecast positions, stand up their countries' forecast offices, and assume leadership positions in their office, ministry, or government. The PITD is administered by the Telecommunications and Social Informatics Research Program at the University of Hawai'I at Mānoa (UH-TASI), formerly known as the Pan-Pacific Education and Communication Experiments by Satellite (PEACESAT), supported by the U.S National Weather Service (NWS) International Activities Office (IAO) and Pacific Region Headquarters, and hosted by the NWS Honolulu and Guam Forecast Offices. The Desk is structured differently from the Weather Prediction Center (WPC) international desks in terms of the education and experience of the participants, the length of training, and operational products. The mission of the PITD, however, is similar - to build capacity in the meteorological services of Pacific Island nations. This is accomplished through online prerequisite modules on fundamental meteorology, a four-week on-site analysis and forecast training program at the NWS Forecast Offices, and ultimately in-country workshops on advanced and specialized topics. Significant recent milestones include a complete program review and redesign. Administration was restructured and formalized, the curriculum was standardized and assessments were developed, and additional training components were added, notably in communications systems such as Radio and Internet for the Communication of Hydro-Meteorological and Climate Related Information (RANET), Chatty Beetle, RAPIDcast, Short Messaging System (SMS), and web development. The PITD site in Guam was launched to serve the Weather Service Offices in the Freely-Associated States in the Northwest Pacific, with fifteen participants from the Federated States of Micronesia, the Marshall Islands, and Palau completing the program since its opening in 2016.

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2. PURPOSE OF THE PACIFIC DESK

The PITD was established in 2001 by the NOAA/NWS at the Weather Forecast Office (WFO) Honolulu at the University of Hawai'i at Mānoa. In alignment with the mission of the NWS IAO, the PITD was established to "promote the international interests of the U.S., meteorological and physical community improving the levels of science, technology, operations, and services worldwide." The Pacific Desk, as one of NOAA's contributions to the WMO Voluntary Cooperation Program (VCP), is intended to provide training opportunities for participants from WMO RA-V, with potential extension to WMO RA II developing countries in East and Southeast Asia and who are also members of the ESCAP/WMO Typhoon Committee. After a period of assessment, the Pacific Desk was re-established in 2013 under UH-TASI management.

Nearly all Pacific island nations staff a National Meteorological and Hydrological Service (NMHS), which is tasked with making routine weather observations; public and marine forecasts; climate analyses; severe weather alerts; or marine warnings for their areas of responsibility. These offices are small (as few as six employees) and usually understaffed. Some are unable to operate 24 hours a day, 7 days a week or provide early warning services. There is a lack of qualified meteorologists across the region to fill the forecasting need. In stark contrast to the United States, very few employees of a Pacific Island NMHS hold any university degree, much less one in meteorology; those with degrees have actually studied physical sciences, mathematics, or computer science, as there is limited coursework in atmospheric science in the tropical Pacific. Fewer than 20% of NMHS employees in the region hold advanced degrees in any specialization.

Pacific Islands NMHS have few resources available to their offices for in-house training and thus rely heavily on external programs hosted by larger countries. With the transference of forecast and warning responsibility from larger and distant weather services or warning centers to sovereign island nations, the importance of local capabilities continues to grow. The Pacific Desk training program is designed to fill a demonstrated need; the curriculum is designed to improve technical capacity to access, manage, interpret, tailor, and share relevant weather information. The Pacific Desk acts as a forum for improving data quality across a data-sparse ocean, and fosters collaboration among past trainees. The

program also contributes to disaster risk reduction through higher-quality forecasts and better communication of weather information.

3. PACIFIC DESK HISTORY

Pacific Desk training began in 2001 as two-month, one-on-one internships at the WFO-Honolulu, and was eventually trimmed to six weeks. Training was expanded in 2010 to include two trainees from a single country at a time, as well as including participants from RA-II member countries, such as Vietnam, Cambodia, Indonesia, and Malaysia. Participants came with a wide variety of knowledge, abilities, and educational and vocational backgrounds, from directors to observers.

The training curriculum covered a range of general topics including stability, satellite interpretation, numerical weather prediction, tropical weather analysis and forecasting. The content was also highly tailored, individualized, and practically relevant; the curriculum was primarily focused on enabling participants to prepare and disseminate local forecasts for their home area of responsibility.

The extensive hands-on component of training made use of tools and operational aids available to each country, and in nearly all NMHS offices, this was limited to weather information publicly available online, because South-Pacific NMHS did not have integrated data and forecast systems and are limited by extremely narrow bandwidths.

From 2001 to 2011, 62 participants from 17 countries across the Pacific and Southeast Asia completed Pacific Desk training at WFO-Honolulu.

4. THE PACIFIC DESK NOW

Between 2011 and 2013, the Pacific Desk underwent an evaluation, needs assessment, and restructuring. Capacity remains low in the region, which includes some nascent NMHS offices, and training opportunities are still limited or inconsistent. A demonstrated need for training remained, with Pacific Desk being the sole source of training for some offices. UH TASI assumed the administration of the program, with training remaining at WFO-Honolulu.

The training program was reformatted from the initial six-to-eight-week arrangement. The on-site program in Honolulu was condensed to four weeks, reducing the amount of time staff spend away from their (already understaffed) home office, by moving introductory meteorology topics to prerequisite e-learning modules provided by COMET/MetEd. Candidates now come with a more uniform knowledge base, which allows for a quicker progression into more advanced topics.

The initial target audience was defined as experienced observers or technical officers with little to no forecast experience, to help bridge the capacity gap in forecasting divisions. This audience is rarely afforded the opportunity for training abroad. The application and selection process was formalized; applicants must be nominated by their director and complete an online sequence of prerequisite modules prior to acceptance to the four-week on-site program. Prerequisite modules cover topics at a secondary, 100- and 200-level undergraduate equivalent and include the structure of the atmosphere and ocean, remote sensing, climatology, climate change and sea level rise, statistics, hydrology, chart analysis, and introductory tropical meteorology.

The curriculum still includes customizable practical components, but was largely standardized and informed by WMO Basic Instruction Package for Meteorology Technicians (BIP-MT). The curriculum now includes regular assessments in multiple modalities, including quizzes, blog posts, forecast verification, laboratory exercises, and map discussions. The concentration on hands-on analysis and forecast practice for participants' home areas of responsibility remains, but the program also provides background meteorology instruction at a 200- to 300-level undergraduate course equivalent. Trainees cover thermodynamics and sounding interpretation, stability, satellite interpretation, general circulation, tropical weather features, streamline analysis, forecast philosophy, numerical weather prediction, forecast verification, marine forecasting, and communication of weather information.

As before, training leverages the co-location of WFO-Honolulu with the UH Atmospheric Science department. Trainees interact with WFO forecasters and management, attend bi-weekly map discussions on the forecast floor, and occasionally attend department seminars and student presentations. Partnerships have been forged with related agencies beyond the forecast offices, including NOAA/NWS Pacific Region, Pacific Tsunami Warning Center (PTWC), International Tsunami Information Center (ITIC), Pacific ENSO Applications Climate (PEAC) Center, Joint Typhoon Warning Center (JTWC), Civil Defense, Coast Guard, University of Guam, media outlets, and airlines. Training includes field trips to or guest presentations from these agencies.

With decades of experience in distance learning and telecommunications network design, development, and implementation in the Pacific Region, the UH TASI has added a communications systems component to the Pacific Desk training. This three-day portion of the on-site program includes several topics of interest to island-nation NMHS, including website development, satellite

communications RANET systems including Chatty Beetle, RAPIDCast, and other satellite communications systems, teleconferencing platforms, and SMS text message alerts.

The Pacific Desk provides participants with travel, lodging, local transportation, and a stipend for living expenses while in Honolulu. The Desk also provides a laptop computer configured with software and training materials for use during training, which is then used by the NMHS upon return.

In 2016, training was expanded to WFO-Guam to serve North-Pacific island nations in free association with the United States. Participants from the Republic of Palau, the Federated States of Micronesia, and the Republic of the Marshall Islands were invited to take part in Pacific Desk training for the first time. The training in Guam follows a similar format to the Honolulu desk, with online prerequisites and a four-week on-site program. The content was adjusted slightly for the geography and weather features of the region, and for the related agencies located in Guam, but is largely the same as the Honolulu curriculum for South-Pacific trainees.

Since relaunching in 2014, 51 participants from 11 countries have been trained in Honolulu, and 15 participants from 3 countries have been trained in Guam. Since the program's inception in 2001, a total of 128 trainees from 20 countries have completed the Pacific Desk program, with details listed by country in Table 1.

Table 1: Pacific Desk Participation by Country (2001-2016)

Country	Participants
Cambodia	1
Cook Islands	5
Federated States of Micronesia	9
Fiji	9
Indonesia	1
Kiribati	11
Malaysia	2
Marshall Islands	3
New Caledonia	1
Niue	4
Palau	3
Papua New Guinea	12
Philippines	3
Samoa	13
Solomon Islands	11
Tokelau	3
Tonga	15
Tuvalu	8
Vanuatu	10
Vietnam	3

5. TRAINING IMPACTS IN PACIFIC NMHS AND BEYOND

Many participants remark during training that they better understand the underlying meteorological principles behind the tasks they and their offices perform. It appears most of their previous on-the-job training has focused on *what* to do, but less on *why*. Participants have returned to their home offices with training materials and shared what they have learned with their colleagues, further extending the Pacific Desk's reach.

Offices have reported beginning or resuming regular in-office map discussions and forecast verification. Following training, participants and their offices are also better-equipped to increase the number, frequency, and quality of their observations, which improves global numerical weather prediction output worldwide.

Pacific Desk graduates in countries such as Cook Islands, Kiribati, Niue, and Tonga have reported their ability to produce their own public and marine forecasts upon completion of training. Many of these countries have relied on Fiji, Australia, or New Zealand for weather forecasts. Tokelau's Pacific Desk participants are currently in the process of standing up their own NMHS.

Many NMHS have increased forecast duration and detail in their public and marine products following Pacific Desk training. The Samoa Meteorology Division reports their forecasts have become more detailed and accurate following Pacific Desk training. The Solomon Islands introduced ten provincial public forecasts and three regional marine forecasts in place of one forecast for their 432,000-square-mile area of responsibility.

Interaction of employees and trainees in the offices has opened communication between WFO-Honolulu and South Pacific NMHS staff, as well as between WFO-Guam and the Weather Service Offices (WSOs) in the Western Pacific. The Pacific Desk has assisted with post-analysis following severe events, including fatal heavy surf in Kiribati in January 2016.

The Pacific Desk designed its communications training to be integrated with operations and workflow. This meant understanding what communications systems each NMHS currently uses. The Pacific Desk works with past participants to provide maintenance and support of systems including RANET Chatty Beetles, HF radio, and website development. The Pacific Desk has been instrumental in collecting data on deployed RANET systems, their operational status, and any needed repairs/replacements.

Within the NMHS offices, individuals have clearly benefited from Pacific Desk training and the professional

development it affords. Several trainees have taken or are taking steps to further their education, including applying for or completion of BS and MS degrees, or have qualified for advanced training programs in the Philippines, New Zealand, and Australia. A majority of participants have been promoted upon return from Pacific Desk training, with many observers now working as assistant forecasters or even as full forecasters working without supervision on their office's forecast bench. Pacific Desk alumni have also progressed into leadership roles, with at least six current or retired NMHS directors having undergone Pacific Desk training.

One barrier to success often reported by Pacific NMHS directors is a lack of confidence in weather analysis and forecast tasks. Since 2014, in addition to measuring performance on assessments such as quizzes and projects, the Pacific Desk computes a trainee confidence metric. Before and after training, participants self-assess (on a 1-5, not-confident to very-confident scale) their own confidence in understanding a variety of training topics, as well as their ability to make a short-term weather forecast, answer questions from the public about weather events or train their colleagues. Predictably, confidence increases are seen for all prompts (though, there are occasional decreases – likely attributable to the "the more you know, the more you know you don't know" phenomenon), and some notable increases are shown in Table 2. Increases of greater than two points on a five-point scale are shown in participants' confidence in their ability to make a 24-hour weather forecast and to train other staff to make weather forecasts. Similarly dramatic, if slightly smaller, increases are shown in accurate diagnosis of current weather elements and the training of colleagues in the same, as well as appropriately fielding questions from the public about the weather. Thus, not only is the Pacific Desk equipping trainees with knowledge, but the repeated analysis and forecast practice and external validation of their progress is empowering them to return to their home NMHS or WSO with greater confidence in their abilities.

6. THE NEXT FIFTEEN YEARS

Training will continue in both Honolulu and Guam throughout 2017, with 35 participants expected to complete on-site training. The first participants from Nauru are expected this year; Nauru plans to stand up their own NMHS soon.

The Pacific Desk plans to expand the training to an intermediate level with learning objectives informed by the WMO BIP-M, which should reach not only previous participants from the introductory level, but also those forecasters who were overqualified for initial training. Curriculum development is underway with review among WMO RA-V subject-matter experts planned for the first half of the year. The Pacific Desk expects to run two pilot cohorts at that level by the end of 2017.

Potential partnerships continue to be explored, including possible training in climate early warning services. In-country training workshops in communications-systems and messaging are also being planned. Several specialized topic training requests have been submitted to the Pacific Desk for consideration in future training, including aviation meteorology, tropical cyclone forecasting, and tsunami generation and warning.

Table 2: Self-Assessed Confidence Change Pre-/Post-Training (2014-2016)

Select Prompts **"Confidence in my ability to…"**	**Mean Difference on 5-Point Scale**
Accurately diagnose current weather; explain current weather elements	+1.63
Make a 24h weather forecast	+2.18
Answer questions from the public about a typical weather forecast	+1.86
Answer questions from the public about a hazardous/extreme weather event	+1.67
Train other staff to analyze weather patterns	+1.96
Train other staff to make weather forecasts	+2.06
All Prompts	+1.82