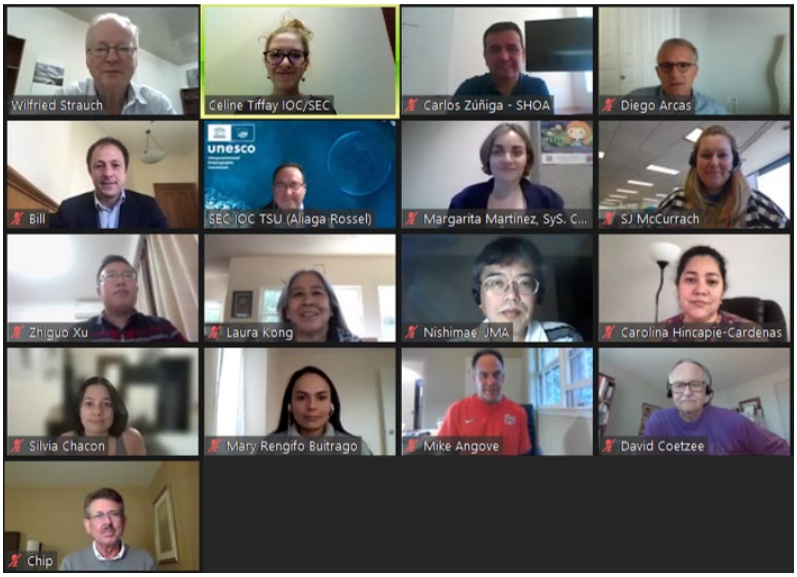
REPORT OF THE ICG/PTWS Steering Committee Meeting

21-23 September 2021, Online



1 Welcome and Opening

The Chair, Dr Wilfried Strauch, welcomed the participants, presented technical arrangements and conducted the meeting.

2 TSP Coordination and TWC Operations

2.1 Report of the PTWC

Dr Charles “Chip” McCreery, Director of the NOAA Pacific Tsunami Warning Center (PTWC), presented the report of the PTWC. He began with an overview of staffing changes during the last year, noting that they had recruited a new oceanographer in January 2021 and a new geophysicist (GNSS specialist) in July 2021, but that they also lost a geophysicist in June 2021. He also noted that they were still waiting to fill one position of duty scientist. He next reported on the COVID-19 impact at PTWC, noting that there had not been any infections and therefore no outages of the centre or significant impacts on operations, except that in-person outreach activities had been put on hold. He also informed that no significant changes had been made to seismic and sea level data.

Next, Dr McCreery reported on message events between 1 June 2020 and 15 September 2021, highlighting that 26 information statements for earthquakes in the Pacific, including 14 threat message sequences, had been issued. Most events produced smaller tsunamis. Dr McCreery drew attention to the New Zealand earthquake sequence and the Alaska Mw8.1 earthquake. For the latter, the tsunami size was negligeable for an event of that magnitude because it occurred in the shallow water of the continental shelf of the Alaska Peninsula.

Dr McCreery also presented the earthquake event in the South Sandwich Islands on 12 August 2021. This event included two earthquakes, although there was disagreement amongst observatories as to which had higher magnitude. The USGS calculated that the

smaller earthquake occurred first whilst the Global CMT Project has the smaller earthquake occurring second. Dr McCreery noted that, had there been vulnerable coastlines nearby, this event could have caused damage and casualties from a tsunami. He noted that the tsunami went far, being recorded as far as Hawaii, Alaska, South Africa and Australia. He summarized key issues related to the event as being the complex source, that the preliminary magnitude was a significant underestimate, that there is only one nearby coastal station and no deep-ocean stations. He also noted that although the PTWC issued an Information Statement for the CARIBE-EWS, because the South Sandwich Islands fall into the PTWS Earthquake Source Zone (ESZ), the only areas that actually had a potential tsunami threat were in Chile and Antarctica (both of which are in the PTWS). If a similar event occurred near a vulnerable coast the resulting no warning or under-warning could have dire consequences. As such, Dr McCreery recommended that expand the PTWS EMZ to include part of the southern Atlantic Ocean that encompasses the Scotia Arc and its adjacent seismic zones.

Actions:

- Identify and implement techniques to more quickly recognize and properly characterize the earthquake and tsunami threat (there will be a special session at the Fall 2021 AGU Meeting),
- Develop a technical proposal to expand the PTWS EMZ to include part of the southern Atlantic Ocean that encompasses the Scotia Arc and its adjacent seismic zones.

2.2 Report of the NWPTAC

Mr Yuichi Nishimae, Scientific Officer for International Tsunami Information, Japan Meteorological Agency (JMA), presented the report for the North West Pacific Tsunami Advisory Center (NWPTAC). He began by noting major activities of the NWPTAC between June 2020 and August 2021. On 5 November 2019, the NWPTAC terminated its interim service for the South China Sea region when full operation of the South China Sea Tsunami Advisory Center (SCSTAC). In November 2020, the JMA moved to its new building and the NWPTAC started its operations at this new building. On 14 July 2020, 15 February 2021 and 3 August 2021, the NWPTAC also performed communications tests.

Mr Nishimae also highlighted that the NWPTAC issued 14 advisory messages since June 2020, noting that on average the advisories were issued within 10 minutes. He also presented results of communications tests conducted since 2012, noting that these usually occur biannually. He reported that approximately 70 percent of countries had sent back acknowledgements of receipt to NWPTAC and that the number of acknowledgments was increasing.

2.3 Report of the SCSTAC

Dr Zhiguo Xu, the Acting Director of Tsunami Warning Division/NMEFC, presented the report of the SCSTAC. He recalled the Area of Service (AoS) of the South China Sea Tsunami Warning and Mitigation System encompasses all coasts of the South China Sea and the adjacent Sulu Sea and Celebes Sea, separated by Palawan and the Sulu Archipelago from north to south respectively. Nine nations are included in this area: Brunei Darussalam, Cambodia, China, Indonesia, Malaysia, Philippines, Singapore, Thailand and Vietnam.

Dr Xu indicated that between June 2020 and September 2021, SCSTAC issued 12 tsunami bulletins, noting that most earthquakes were located in the eastern part of the SCS. He also noted that a new and updated website was available for SCSTAC, where additional information can be found. Dr Xu reported that SCSTAC had developed a tsunami warning decision supporting system based on Python to improve their tsunami warning capability. The software will be upgraded by the end of 2021.

Next, Dr Xu reported on communications tests conducted on 28 January and 28 May 2021, noting that six Member States had responded to the dummy information. He thanked the Secretariat and Member States. He also spoke about technical training activities that were conducted since June 2020, including related to seismic analysis, sea level data analysis, tsunami forecasting, message dissemination and routine drills.

Finally, Dr Xu spoke about future plans for the SCSTAC, noting that SCSTAC would join the Tenth Meeting of the Working Group for the South China Sea (September 2021), continue to perform communications tests, conduct an online training workshop on tsunami forecasting and risk assessment for tsunami warning operators in the South China Sea region (December 2021, hosted by China), and provide opportunities for in-person education, outreach and training activities in the region. He noted that the latter would be dependent on the COVID-19 pandemic.

2.4 Report of CATAC

Dr Wilfried Strauch, Coordinator of the Central America Tsunami Advisory Center (CATAC), presented the report of CATAC. He began by indicating the area covered by CATAC, namely the oceans linked to Central America. Due to time constraints, he limited his presentation to CATAC's workplan for 2021-2022.

Dr Strauch highlighted key activities for the period 2021-2022, including two regional tsunami exercises for Central America (prepared by CATAC). He noted that the exercise that was due to take place in August 2021 did not occur because of other priorities. The next exercise will take place on 22 November 2021. He also informed that the training of CATAC watch standers for tsunami advisory will continue. Currently, there are 16 trained watch standers, although eight were integrated recently and are still acquiring experience.

Dr Strauch also noted that they have not been able to conduct training for staff of recipient institutions on the CATAC messages yet and this is due to take place in October 2021. He also noted that there has been and will be a massive installation of seismic stations for Earthquake Early Warning (2021-2022) in Nicaragua (50), El Salvador (25), Guatemala (17), and Costa Rica (4) under the EWARNICA project. These stations will improve processing of larger earthquakes and tsunami warning. CATAC also tested massive Earthquake Early Warning in Nicaragua (under the JICA-EWARNICA project). Dr Strauch reported the creation of a new and more complete tsunami warning messaging suite during the past years. This, together with the TOAST software, will provide the tsunami simulation data.

Finally, he reported that CATAC can start with full tsunami service by end of 2021.

Actions:

- Recommend at the ICG/PTWS XXIX Meeting in November 2021 for CATAC to become a fully operational TSP.

2.5 Report of TSPs coordination

Dr Charles "Chip" McCreery, Director of the NOAA PWTC, presented the report of the Tsunami Service providers (TSPs) coordination. He noted that a PTWS TSP coordination meeting was held on 29 October 2020. Issues raised at the meeting included the procedure for issuing messages for events outside of normal Areas of Service (AoS). The other key theme discussed was TSP products for the Maritime Community. At the moment, TSPs have not yet begun to develop new products for the maritime community for NAVAREA coordinators to disseminate to ships at sea.

Dr McCreery also remarked on operational coordination between TSPs. He highlighted that the ESZ indicates which TSP will issue the authoritative initial information or threat message, and that PTWC follows from these according to their set parameters (for events in the NWPTAC and SCSTAC earthquake source zones).

Actions:

- TSPs will define more clearly, in their respective User Guides, procedures for issuing products when the earthquake is located outside of a TSP's coastal area of service.

Discussion on Agenda Item 2:

The Group requested additional information about CATAC trainings, noting that they could be useful for Pacific Island Countries and Territories (PICTs). Dr Strauch informed that CATAC followed several different types of courses, most important of which was training on the job.

The Group strongly supported the recommendation of PTWC to expand the PTWS EMZ to include part of the southern Atlantic Ocean that encompasses the Scotia Arc and its adjacent seismic zones. ***The Group agreed*** that this recommendation should be sent to the ICG/PTWS XXIX Meeting.

The Group also discussed the establishment of CATAC as fully operational. Mr Bernardo Aliaga, the Technical Secretary, explained that the process for validating CATAC. He stated that CATAC needs to be endorsed by the ICG/PTWS and ICG/CARIBE-EWS separately.

Actions:

- A final document must be prepared for ICG/PTWS XXIX Meeting for it to endorse CATAC as a fully operational TSP.

3 PTWS Working Groups and Task Team reports

3.1 WG 1 Understanding Tsunami Risk

Dr Diego Arcas, Chair of WG 1, reported on this item, noting that the number of activities that the NOAA Centre for Tsunami Research (NCTR) was involved in has been reduced because of the pandemic. Nonetheless, the NCTR continued to develop the TsuCat tool with ITIC., releasing TsuCat Version 4.2 (PMEL). Updates include: Updates to PTWC messages (improvements in Graphical Products, hillshading and grouping Estimated Time of Arrival (ETAs) by country; added ability to download entire source catalog online in the background (progress reported through the "stoplight" icon); added dialog for editing the Requested Epicenter and the Closest in Catalog epicenter; fixed bug in showing best source in very

large events (restricts sources closer in magnitude, but very far from the Requested Epicenter). Dr Arcas also provided visuals of updates in TsuCat.

Dr Arcas also reported that WG 1 also supported SHOA on acquiring DART metadata as a proxy for NDBC service (PMEL). The WG also worked on setting up a Web Portal for DART metadata updates (PMEL). It also conducted analysis of DART 4G performance during the 4 March 2021 Kermadec events in support of New Zealand array. In addition, members of the working group drafted the new PTWS Strategy 2022-2030 report for consideration in this PTWS Steering Committee meeting.

Actions:

- WG1 and ITIC to provide Guidelines for use of TsuCat (e.g. planning vs response).

3.2 WG 2 Task Team for Integrated PTWS Sensor Networks for Tsunami Detection and Characterization

Dr Bill Fry, Co-Chair of the TT, reported on this item. He recalled that the TT's goal is to support accurate and timely coastal forecasts. Challenges for achieving this include that different data have different spatial sensitivities and times to detection, measuring deep sea waves (DARTs) provide good forecasts but data is not rapidly available (10s of minutes), and seismic and geodetic data are available more quickly but their information is limited.

Dr Fry explained that two different approaches are used by the TT. The first is a source-based approach which relies on time to detection/forecasting for propDB unit sources, based on origin time. The second approach is risk-based and relies on understanding what the tsunami monitoring and detection system can do for exposed populations. Dr Fry provided visuals for regional w-phase blindspots, noting work conducted by Stu Weinstein/PTWC, NZ & Zhao et al. on this topic.

Finally, Dr Fry shared upcoming tasks of WG 2, which include: more work around GNSS sensitivity, testing of routine regional w-phase inversions, merging DART analysis with seismic and GNSS data, drafting a report and a spinoff report addressing SMART cables, and conducting a workshop to progress risk-based assessment.

3.3 WG 2 Task Team on National Tsunami Warning Centre (NTWC) Competencies - Capacity Building

Mr Ofa Fa'anunu, Co-Chair of the TT, reported on this item, noting that developments have been limited due to internal priorities. Nonetheless, the Ocean Teacher Global Academy (OTGA) Suite of Tsunami Awareness Trainings is being developed by IOC and will contribute to competencies. In addition, Tonga is developing an accredited competency certificate through the Tonga Accreditation Board. With regards the establishment of a framework for the required competencies required by the roles of a NTWC, a survey was due to take place in 2021 but will take place in 2022.

Mr Fa'anunu also reported on the establishment of trainings required to ensure NTWC staff meeting minimum competency levels. A basic SeisComP Training for ORSNET Member States was conducted in October-November 2020. In 2021, SPC supported ORSNET Status review revealed the need for the following trainings to upskill NTWC: Basic seismic data centre training - SeisComP4, advanced seismic analysis training and training on station XML

creation/edition. The decision to support tools for local and distant tsunamis will be established under the World Bank Project and upgrade to SEISCOMP4.

Mr Fa'anunu remarked that efforts to investigate and document schemes, guidelines and principles to be adapted for this purpose were ongoing, noting that competencies have been collected from PTWC, ATWC and India.

Mr Fa'anunu next reported on the capacity development of Pacific island countries and territories, noting the cooperation between Tonga and ITIC for the Tsunami Warning Operations Training to pilot the NTWC competency framework for Tsunami Watchkeepers in 2019. He also noted efforts of ITIC, IOTIC, and SPC under the OTGA and USP to provide a suite of tsunami courses that allows tsunami watchkeepers to attain micro-qualifications or an officially recognized qualification to enable them to issue a national tsunami warning.

Mr Fa'anunu reported on Tonga Seismic Upgrades for tsunami and volcano monitoring (through the World Bank Pacific Resilience Project) an activities of the WG-Pacific Island Countries (PIC) capacity building TT which continued to develop guidelines for NTWCs. He noted that workshops are planned for Fiji, Solomon Islands, Vanuatu and Samoa to review and adapt guidelines for NTWC in responding to local tsunami and incorporate into National Tsunami Warning SOPs in October and November 2021.

With regards to developing an online survey of warning and mitigation capabilities in the Pacific Island, the TT noted the outcome of the series of surveys and identified capacity development and training gaps, including in tsunami forecasting and end-to-end tsunami warning and response SOPs.

Mr Fa'anunu reported that the Tonga Meteorological Service developed an earthquake application called the "Mofuike App". The App includes three questions about the estimated Intensity, estimated duration, and nature of shake. This application was rolled out into the communities in June 2021, with 78 community authorized officers in Vava'u, with the objective of over 500 community authorized officers throughout the country by the end of 2021. Mr Fa'anunu also reported on the Tonga nationwide early warning alert system that was developed. Through this, 88 voice and sound sirens as well as 515 community radios have been installed.

3.4 Working Group 3, incl Tsunami Ready - WTAD

Dr David Coetzee, Chair of WG 3, reported on this item, sharing activities conducted pertaining to each element of the WG 3 terms of reference.

With regards to WG 3 objective to facilitate exchange of experiences and information on risk reduction and preparedness actions and matters related to disaster management, WG 3 continued to play an active role in the TOWS-WG TT on Disaster Management and Preparedness (DMP), contributed to the TOWS-WG submission re a Tsunami Programme to the UN Ocean Decade, and participated in the WMO RAV Ocean Side Event - synergies between the IOC Tsunami Ready Programme and the WMO Weather Ready Nations Programme. In addition, the Director of ITIC continues to participate in the IUGG Joint Tsunami Commission (JTC) where she chairs the JTC Working Group on Science-based Tsunami Warning and is a member of the WG on Tsunami Terminology which contributes to the Tsunami Glossary updates.

With regards to WG 3 objective to promote preparedness in coastal communities through education and awareness products and campaigns, WG 3 has contributed to World Tsunami Awareness Day (WTAD). In 2020, WG 3 supported two Regional Pacific Seminars and several 2-minutes videos on Tsunami Ready. For WTAD 2021, WG 3 will support the creation of videos. In addition, WG 3 supported the PacWave 2020 exercise and has continued to support the development of awareness products. ITIC also continued to update its global and regional awareness products, and to create new ones

With regards to WG 3 objective to facilitate SOP training across regions to strengthen emergency response capabilities of Member States and their Disaster Management Offices, WG 3 has provided trainings, although these were impacted by COVID-19 restrictions (see report for a full list of ITIC trainings in 2019 and 2020, and requests/planned for 2020 and 2021). ITIC is also supporting the IOC Ocean Teacher Global Academy (OTGA) as a designated Specialized Training Centre for Tsunamis, also working closely with the IOTWS. ITIC has also been working with Indonesia BMKG to develop standard training courses that can be delivered online or in hybrid formats.

With regards to WG 3 objective to facilitate the piloting of IOC-UNESCO Tsunami Ready, and report results from pilots to the ICG/PTWS and the TOWS-WG, WG 3 has continued to participate in the development of *IOC Guideline MG 74*, currently under preparation for publication. Dr Coetzee noted that the indicators have slightly changed. WG 3 has also continued to facilitate the piloting of Tsunami Ready. In addition, ITIC funding has been planned to assist Marshall Islands, Micronesia and Palau to achieve Tsunami Ready over the next two to three years. In total, 14 communities in the PTWS are recognized Tsunami Ready with 30 other communities with Tsunami Ready planned. In addition, an ambitious target has been set by the IOC under the Ocean Decade Tsunami Programme: 100% communities at risk of tsunami are Tsunami Ready by 2030. WG 3 will participate in the establishment of an international coalition of stakeholders to help achieve this goal.

With regards to WG 3 objective to develop and promote best practice preparedness material, programs and assessment tools, WG 3 developed Guidelines on tsunami warnings during COVID-19 in 2020, supported the development of the TsuCAT tool, and supported development of Guidance on Structural Design and Vertical Evacuation as well as on Marine Port Guidance. Indeed, at the request of the TOWS TTDMP, the ITIC compiled global best practices in tsunami-resistant building design and vertical evacuation guidance (117 references from 15 countries, with the 79 references from the Pacific) and Marine Port Guidance (99 references, with 92 references from the Pacific).

Finally, with regards to WG 3 objective to promote tsunami risk reduction theory and practice, WG 3 developed the draft PTWS Strategy 2022-2030.

3.5 Task Team for PacWave20

Dr Laura Kong, Co-Chair of the TT on PacWave20, reported on this item.

Dr Kong recalled the TT members. She noted that, due to the COVID-19 pandemic, the scope of PacWave20 was limited compared to previous exercises. The exercise consisted of a communications test (5 November 2020), SEP regional exercise (22 October 2020) and the CATAC regional exercise (11 November 2020). Other activities were encouraged but were at the discretion of each country. Dr Kong summarized the timeline and process for PacWave20, noting that the exercise was announced through Circular Letter 2812 (21

October 2020), the Exercise Manual (*IOC TS 155*) was shared on 22 October 2020, two webinars were conducted on 28 and 29 October 2020, evaluation forms were available from November to 21 December 2020, and a draft summary report was prepared for September 2021, will be circulated at ICG/PTWS XXIX and is due to be published in January 2022. Dr Kong underlined that only 24 countries submitted evaluation forms, even though many more received the communications test.

The SEP exercise was conducted without external involvement and involved Chile, Colombia, Ecuador and Peru TWC. The role of PTWC was played by Peru. The exercise scenario consisted of a Mw8.8 earthquake north of Tonga. A total of 40-50 messages were disseminated over six hours. A report was disseminated and is available on the PacWave website. Regarding the CATAC regional exercise, it was hosted by Nicaragua INETER and the scenario consisted of a slow earthquake and tsunami off the coast of Fonseca. They used TOAST as a way to provide modelling information, forecast, and help countries with decision-making. Several countries also conducted national exercises, including Fiji, Tuvalu and Vanuatu who conducted full-scale exercises, as well as Colombia and Russia.

Dr Kong reported on the findings from the communications test, noting that dummy messages were received in a timely manner by email and that 35 percent received them by GTS. For those countries that held national exercises, the majority disseminated the warning message to emergency services and other national and local government agencies. The warning message was usually disseminated by email or SMS, although social media methods of dissemination were also used, and nearly all these communication methods were considered timely and effective.

With regards to findings about the national exercises, countries reported that local stakeholders acquired a better understanding about tsunami preparedness, nearly all countries had activation and response procedures in place, most countries have emergency response plans and “Safe to return” notices, and all conduct regular capacity and capability training. However, only 27 percent of countries have evacuation routes and maps and only 33 percent have tsunami curriculum programmes developed for all levels of education. Although few countries tested regional communication and cooperation between countries, those who did reported that exercise planning, conduct, format and style were very satisfactory; exercise documents and website were useful and detailed, and about half used TsuCat for exercise planning and hazard assessment. Dr Kong noted the aspiration to have TsuCat be used more, but they are currently having some issues with distribution. PMEL and ITIC will work on improving this.

Dr Kong identified several gaps and opportunities to improve on, including coordinating with other ICG exercises to avoid overlap, more proactive engagement with stakeholders earlier in the planning process, and creating guidelines for conducting virtual exercises, review tsunami reporting formats (wave height vs tsunami amplitude), and additional forecast points requested by French Polynesia. In addition, for the tsunami evaluation process, suggested improvements include providing a copy of the completed evaluation form after submission and providing options to skip sections. Finally, she highlighted that a news article on PacWave Exercises featured in the ECO Magazine.

Actions:

- Secretariat to circulate draft report for input and comment prior to ICG/PTWS XXIX.

4 PTWS Regional Working Groups reports

4.1 Regional Working Group South China Sea

Mr S.T. Chan, Chair of the Regional Working Group South China Sea (WG SCS), presented this report.

He noted that the Ninth Session of the WG SCS was held virtually from 27-28 August 2020. He also highlighted that SCSTAC has been in full operation since November 2019 and has since responded to 26 earthquake events and issued a total of 28 Tsunami Bulletins to Member States. The SCSTAC organized the second SCSTAC International Staff Programme in 2019, with three tsunami operators from Indonesia, Malaysia and Vietnam attached to the Center for two months. However, the programme has since been suspended due to COVID-19. In addition, an online training workshop on tsunami forecasting and risk assessment for tsunami warning operators is being organized by SCSTAC and the IOC Secretariat and is scheduled for December 2021.

He reported that a question was raised about the TSPs during the last session of the WG SCS. NWPTAC raised a question as to the necessity of NWPTAC & SCSTAC issuing tsunami advisories for a big earthquake occurring outside their Areas of Service (AoS); it was noted that discussion on this topic is ongoing among TSPs, although TSPs have agreed to clarify this point in their respective User Guides.

Mr Chan also reported that SCSTAC is working with the Hong Kong Observatory (HKO) to build a backup centre of SCSTAC. The backup SCSTAC (BSCSTAC) will be operated at the Central Forecasting Centre (CFO) at HKO Headquarters and manned around the clock by duty officers. Mr Chan also set out the implementation plan for the BSCSTAC, highlighting that the centre is due to start trial operation in the first half of 2022. He also noted that the BSCSTAC website is under development. Mr Chan also highlighted trainings provided by SCSTAC, including two days remote training conducted in November 2020 to strengthen Hong Kong's capability on earthquake monitoring and tsunami warning.

Finally, due to COVID-19, the Tenth Session of the WG SCS will take place on 28 and 30 September 2021. He also noted that he (Mr. Chan) will leave his current position and step down as Chair of the Working Group after ICG/PTWS XXIX; as such, a new Chair will be elected.

4.2 Regional Working Group Central America

Dr Silvia Chacon, Chair of WG for Central America, reported on this item.

Dr Chacon reported that El Salvador is improving tsunami warning by implementing a database of pre-calculated scenarios and they are creating an App that connects the tsunami database with automatic earthquake localization (SEISCOMP). It also has automatic messaging. In addition, the Pacwave 2020 and Central America exercises were conducted in November 2020. Both were limited to communications tests by Member States due to the Covid-19 pandemic. Most Member States only received the dummy message for PacWave and performed a communications test for the Central America exercise.

Dr Chacon also reported on improvements pertaining to Tsunami Ready in the Central America region. Costa Rica has four new communities recognized: El Coco (through the DIPECHO Project), Tamarindo, Sámara, and Uvita-Bahía. Costa Rica also has three

communities in progress. El Salvador is currently working on Barra de Santiago (through the Red Cross and MARN. Panamá is currently working in Puerto Armuelles. Dr Chacon also highlighted that a pilot project on Coastal Hazards for Man and Biosphere (MAB) sites is being implemented jointly by the Tsunami Unit (IOC) and MAB programme (UNESCO) in the Savegre Biosphere Reserve in Costa Rica (includes one national park and two communities). Products from this project will include Guidelines for replication in other Biosphere Reserves.

Finally, Dr Chacon noted that some Member States have expressed interest in receiving PTWC messages on cellphones and enquired as to when this service would be available.

4.3 Regional Working Group Pacific Islands Countries

Ms Esline Garaebiti, Chair of WG PICT, reported on this item. She noted that the Eight Session of the WG-PICT was held online on 1 April 2021, during which time new officers were elected. The Chair is Ms Esline Garaebiti and the Vice Chair is Mr Mathew Moihoi. The meeting discussed the establishment of the UN Decade Tsunami Programme which was supported by PICT Member States. The meeting also noted ways forward on Post Event Hot Wash/ Debrief, including to: Review the Hot Wash/Debrief and survey applicability and guidelines, develop Hot Wash/Debrief templates, develop format/structure for national and regional Hot Wash/Debrief, and develop proposals for more online seminar on forecasting to minimize confusion. The terms of reference of the WG-PICT were also discussed and slightly updated.

Ms Garaebiti reported recommendations established during this meeting which include to:

- Continue the WG-PICT with updated TOR and newly elected office bearers,
- Continue WG-PICT Task Team Capacity Development with updated TOR and recommendations,
- Recognize and support WG 2 Task Team Seismic Data Sharing in Southwest Pacific recommendations,
- Ensure support towards ORSNET continuing operations,
- Have continuous bilateral and multilateral support for Tsunami Ready Programme, TEMPP and Multi Hazard Early Warning (MHEW) through Development Partners and Donors,
- Encourage SPC to seek additional funding for improved coastal bathymetry acquisition (LIDAR) and build regional resources for modelling and support toward TEMPP,
- Encourage the ICG/PTWS to develop a template to conduct Hot Wash/Debrief after a significant event efficiently,
- Consider ITIC to be a member of WG-PICT,
- Encourage in-country collaboration (private and public partnership) for building tsunami community resiliency.

4.4 Regional Working Group South East Pacific

Ms Mary Rengifo, Chair of WG SEP, presented on this item.

Ms Rengifo reported on activities conducted between June and November 2020 which included one virtual meeting to discuss the coordination of the regional exercise (August 2020); one virtual meeting to discuss the roles and rotation of Chairs and Vice-Chairs

(November 2020); one annual virtual meeting of the WG (October 2019) where the 2021 regional exercise was approved, a TT for working on the templates was approved, and if necessary a procedure for dissemination of tsunami information; and one TsuCat workshop.

Ms Rengifo reported that PacWave20 was conducted on the 22 October using the Tonga scenario and was developed as a communications test, although those in Chile and Colombia also involved coordination with the disaster risk management offices. In addition, three regional tsunami exercises which tested the regional tsunami warning protocol for the South-East Pacific were conducted in January, May and August 2021.

She next reported on activities between January and September 2021 which included six virtual meetings and an update of the group web portal. In addition, some planned activities are still ongoing such as the Navarea bulletins template, the fourth regional exercise, the annual meeting, and the report on SMART cables which will be prepared for ICG/PTWS XXIX.

5 ITIC REPORT

Dr Laura Kong, Director of ITIC, reported on this item. She noted that, effective 1 September 2020, the Caribbean Tsunami Warning Programme became the Caribbean ITIC Office. This change is to provide better support to the Caribbean Tsunami Information Centre (CTIC) and CARIBE-EWS, and provide more seamless interaction for countries that have both Pacific and Caribbean coasts.

Dr Kong reported on training provided by ITIC, noting that they were pivoting to virtual provision of trainings due to COVID 19. ITIC is working with the OTGA, Indonesia BMKG and IOTIC to provide hybrid or virtual trainings. Dr Kong also presented the ITIC workplan for OTGA 2021-2023, which includes training on Tsunami Awareness, Tsunami Ready, tsunami early warning systems (TEWS), Tsunami Evacuation Maps, Plans, and Procedures (TEMPP), Tsunami Warning and Emergency Response Standard Operating Procedures (SOPs), and tsunami hazard and risk assessment. To support trainings, ITIC is also developing training and information videos, including on PTWS enhanced products, TWC operations, tsunami forecasting, and PacWave and CARIBE Wave exercises.

With regards to tsunami awareness materials, new ITIC-NCEI tsunami hazard posters have been printed and ITIC has also produced new regional posters. In addition, the Tsunami Glossary 2019 will be updated in 2022 (currently taking inputs and comments), a Tsunami Warning! Comic was created, and ITIC has several materials available in Spanish.

Dr Kong highlighted that ITIC is hosting a Tsunami Ready website on their ITIC website, where a list of recognized communities can be found. In addition, an interactive map is being developed by IOC/TSU. In addition, ITIC has developed compilations of best practices for vertical evacuation and for marine preparedness (ports and harbours).

Dr Kong also underlined the role of ITIC in the UN Ocean Decade, noting their desire to provide support as well as push through key initiatives. In particular, these include developing timely forecasts for Local Tsunami Warning (GNSS, SMART, etc.), SMART cables for tsunami early warning, and Tsunami Ready pilots. She noted that ITIC has received funding from USAID to support Tsunami Ready pilots between 2021 and 2023.

Finally, Dr Kong presented ITIC tsunami warning decision support tools, which include the tsunami bulletin board, real-time EQ display and sea-level monitoring, tsunami travel time

software, tsunami historical databases, and tsunami hazard assessment tools (such as TsuCat).

Discussion:

Dr Bill Fry enquired about progress made with regards to maximum credible events in the area of the New Hebrides. Dr Kong responded that all regional posters are based on historical data and do not involve predictions, and also agreed that an expert meeting in the region would be beneficial to discuss maximum credible events in the area of the New Hebrides.

6 PACWAVE 2022

Ms Margarita Martinez, Co-Chair of the TT on PacWave, presented the report.

Ms Martinez explained the aims and objectives of the exercise. It is primarily conducted with the aim of testing PTWS Tsunami Service Providers (TSPs) arrangements, country preparedness arrangements and operational procedures to respond and recover from a destructive tsunami. Key objectives of the exercise include to test communications from the PTWS TSPs to Tsunami Warning Focal Points (TWFPs) and National Tsunami Warning Centers (NTWCs) of Member States; to test national communication and cooperation, and readiness within the country; to test regional communication and cooperation between Member States; and to support the development of tsunami procedures and products by CATAC.

Ms Martinez next reported on the conduct of the exercise, which will take place from September to November 2022 to support International Disaster Risk Reduction Day (13 October) and World Tsunami Awareness Day (5 November).

She also noted that PacWave 2022 will be conducted as a series of regional exercises organized through the PTWS Regional Working Groups where applicable, with support from the PTWS TSPs and ITIC, involving all PTWS countries as part of the regular biennial Pacific Wave exercise conducted since 2006. In addition, the exercise will be conducted to include one live communications test from the PTWS TSPs to Member States on 5 November 2022.

Ms Martinez further detailed the characteristics of the planned activities for PacWave 2022. The exercise will be conducted to include exercise activities over and above a tabletop exercise. She noted that possible exercise variations related to the pandemic include: conducting virtual exercises, and/or evacuations/sheltering considering physical distancing practices of a pandemic; conducting in real time during the daytime working hours with full staffing, or simulating minimal staff during night time or weekend hours; testing country capability to carry out their warning and response responsibilities for the situation where one or more PTWS TSPs is not able to provide guidance in a timely manner; conducting the exercise down to the community level, including where possible an extensive public awareness campaign. She also noted the importance of considering the Global Sendai Framework for Disaster Risk Reduction, World Tsunami Awareness Day and/or the UN Decade of Ocean Science for Sustainable Development in designing the exercise.

The exercise shall be announced by the IOC to Member States at least 240 days in advance of the date. The exercise manual will include information on each regional exercise; inform Member States on the availability of exercise products for their region, including

instructions to Member States regarding the distribution dates; and include instructions to Member States regarding their participation and the evaluation instrument. This manual will be distributed by the IOC to Member States at least 180 days in advance of the exercise date. She noted a key issue for the Group to discuss is how to provide virtual exercise guidance to assist in planning, conducting, and evaluating.

Ms Martinez also provided information on the process for evaluation and reporting after PacWave. She noted that participating Member States will be asked to complete and return the evaluation instrument no more than 21 days following the exercise. The TT on PacWave will then prepare the Summary Report for the exercise, compiling a list of recommendations and the list of actions from the findings for consideration by the ICG/PTWS-XXX. The TT will also provide guidance for the conduct of the next Exercise Pacific Wave, tentatively planned for 2024.

Finally, Ms Martinez identified the Members of the TT on PacWave and Co-Chairs to be elected by the ICG/PTWS.

Dr Laura Kong, Co-Chair of the TT on PacWave, highlighted the creation in the coming month of a PacWave information video by ITIC (IOC, USA, Chile). She urgently requested the Steering Committee and the TT on PacWave to assist with obtaining visuals. The content of the video will cover the history and context of PacWave, why it is important, the process of PacWave, and finally encourage Member States to participate. She also presented the timeline for creation of the video.

Discussion:

The Group discussed consideration of pandemic related activity, noting that for PacWave20, due to COVID-19, many countries only conducted virtual exercises. *The Group also discussed* the need for further information on the PacWave 2022 video would be useful.

The Group discussed changing the dates of PacWave 2022, however no other time of year was practical for the PTWS region due to times of rainy seasons, typhoon and hurricane seasons, CaribeWAVE exercise and IOWave (important to not overlap with these), and the benefits of aligning with international disaster days. *The Secretariat remarked* that although reporting on PacWave 2022 at ICG/PTWS XXX in November 2022 is not mandatory, it is customary; however, the final report may not be ready with such short notice.

The Group agreed that the period of the PacWave exercise should be maintained (September to November 2022), and that the communications test will be held on 13 October 2022. ***The Group also agreed*** that the results of the communications test will be reported at the ICG/PTWS XXX Meeting and that other PacWave22 activities can be reported later, by 21 December 2022. ***The Group also agreed*** that the TT PacWave will compile Summary Report containing all evaluation results, with findings, for presentation later (dates TBD at ICG/PTWS-XXIX).

Actions:

- TT PacWave will compile and summarize good practices for planning, conducting, and evaluating virtual exercises, and include in the PacWave22 Exercise Manual
- TT PacWave to send further information on the PacWave informational video
- TT PacWave to explore more automatic and efficient ways to compile the information prior to October 2022

- TT PacWave will inquire about and confirm the dates of IOWave
- The communications test of PacWave 2022 will be held on 13 October 2022 and countries must report their test results 10 days after the exercise
- The current name of the TT of "PacWave 20" will be changed to "PacWave" – this will be changed in the terms of reference and name of the TT for approval at PTWS XXIX.

7 PTWS MEDIUM TERM STRATEGY 2022-2029

Mr David Coetzee, Chair of WG 3, and Ms Sarah-Jayne McCurrach, Co-Chair of WG1, presented the report on the PTWS Medium Term Strategy 2022-2029.

Mr Coetzee began with a review of the process for drafting the PTWS Strategy 2022-2029 report, noting that whilst the original draft was prepared by himself, this latest redrafting was led by Ms McCurrach.

Ms McCurrach presented on the approach and strategy taken in the report. She remarked that the first draft prepared in 2020 did not change many elements from past equivalent documents and presented more of a quick review. She also presented the context for the proposed new Strategy. She noted that through the TOWS-WG TT DMP work is ongoing on developing a global KPI framework, emphasizing the need for globally aligned strategies for each ocean basin as well as strategies that align with global KPI frameworks such as the Sendai Framework or the UN Ocean Decade. Based on this need, she analysed the new Mediterranean Strategy (that was based on the current PTWS Strategy) as well as similar strategies globally. Taking from this, she developed this new Strategy. She also remarked that this new Strategy 2022-2029 has not removed anything from the current strategy but has rather refined or added elements. She also reiterated the process for this redrafting, noting that after her original draft, Mr Coetzee and Mr Aliaga provided feedback, and the draft was shared with Member States for a first round of comments.

Discussion:

The Group discussed the Outstanding Comments of the Strategy 2022-2029 report (document available on meeting website and here).

Comment 1. Consider including a section in the Strategy titled "Analysis of the Current State of the Pacific Tsunami Warning and Mitigation System" (Japan)

The Group noted that there is no existing analysis of the current state of the PTWS in a consolidated and agreed form. This could however we developed from the KPI analysis carried out in 2019 (See IOC Circular Letter No 2756, February 2019).

The Group agreed on the drafting of an "Analysis of the Current State of the Pacific Tsunami Warning and Mitigation System" section for the Strategy 2022-2029, led by Ms McCurrach with support from the Secretariat. ***The Group also agreed*** that this should be done in advance of the ICG/PTWS XXIX Meeting in November 2021, with the goal to present the report for endorsement at this meeting.

Comment 2: "International Coordination and Cooperation and Partnerships" is significantly important but it is not an objective and should be moved to a guiding principle (Japan)

The Group agreed with removing "International Coordination and Cooperation and Partnerships" from objectives and adding it into the guiding principles.

Comment 3: Add 'Voluntary Commitment of internal and external resources' to the Role of Members States (Fiji)

The Group agreed to add 'Voluntary Commitment of internal and external resources' to the Role of Members States.

Comment 4: Suggest removing recovery from the Strategy because it wasn't in the previous one (Chile)

Ms McCurrach remarked that "recovery" was included in the previous Strategy, but just in a very minor way. *The Group discussed* this comment, notably discussing the meaning of "recovery". The Group noted that reasons for including "recovery" were if it was more generic for tsunamis and if we are trying to align with other frameworks. However, reasons for not incorporating "recovery" include that the work of the PTWS usually ends before recovery, which tends to be undertaken by civil contingencies within countries where the event has happened. Therefore, "recovery" is outside the Terms of Reference of the PTWS.

The Group agreed to not include "recovery" in the Strategy, but instead to add a comment within the document on why this is. The Group noted that recovery is reflected in response through the post-tsunami surveys that are conducted.

Mr Aliaga, the Technical Secretary, explained that the Strategy has been extended by one year (2022 to 2030 instead of 2022 to 2029) in order to align with the UN Ocean Decade.

The Group agreed that the name of the document is the PTWS Strategy 2022-2030 (instead of the of PTWS Medium-Term Strategy 2022-2030). *The Group noted* that the PTWS Strategy 2022-2030 aligns with the IOC Medium-Term Strategy. *The Group* also noted its desire for more alignment amongst strategies of other ocean basins, both to this new strategy and the overarching KPI framework being established.

Actions:

- Ms McCurrach and the Secretariat will conduct analysis of KPIs in a more wholesome way and draft a document on the current state of the PTWS to include in the Strategy by 6 October 2021
- This document will be shared for comments on the 6 October; members of the Steering Committee must provide comments by the 15 October and Member States must provide comments prior to the ICG/PTWS XXIX Meeting.
- Ms McCurrach will remove "International Coordination and Cooperation and Partnerships" from objectives and add it to the guiding principles, will add 'Voluntary Commitment of internal and external resources' to the Role of Members States, and will remove "recovery" from the Strategy though include a comment about it.

8 UN DECADE OF OCEAN SCIENCE FOR SUSTAINABLE DEVELOPMENT, PTWS PARTICIPATION

8.1 Strategy

Mr Mike Angove, Director, NOAA Tsunami Program, reported on this item. He recalled that the IOC XXXI Assembly (June 2021) approved the establishment of the Ocean Decade Tsunami Programme as a UN Decade Programme as well as a Scientific Committee to prepare the Draft 10-Year Research, Development and Implementation Plan and the

establishment of a Tsunami Ready Coalition. He noted with appreciation the work and commitment of Dr Alexander Frolov to getting the tsunami programme approved.

He presented the two over-arching goals of the programme. The first aspect is to fully explore technological and observational advances that will allow us to move from a capability based largely on seismic assumptions and large uncertainties to one based on real-time dynamic assessment and low uncertainties. The second aspect will be to match these capability advancements with improved community preparedness efforts, including striving for 100% Tsunami Ready or comparable recognition of all at-risk coastlines. In this way—by combining scientific and technological advances with unprecedented levels of understanding and preparedness—the aim is to achieve true long-term tsunami resilience where communities have access to accurate real-time tsunami impact forecasts that enable them to minimize impacts and maintain critical infrastructures and services even under extreme circumstances.

Mr Angove highlighted key challenges and opportunities for the development of tsunami warning systems, including high-resolution mapping of all tsunami-vulnerable coastlines (topography and bathymetry), improved data exchange, improving speed of tsunami detection and measurement systems, scaling up of the IOC Tsunami Ready programme, increasing capacities for tsunami warning and mitigation in SIDS/LDS, and ensuring interoperability with other components of a global coastal Multi-Hazard Early Warning System (MHEWS).

Next, he presented the planning overview for the Ocean Decade Tsunami Programme. From an overall planning and execution perspective, they envision the TOWS WG serving as the Global Steering Committee, with primary functions of establishing a Scientific Committee to develop the Decade Research, Development and Implementation Plan, as well as the Special Coalition on Tsunami Ready. A key component is identifying Member State Contributions that can be matched to the scientific plan and Tsunami Ready objectives and developed into Pilot Projects, Experiments, or Outreach and Education activities with the assistance of the ICG regional steering committees.

Mr Angove identified and explained potential PTWS contributions in the programme. The PTWS can support governance, notably by establishing a Task Team to facilitate and guide UN Ocean Decade Tsunami Programme implementation within PTWS, as well as set up inter-ICG coordination on decade matters. In addition, establishing projects and experiments relevant to the programme, notably including SMART cables, GNSS, and DART. A key element will be to assume a lead role in the Tsunami Ready Coalition as well as scale up implementation through regional resource hubs (establish ‘community of practitioners’), online training and support. In addition, Mr Angove noted that representation of PTWS at conferences and fora was important, including the UN Ocean Decade laboratories and themed Events, professional conferences, and UN and Regional events. Finally, PTWS can also support capacity development and education initiatives such as Ocean Teacher Global Academy (OTGA), as well as encourage involvement of Early Career Professionals and promote gender-balanced participation in tsunami activities.

Mr Angove identified key next steps, including creating an ad hoc team (or giving the responsibility to the Guiding Committee) to draft a recommendation for ICG/PTWS-XXIX to establish a TT, draft the TT terms of reference, and solicit nominations for TT membership. In addition, the ICG/PTWS-XXIX (Nov 2021) Session needs to approve the above next steps.

Discussion:

The Group highlighted the importance of finding new resources to support the additional work of the UN Ocean Decade programme. The Group also noted the potential for aligning goals and outputs amongst projects and activities and partnering to avoid duplication and reduce additional burden, as well as leveraging existing structures. The Secretariat suggested approaching UN Regional Commissions and DRR Regional Commissions for resources. *The Group suggested* that a marketing effort be undertaken, notably with support from the Secretariat, to promote the UN Decade activities and facilitate additional resources. *The Group also noted* that UN Decade endorsement can help secure resources.

The Group also discussed Tsunami Ready, highlighting the importance of regional sharing of resources and creation of resource hubs to achieve more Tsunami Ready communities. *The Group also noted* Member States can be targeted and political leaders and community champions leveraged to promote the Ocean Decade Tsunami Programme; there should be a level of intervention at the political as well as technical level.

The Group also remarked that the Scientific Committee and 10-Year Research, Development and Implementation Plan will be the main driver of the Ocean Decade Tsunami Programme, and PTWS will need to adapt to this overarching mechanism. *The Group proposed* that to secure long-term change, it may be necessary to provide long-term resources, for instance bolstering a TIC with more resources to be able to support Decade activities in the long-term.

8.2 Participation in the Scientific Committee

Dr David Coetzee, Chair of the DMP Task Team, reported on this item. He recalled that the IOC XXXI Assembly (June 2021) approved as the establishment of the Scientific Committee to prepare the Draft 10-Year Research, Development and Implementation Plan.

Dr Coetzee reported on the nominations for the Scientific Committee, noting that there will be a total of 11 members: four nominated by the TWO TT of the TOWS-WG, four nominated by the DMP TT of the TOWS-WG, and three by the TOWS-WG. The TWO TT have met virtually to discuss nominations and have identified, though not finalized, a list of nominees. The TT DMP has met virtually and nominated four people across the four ICGs and have passed on these nominations.

Next, Mr Coetzee reported on the Tsunami Ready Coalition, noting that this is a collaboration with other critical stakeholders across the UN structure as well as national civil protection agencies. This coalition will report back to the TOWS-WG. The TT DMP was requested to lead identification of potential members of this Coalition; this will be discussed at an upcoming virtual meeting and Mr Coetzee invited suggestions from Steering Committee members.

Mr Coetzee noted that this is a resource intensive activity, highlighting again the need for more dedicated capacity towards the Ocean Decade Tsunami Programme..

Discussion:

Japan noted that they are currently in the process of identifying a person to nominate and expressed their desire to nominate a person for the Scientific Committee.

The Group approved *the* creation of an ad hoc TT to draft a recommendation for ICG/PTWS-XXIX and approved Dr Laura Kong, Dr Wilfried Strauch, Mr Mike Angove, and Mr Jerome Aucan as volunteers to draft this document. ***The Group agreed*** that the draft recommendation will be produced in advance of the ICG/PTWS XXIX Meeting.

Actions:

- The *ad hoc* TT will draft a recommendation for submission to the ICG/PTWS-XXIX.

9 Options about extension/election of new Officers

Mr Aliaga, Technical Secretary, recalled the rules of procedures of IOC and the main roles of Chairs and Vice-Chairs, highlighting the role of the ICG/PTWS to elect officers (including Chairs and Vice-Chairs). He noted that Chairs and Vice-Chairs are allowed to serve two terms. Mr Aliaga also recalled that the current Chair and Vice-Chairs of ICG/PTWS were elected in Montelimar, Nicaragua, at the ICG/PTWS XXVIII Session in April 2019. If elections are scheduled for the ICG/PTWS XXIX Session (which they should be as it is a normal session), the Chair and Vice-Chairs are all re-eligible for one term, until the next ordinary session. He added that because the ICG/PTWS XXX Session is scheduled for November 2022, this term will be longer than usual as the normal session was due to take place in March or April, and the next term will therefore be shorter.

10 PTWS-XXIX Session arrangements

Nr Yuji Nishimae, Scientific Officer for International Tsunami Information, Japan Meteorological Agency (JMA), and Mr Bernardo Aliaga, ICG/PTWS Technical Secretary, reported on this item.

Dr Nishimae recalled that Japan had offered to host the ICG/PTWS XXIX Session during the ICG/PTWS XXVIII Session. This meeting was originally due to take place in March 2021 on the anniversary of the 11 March 2011 earthquake and tsunami in Japan. Due to the COVID-19 pandemic, the date was postponed to November 2021 or March 2022. Given the continuing pandemic, the ICG/PTWS Steering Committee agreed in June 2021 to hold the ICG/PTWS XXIX Session online in November 2021 to discuss high priority items such as the PTWS Strategy 2022-2029, PTWS participation in the UN Ocean Decade and PacWave 2022.

Dr Nishimae indicated that Japan was willing to host ICG/PTWS XXX Session due to take place in November 2022.

Mr Aliaga reported on the technical arrangements for the ICG/PTWS XXIX Session.

The Group agreed that the PTWS-XXIX meeting would take place on the IOC Zoom platform and would be supplemented by interpretation services into Spanish and maybe French. ***The group also*** **agreed** the dates of the ICG/PTWS XXIX Session to be in the second half of November (over four days).

11 PTWS- XXIX Session Agenda

Dr Wilfried Strauch, Chair of ICG/PTWS, reported on this item and Mr Aliaga, Technical Secretary shared the draft agenda on-screen. This was elaborated based on proposals made at Steering Committee meeting in June 2020. Dr Strauch suggested shortening the agenda and that the duration of the meeting be 2 hours per day.

The Group agreed that that several agenda items can and should be discussed prior to ICG/PTWS XXIX; these items would therefore only require endorsement at the ICG/PTWS XXIX meeting as opposed to discussion. Dr Strauch suggested exploring via virtual communication methods (such as emails) on Member States' views on certain agenda items prior to the meeting.

The Group also agreed to omit national reports from the agenda. Nonetheless, Member States will still be requested to provide a national report.

Mr Aliaga highlighted lessons learned from the planning of this Steering Committee meeting (September 2021), including the benefits of separating the important agenda items into different days. He suggested working on the agenda in parallel with the timetable to achieve this same distribution.

The Group agreed to share the burden of time zones; thus, if possible two days of the meeting will take place during the night-time for Paris and two days will take place during the daytime for Paris.

Actions:

- Mr Strauch and the Secretariat will elaborate the agenda and timetable for the meeting according to agreed criteria.

12 PTWS-XXX Session Arrangements (Nov. 2022)

Mr Aliaga confirmed Japan's willingness to host the ICG/PTWS XXX Meeting and noted that the Secretariat would provide organizational and logistical support.

Mr Nishimae stated that there were not proposed specific dates and times in November 2022. He noted that approval was required from ICG/PTWS for deciding this.

Action:

- An agenda item on the date and time of ICG/PTWS XXX will be added to the agenda of ICG/PTWS XXIX.

13 Any Other, New Business

Dr Kong requested and ***the Group agreed*** that the evaluation period for PacWave 2022 communications test results be shortened from 21 days to 10 days.

Mr Aliaga thanked the members of the Steering Committee for their active participation and engagement throughout the three days of the Steering Committee Meeting (September 2021).

The meeting closed at 11pm (UTC) on 23 September 2021.

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