



WCRP-FPA2 Polar Challenge

Rules and Procedures¹

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Version 1.3

Polar Challenge Committee
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¹ This document is subject to change, refinement and further development without notice, and only the latest issued version shall be considered as the official and binding reference. Please visit <http://www.wcrp-climate.org/polarchallenge> for the latest version.

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1. DOCUMENT REVISION HISTORY

1 March 2016	Version 1.0	Initial version
22 March 2016	Version 1.1	Amendments on Prize Amount and ship time support
25 May 2016	Version 1.2	Clarify, harmonize and edit requirements on AUV vertical resolution and measurement frequency in Section 7; refinement of Section 9 on prize use; update requirements on verification tag return; editorial changes
16 May 2017	Version 1.3	Added cross-references to Section 5.9 in Tag document as well as Sections 7 and 8 within this document; added provisions concerning partial mission fulfilment and partial prize awards; added provisions concerning potential late registrations; refinement of required mission and AUV properties; refinement of mission and application timing requirements; editorial changes.

2. DEFINITIONS

Throughout this document, as well as all other documentation relating to the WCRP-FPA2 Polar Challenge, the following definitions shall apply:

“Challenge”, “Competition”, or “Polar Challenge”	shall denote the WCRP-FPA2 Polar Challenge
“Guidelines”	shall denote the entirety of the Challenge’s documentation and information material onto which binding character is conferred. These documents include, in order of precedence: <ul style="list-style-type: none">• the Application Form;• this Rules and Procedures Document;• the Regulations and Standards for Installation of Mission Verification Tags;• any other documents made available alongside the above three documents on the “Guidelines” section of the Challenge homepage.
“Organizer(s)”	shall denote the World Climate Research Programme (WCRP), its sponsors (including but not limited to WMO, IOC and ICSU), individual officers and employees as well as its contractors and agents, the Challenge sponsors, committees and panels
“Competitor(s)”, “Participant(s)”, “Team(s)”	shall denote any or all Teams competing for the Challenge
“Tag”, “Sensor Tag”, “Verification Tag”	shall denote the mandatory mission verification sensor tag, one of which is to be installed by the Competitors on each and every competing autonomous underwater vehicle (AUV).

3. INTRODUCTION

The World Climate Research Programme (WCRP) and the Prince Albert II of Monaco Foundation (FPA2) are jointly promoting the «Polar Challenge» (<http://www.wcrp-climate.org/polarchallenge>), which will reward the first team to complete a 2000km mission with an Autonomous Underwater Vehicle (AUV) under the sea-ice in the Arctic or Antarctic. Bonus awards will be delivered for demonstration of regular measurements of sea-ice thickness or draft, and successful under-ice transmission of position and environmental data onto operational networks.

The guiding rationale of the competition is to promote technological innovation (including, but not limited to, in AUV endurance, positioning, data collection and transmission) towards a future, cost-effective, autonomous and scalable observing network for sea-ice covered regions based on a fleet of such platforms. In this respect, any attempt at completing the challenge should in principle be scalable to the above-envisioned, larger-scale network of an autonomous under-ice observation system, or at least significantly reduce the amount of outstanding innovation needed to make such a system possible.

4. BACKGROUND

The cryosphere represents a major indicator of global climate change and plays a fundamental role in climate feedback. Despite numerous model improvements, the reliability of long-term climate change outlooks in Polar regions is severely limited by the lack and cost of systematic in-situ observations of the sea-ice and underneath.

Traditional in-situ ocean observations in Polar regions are inherently expensive, risky and sparse, even more so under the sea-ice. A new paradigm is required to complement remotely sensed Earth Observations. Motivated by the potential scalability, limited risk and cost-effectiveness of emerging AUVs, the Challenge will push the boundaries of existing observing systems and scientific knowledge in both the Arctic and Antarctic.

AUVs of different kinds are already used in an operational context around the world in ice-free zones, and they surface on a regular basis to get a GPS fix and to transmit environmental data in near real-time. They are able to collect crucial and high quality oceanographic observations (such as temperature, salinity, chlorophyll, pH, etc.) at much lower cost compared to conventional observing systems.

Under the sea-ice, the operating range, positioning and data transmission represent major challenges for current underwater vehicles. The integration of recent progress regarding power systems, as well as navigation and communication techniques would expand significantly the range of applications of such vehicles, currently mainly limited to the open ocean.

The WCRP and FPA2 seek to promote technological innovation (AUV endurance, positioning, data collection and transmission, etc.) towards a future cost-effective, autonomous and scalable observing network for sea-ice covered regions based on a fleet of such platforms, similar to what ARGO (<http://www.argo.ucsd.edu/>) has accomplished for the open ocean.

Any demonstration conforming to the WCRP-FPA2 Polar Challenge rationale will make a tremendous impact in shaping climate research in polar regions. It will extend substantially the current scope of applications of AUV technology in the Arctic and Antarctic. New collocated multidisciplinary data sets of sea-ice and under-ice properties at unprecedented temporal and spatial resolution far into unexplored territories could revolutionize our knowledge of, for example, heat fluxes and storage, fresh water exchanges, carbon sequestration and ocean acidification in those regions. Any proofs of concept successfully demonstrated within the Challenge could be scaled up into a game-changing ocean monitoring network for the polar regions with wide-ranging benefits in a diverse array of sectors and services: climate monitoring, global change research, environmental protection, weather forecast, safety, security, transport, energy, biodiversity, fisheries, insurance, health, etc.

The WCRP-FPA2 Polar Challenge is well aligned with the activities of both the World Climate Research Programme and the Prince Albert II of Monaco Foundation. The Polar Challenge is well related to WCRP research priorities, in particular the Grand Challenge on Cryosphere in a Changing Climate and the Grand Challenge on Regional Sea Level Rise. It represents also a definite contribution to WMO polar initiatives (such as the Global Cryosphere Watch, GCW, and the Global Integrated Polar Prediction System, GIPPS) and the World Weather Research Programme (WWRP), in particular the Year of Polar Prediction (YOPP, see <http://www.polarprediction.net/yopp.html>) of the Polar Prediction Project (PPP). It is further expected to benefit the wider stakeholder community and the Global Framework for Climate Services (GFCS). The initiative is endorsed by the Scientific Committee on Antarctic Research (SCAR) and the International Arctic Science Committee (IASC).

The Prince Albert II of Monaco Foundation is dedicated to the protection of the environment and the promotion of sustainable development on a global scale. It supports initiatives of public and private organizations, in the fields of research and studies, technological innovation and socially-aware practices. The polar regions, as privileged indicators of climate change evolutions, constitute one of its three priority areas.

The spirit of the Competition is established within this overall backdrop, and the above guiding principles serve as a general framework in which the Challenge Guidelines have been developed. In essence, competitors shall strive to demonstrate that the proposed technology and concept of operation to solve the main mission and bonus demonstrations represent a suitable solution for a scalable, cost-effective and sustainable monitoring system for the polar oceans.

5. OFFICIAL CORRESPONDENCE

The official address of the Organizers is:

WCRP-FPA2 Polar Challenge
World Climate Research Programme (WCRP)
c/o World Meteorological Organization
7 bis, Avenue de la Paix, C.P. 2300
CH-1211 Geneva, Switzerland
polarchallenge@wcrp-climate.org

All correspondence to the Organizers should be directed by email or regular mail to the above address. Communications to the Organizers dispatched to any other address than the above will not be considered by the organizers.

The official language of the competition is English.

6. RULES AND REGULATIONS

This document, in its latest version, is the official and binding reference concerning the Challenge Guidelines, rules, their interpretation, as well as related information and can be found on the Polar Challenge website (<http://www.wcrp-climate.org/polarchallenge>). It is accompanied by the Application Form document and the Regulations and Standards for Installation of Mission Verification Tags document, as well as any other documents referenced on the Guidelines section of the Challenge homepage. In case of conflicting provisions, any passages given in the team Application Form will take precedence over this Rules and Procedures document; and all of the preceding over the Regulations and Standards for Installation of Mission Verification Tags; and all of the preceding over any other documents referenced on the Guidelines section of the Challenge homepage.

The Challenge Guidelines are subject to change by the Organizers without prior notice. The Organizers reserve the right to update all Guideline documents any time, as the competition proceeds. Prospective competitors are invited to check the website for updates regularly. The Organizers will announce any modifications of the Guidelines with an e-mail to all currently registered applicants and known prospective competitors as well as through a corresponding notice on the Polar Challenge website.

Reasons for modifications to any part of the Guidelines may include, but are by no means limited to, clarifications on and interpretation of the Guidelines, the accommodation of promising but unexpected technical approaches that would have been prohibited by the Guidelines, the exclusion of approaches that seek to participate without demonstrating the desired technical achievement that is the purpose of the event, and the refinement of mission verification requirements.

Particular reference is in this context made to Section 4 of the “Application Form” document as well as Section 5.9 of the “Regulations and Standards for Installation of Mission Verification Tags” document, which outline the possibility for prospective Competitors to propose either Guideline amendments or changes as well as alternative mission verification strategies in cases where they find that the current Guidelines and/or verification requirements unduly exclude their legitimate approach to completing the Challenge. Reference is likewise made to Sections 7 and 8 of this document, which outline the possibility of partial award of prize funds for Competitors in recognition of partial achievements toward the Challenge main and potentially bonus missions.

The Organizers may provide interpretation of the Guidelines at any time and in any manner that is required. The Organizers offer to provide interpretation of the Guidelines and encourage prospective and participating Teams to inquire on any ambiguities or doubts. In case of requests for interpretations or any other questions, participants should contact the organizers at polarchallenge@wcrp-climate.org. The organizers will strive, while also protecting competitors’ confidential technical information, to make available equally to all participating or prospective teams any such clarifications given to one of the participating or prospective teams, either through updates to the Guidelines documents, or the establishment of an online overview over past clarifications in a question-and-answer section on the Challenge web page, or other suitable means.

If this Competition is interfered with in any way or is not capable of being conducted as reasonably anticipated due to any reason beyond the reasonable control of the Organizers, including, but not limited to, technical difficulties, unauthorized intervention or fraud, written directions from a regulatory authority, or similar, the Organizers reserve the right, in their sole discretion, to the fullest extent permitted by law:

- (a) to disqualify any entrant or entrant member
- (b) to modify, suspend, terminate or cancel the competition, as appropriate.

The Organizers reserve the right, in their sole discretion, to create novel or terminate existing auxiliary entities or bodies in assistance and best interest of the Challenge’s implementation, as well as to initiate changes in any those bodies’ personnel composition, tasks, rights, procedures, and scope.

7. MISSION REQUIREMENTS

The Competition consists of one main mission and 2 bonus demonstrations. Completion of the main mission is a prerequisite for being fully eligible for the two bonus missions.

The Organizers expressly foresee the possibility of partial prize fund awards for teams which either do not completely fulfill the main (plus potentially bonus) mission(s), or which did fulfill the mission(s) but with slight deviations from the mission requirements outlined below, or which in general made use of any technology not fully scalable to a polar-wide, cost-effective, under-ice, autonomous observation network (also see Section 8). Any decision to award or to not award a prize partially, and to what fraction of the full prize, under these provisions is entirely, solely, and in final authority made by the Organizers and Challenge Judge Panel.

Main mission:

The main challenge aims for the successful completion of a continuous 2000km mission under the sea-ice by an autonomous underwater vehicle (AUV), while maintaining accurate navigation and performing regular observations of temperature and salinity from the near-surface to at least 700m. Herein, in detail:

- a) **“continuous”** shall be understood as “un-interrupted” in the sense that no recovery of, re-deployment of, or manual interaction with the AUV (in the sense of physical work on the AUV or its components) are admissible during the entire mission. Any intervention must be both announced beforehand and reported on afterwards, and will reset the mission start.
- b) **“2000km”** shall be understood as “over ground” and NOT “in water”. The main requirement for the vehicle’s track is that the 2000km are to be completed in a planned and controlled manner, demonstrating precise navigation capability. It is any Competitor’s duty to provide evidence that the route taken by their AUV is the outcome of deliberate planning and control. Announcing a precise, planned track within a team’s “Application Form” and subsequently attaining a high degree of congruence between the (i) planned, (ii) claimed and (iii) verified mission tracks will serve to enhance confidence in a Competitor’s ability to control AUV paths. Any missions conducting virtual mooring strategies – i.e., staying in close proximity to a reference point and carrying out very small path segments a large number of times, or structurally similar strategies – are prohibited, and it is solely and in final authority the Organizers’ and Judge Panel’s right to determine whether an AUV’s track is to be considered and treated as a virtual mooring strategy. As with any and all of the Challenge Guidelines’ provisions, any assessment of a team’s performance and adherence to Challenge rules will be conducted in view of the Challenge’s overall vision of a scalable, cost-effective and sustainable monitoring system for the polar oceans.
- c) **“AUV”** shall be understood as a single autonomous underwater vehicle, untethered, such as an underwater glider; in particular, “autonomous” shall be understood as ‘without direct external

assistance or direct physical intervention'. Automated acoustic navigation and autonomous recharging are allowed if performed from under the sea-ice (see definition below); intermittent live remote human operator control is allowed if delivered to the AUV via under-water and under-ice communication and if constrained to such an extent that a Polar-wide AUV observing fleet could be controlled with limited overall human supervision.

- d) **“under the sea-ice”** shall be understood as “where actual sea-ice concentration is 80% or higher”. The official reference sea ice product for all aspects of the Polar Challenge is the U.S. National Ice Center’s daily sea ice edge product (see e.g. http://www.natice.noaa.gov/products/kml_archive.html for .kml-format files), which gives the outline for the daily 80% sea ice concentration edge in both the Arctic and Antarctic. Competitors are expected to conduct the main mission such that the AUV at any given day operates inward from the respective daily N.I.C.-defined ice area, except during potential deployment and recovery phases. The Organizers strongly advise to conduct missions in such a way that no misunderstandings on this requirement can arise.

Surfacing in ice-free zones and leads is allowed, as long as this surfacing is not mission critical and that navigation accuracy does not depend on it. Due to the difficulty of proving that a Competitor’s mission strategy does not rely on AUV surfacing events if they are recorded by Competitor and/or validation tag recorded data, the Organizers strongly advise to conduct missions in such a way that no misunderstandings on the necessity of surfacing events can arise.

- e) **“Accurate navigation”** shall be understood as a central necessity throughout the challenge and a prerequisite for scientific interpretation of all collected data. In particular:

- Horizontal (i.e., pertaining to latitude and longitude) navigation accuracy of the participating AUV should aim for 10 km or better. Competitors should be prepared to present to the Judge Panel data to support their claim to having achieved such navigation accuracy in a way suitable for their chosen navigation approach. As a non-binding list of examples, this could include: (1) for acoustically-aided navigation, data on acoustic handshake sequences, acoustic propagation, time of arrival and localization evidence for acoustic navigation; (2) for terrain navigation: depth sounding data (3) for inertial navigation: INS data, etc.

- Vertical (i.e., pertaining to AUV depth) positioning accuracy should be within the range of standard depth sensor uncertainty, i.e. one meter or less.

- f) **“Regular observations of temperature and salinity from the near-surface to at least 700m”** is to be understood such that one profile should be provided at least every 30 km (over ground). It is admissible for an AUV to average these profiles during potential down- and up-casts occurring in conjunction with reasonably limited horizontal displacement, as common e.g. in underwater glider operations. Measurements for both variables should on average be conducted at least every one meter of vertical displacement (depth change) of the AUV. Temperature and salinity observations have to be reported in degrees Celsius and SI units, respectively. In addition, the depth profiles should not extend further down than to an absolute maximum depth of 2000m due to the verification tag’s maximum depth rating, as laid out in the Regulations and Standards for Installation of Mission Verification Tags document.

Bonus demonstration 1 (optional)

One of the two bonus award prize fund pockets will be awardable to competitors who, in addition to the main mission described above, demonstrate regular observations of sea ice thickness, where:

- a) “regular” should be understood as “at least one measurement every 30 km (over ground)”;
- b) observations of sea ice thickness or draft can be performed by direct measurements (such as upward looking sonar or laser) or proxy measurements (for example upward docking against the ice);
- c) ice thickness or draft shall be reported in meters;
- d) the bonus demonstration must have been fulfilled with the same vehicle and during the same uninterrupted journey with which the main mission was completed and claimed.

Bonus demonstration 2 (optional)

The second of the two bonus award prize fund pockets will be awardable to competitors who, in addition to the main mission described above, successfully demonstrate under-ice transmission of position and environmental data onto WIS/ GTS operational networks. Such transmissions should:

- a) be demonstrated at least 3 times during the mission run and take place via an ice-based relay station (such as an ice-tethered platform equipped with underwater communication, GPS and satellite communications to transmit data onto WMO operational networks). As this is to be demonstrated as part of the main mission, the AUV must likewise be located inward from the 80%

sea ice edge (see definition in “Main Mission – requirement (d) above) at the time of transmission.

- b) be conducted with the same vehicle and during the same uninterrupted journey within which the main mission was completed and claimed.

Both bonus demonstrations can be attempted and claimed during the same main mission.

8. PRIZES

The main mission’s Prize money will be awarded to the first team completing the full main mission of the Challenge in adherence to all of its technical specifications and requirements laid out above. For potential partial prize awards, reference is made to both Section 7 of this document and further details below. Bonus prizes can be gained through additional completion of the two optional bonus demonstrations during the main mission. Every Prize will be awarded only once. If the main mission award is delivered to one team that did not also fulfill both bonus demonstrations, any awards for unachieved bonus missions remain available within the Competition provided a main mission is validated as well.

Prize money awards:

- **main mission: 400,000 CHF (main Prize)**
- **bonus demonstration 1: 50,000 CHF (bonus Prize 1)**
- **bonus demonstration 2: 50,000 CHF (bonus Prize 2)**

The above stated amounts may evolve during the course of the Competition if additional resources are mobilized to that effect. The official currency in which prizes are stated and awarded is the Swiss Franc. The Organizers intend to organize an award ceremony during which Prizes for any successfully completed challenge tasks will be delivered.

The Organizers reserve the right to deliver these awards with full or partial associated prize funds for any major accomplishment towards the main aims of the Challenge within reasonable tolerance of the Challenge Guidelines. Likewise, the Organizers also reserve the right to award only a fraction or none of the prize funds if one or all of the missions were completed according to the present Guidelines, but through the use of any one technology that is not fully scalable to a polar-wide, cost-effective, under-ice, autonomous observation network. Partial award of prizes would in the majority of cases not take place before the regular termination of the Challenge (see Section 10 for details). Any decision to award or to not award a prize partially under these provisions is entirely, solely, and in final authority made by the Organizers and Challenge Judge Panel.

The Organizer further reserves the full right, in its sole discretion, to cancel the Competition or adapt the Competition's prize fund amount in case of withdrawal of one of its main sponsors or other unforeseen events which are not attributable to the Organizers and lead to the partial or total unavailability of the prize funds, including, but not limited to, changes in currency exchange rates and general force majeure. Similarly, the Organizer further reserves the full right, in its sole discretion, to augment these Prizes for special achievements, for example to recognize the additional difficulties of completing these missions in the Antarctic. Any such decision under these provisions is entirely, solely, and in final authority made by the Organizers and Challenge Judge Panel.

For reasons related to contractual arrangements with some of the Challenge's sponsors, the Prize money associated with any successful mission will not be awarded sooner than 1 Jan 2018, even if any of those missions are validated earlier. In general, transfer of the Prize money will be subject to common and reasonable administrative delay after mission validation through the Judge Panel.

All taxes imposed on prizes are the sole responsibility of the winners. There is no right to payment of the prize in any other currency, on any particular day, according to any particular day's exchange rate value, or to payment by any other means than international bank transfer. Any transaction costs arising are the sole responsibility of the winners. If the winning team is, for whatever reason, not able to within reasonable time accept their prize or provide details that enable the Organizers to award the prize funds, the Organizer reserves the right, in its sole discretion, to not award the corresponding prize funds, or award them to another participant.

Prizes are delivered only after validation of the corresponding mission and its adherence to the Challenge Guidelines by the Judge Panel. In particular, the below Section 14, "Claiming a Prize", sets out detailed requirements for data, reporting and other standards.

The offer of a Prize by the Organizers or completion by a Team of any mission or bonus demonstration shall not in any way be understood as endorsing the underlying technology or holding the prospect of adopting it in any future implementation of the envisioned operational observing network for polar oceans.

9. RECIPIENT AND USE OF THE AWARD

The Team Leader's organization will be the recipient of the award.

The prize funds shall be used and invested by the receiving organization and its collaborators to pursue research projects in line with the overall objectives of the Challenge. A research project is scientifically admissible if primarily

non-commercial in nature, and if it further supports the technology developments and implementation of a scalable, cost-effective and autonomous monitoring system for the polar ice-covered regions. All Teams agree that accounting and monitoring of research projects funded thus by the prize money may be requested by the Organizers or one of the prize fund sponsors to verify and confirm the allocation and usage of the associated prize funds.

It will be the responsibility of any Team that has received prize funds, as well as of its Team members and their correspondingly represented organizations, to jointly agree on and implement a research agenda for the use of any prize funds received. This includes in particular the manner of allocation of funds for collective projects and/or for sub-projects to be conducted at any subset of the recipient Team's constitutive organizations, as well as any decisions on personnel or other resource allocation. The Organizers extend a recommendation to internally agree on such questions within a Team prior to a Team's mission start.

All participating team members declare that they will not hold the Organizers accountable for any internal dispute on the use of any portion of any awarded prize funds. In particular, no claims toward the Organizers can be made by any Team, Team Member or their respective organization after any awarded prize funds would have been transferred to the latest named bank account as stated by the Team Leader in the Application Form.

10. TIMEFRAME AND LOCATION

To foster rapid technological innovation on a pressing global topic, the Polar Challenge competition is limited in duration, such that only missions being completed between the Challenge's official opening on 15 March 2016 and its closing date on 31 Dec. 2019 are eligible for a prize award (see below for possible extensions to later closing dates). The Organizers may end the Competition prematurely if all main and bonus missions have been validated (in addition to the Organizer's general right to suspension or earlier termination of the competition for extraordinary circumstances as outlined above). If any of the main or bonus missions remain open or have only been partially achieved on 31 Dec 2019, the Organizers may extend the Competition under the same or altered Guidelines after consultation with the Challenge's sponsors.

Missions are to be completed under the sea-ice in the Arctic or Antarctic/Southern Ocean, according to the definitions given in paragraph (d) of the Section "Mission Requirements - Main mission".

All deadlines and dates are understood to refer to Central European Time (CET), and to according end-of-day where no times are given.

11. JUDGE PANEL

The Organizers establish a Judge Panel, which will include, but not be limited to, a combination of experts in ocean engineering, oceanography, cryosphere, underwater navigation, communication, and acoustics, as well as juridical advisors and representatives of previously organized comparable competitions. The Judge Panel will be co-chaired by a Chief Judge and a representative of WCRP. The task of the Judge Panel will be to validate or invalidate claimed missions as conforming to the Challenge aims and Guidelines. The Judge Panel likewise determines the degree of compliance for missions that either not fully meet the mission goals or achieved them with deviations from the required mission specifications and accuracies, and determines, in consultation with the Organizers, any possible partial prize awards. It further advises on any other matters of judgement related to the Challenge Guidelines. The Judge Panel may be augmented by early career scientists whose professional activities and center of expertise fall into the relevant fields. Their voting rights in the judge panel may be adjusted relative to a full vote according to their level of expertise and prior experience.

The Organizers have the right to appoint new or additional judges to the Judge Panel if the need arises, and at their sole discretion. Each Judge Panel member will upon admission to the Judge Panel sign a Judge Panel membership agreement with the Organizers in which Judge Panel members declare that no conflict of financial or other interest exists with respect to their role in the Judge Panel and any other of their professional or private activities or affiliations. Judge panel members will promptly offer to the Organizers their resignation from the Panel if any conflict of interest arises. Judge panel members will further declare to conform to confidentiality obligations (also see below Section “Intellectual Property”).

The primary task of the Judge Panel will be to validate the evidence provided by the competitors and the validation tag against the mission requirements as set out in the Competition Guidelines and the overall rationale of the Challenge. Beyond mere formal compliance with the Challenge Guidelines, the Judge Panel’s decisions can in a larger context incorporate factors including, but not limited to, general formal, technical and legal compliance, competition goals, safety, fairness, environmental protection, efficient operations, and potential for later up-scaling. The Judge Panel will strive to announce a decision on any claimed mission prize in a reasonable time after receipt of all necessary documentation by the Organizers.

Decisions by the Judge Panel are final. The Judge Panel shall have the sole and absolute discretion: (i) to allocate duties among the Judges; (ii) to determine the degree of accuracy and error rate that is acceptable to the Judge Panel for all competition calculations, measurements, and results, where not specified in the Challenge Guidelines; (iii) to determine the methodology used by the Judge Panel to render its decisions; (iv) to declare the winners of the competition; (v) to award (fully, partially, or not at all) the Prize funds and any potential other awards; and (vi) to, if the need arises, commission sub-tasks of pronounced technical or other difficulty to further

external committees, expert bodies, or also commercial service providers, who will in turn be bound by confidentiality agreements. Decisions of the Judge Panel shall be binding on the Organizers, all Teams and each team member, to the extent permitted by applicable law. The Organizers and Teams each agree not to dispute any decision or ruling of the Judge Panel, including decisions regarding the degree of accuracy or error rate of any competition-relevant calculations, measurements and results. The Teams shall have no right to observe other Teams' performance indicators, or to be informed of other Teams' data, calculations, methods, measurements and results, unless such information is made publicly available by the Organizers or the respective Teams themselves.

The Judge Panel composition will be announced on the Challenge web page after the panel's formation. Attempting direct communications with any members of the Judge Panel is prohibited and may incur disqualification of the competing Team.

12. APPLICATION AND REGISTRATION

Prospective Competitors can register anytime during the timeframe of the Competition unless all main and bonus missions have been fully completed. It is recommended to register and await positive confirmation before making any attempt to the main mission and/or bonus missions. Late registrations posterior to a team's mission start are strongly discouraged, but may be considered in accordance with Section 4 of the "Application Form" document, at the sole and final discretion of the Organizers.

The application process will commonly involve the following steps:

- all prospective Team members familiarize themselves with the Challenge goals and Guidelines;
- the Team Leader fills-in and signs the application form available from the web site and forwards it to the Organizers on behalf of the Team;
- the Organizers review the application form and verify its a priori compliance with the challenge Guidelines and aim of the challenge;
- the Organizers inform the Competitors about the outcome of their application.

The Organizers will aim to confirm or deny the registration within 30 days of submission of the Application Form.

The Organizers reserve the right, at any time, to verify the validity of entries and entrants (including an entrant's identity, age and organization affiliation). The Organizers also reserve the right, in their sole discretion, to disqualify any individual who it has reason to believe has breached any of the Challenge Guidelines, tampered with the entry process or engaged in any unlawful or other improper misconduct, calculated to jeopardize fair and proper conduct of the challenge and its overall spirit, as well as possibly that individual's team.

Errors and omissions may be accepted at the sole and final discretion of the Organizers.

By registering to the Competition, Competitors acknowledge they have read and fully adhere to all Challenge Guidelines. Their violations may result in an exclusion from the Competition. Dishonest access to the awards will be prosecuted.

13. AUV REQUIREMENTS

Mass

The ideal vehicle weight will be below 250 kg (in air) per vehicle.

Attempts at completing the Challenge with AUVs over the above mentioned weight limited will be judged, and may be deemed eligible for partial prize awards, in light of the suitability of both AUV as well as general technology for the Challenge's goal and vision of a scalable, cost-effective and sustainable monitoring system for the polar oceans.

Size

There are no size limitations except that each vehicle (movable parts such as wings taken off) should fit in a 20 feet (ISO 1C) container (see e.g. https://en.wikipedia.org/wiki/ISO_668 for details).

Emergency release mechanism

AUVs have to be equipped with a release mechanism for possible recovery in case of emergency or after the expected end of the mission.

Power

All batteries must be sealed. The open circuit voltage may not exceed 60 Volts DC.

Labels

AUVs shall carry clearly legible labels showing the vehicle owner contact, vehicle dimensions and weight (in air).

Number of vehicles

The number of vehicles used by a Team is not limited, but the mission, together with the potential bonus demonstration(s), has to be accomplished in full by a single vehicle. In case that multiple vehicles from one team each accomplish the same mission goals separately, competitors may submit the mission data for each of these successful vehicles' missions in multiple claims

to the competition prizes. Particular care has to be taken in these cases by the respective Competitor to clearly mark and separate each individual AUV's mailed mission tags and electronically transferred mission data.

Tags

Vehicles shall carry a validation tag to provide Organizers with independent validation data. This tag is to be ordered and purchased by each Competitor from a tag provider at the Competitor's cost and account, and hull-mounted on the AUV by the Competitors according to the operating procedures provided by the Organizers in the "Regulations and Standards for Installation of Mission Verification Tags" document. Competitors should note that this device may impact the vehicle balance, drag and overall dynamics. Tags are rated to operate in specific conditions (e.g., a strict maximum depth of 2000m and tag permissible temperature range) which shall be duly accounted for when planning the Challenge mission. It is the responsibility of Competitors to ensure that the tag is safely mounted on the vehicle to operate and measure properly during the entire mission. The tag must be switched on at the start of the mission according to the instructions given in the "Regulations and Standards for Installation of Mission Verification Tags" document as well as by the tag provider. It must be returned to the tag provider after the mission for mission validation according to the below Section "Claiming a Prize". Complete instructions for all aspects of tag ordering, installation, use, handling, and return are given in the "Regulations and Standards for Installation of Mission Verification Tags" Document.

14. CLAIMING A PRIZE

The WCRP-FPA2 Polar Challenge calls for participants to conduct pioneering scientific AUV missions in remote, inaccessible, and challenging environments. Unlike for small-scale and on-site competitions, which can seek proof-of-concept demonstrations in controlled settings, the Polar Challenge cannot deploy both a Judge Panel and AUV monitoring infrastructure to all Competitors' mission locations for all Competitors' mission durations. The Polar Challenge employs a dual approach to mission verification, relying on a sealed, black-box mission verification tag, one of which is to be installed by each Competitor on every participating AUV (see the "Regulations and Standards for Installation of Mission Verification Tags" document, as well as its Section 5.9 on alternative verification strategies). Data collected by this sealed device will be exclusively evaluated by the Organizers and the Judge Panel. The second pillar of the Polar Challenge's evaluation scheme is the requirement for complete provision of a Competitor's mission critical data as collected by the AUV (and potentially other involved relevant equipment). In order to claim a Prize, data content for both verification pillars must be provided fully to the Challenge Organizers, and the burden of providing sufficient evidence lies with the Competitors.

Upon a presumed successful mission and optional bonus demonstrations, Teams shall, within 1 month, forward to the organizers a claim to the corresponding Prize(s) and all the necessary and sufficient evidence to validate such claim. The claim consists of 1) the sealed tag and 2) mission evidence. Competitors should review this mission requirement carefully. Failing to forward the claim within 1 month carries the risk of losing precedence against other competitors. For cases in which Competitors were carrying out a mission with the intent of fulfilling mission requirements only partially (see Sections 6 through 8 of this document), it is strongly recommended that Competitors adapt the communication of their mission's outcomes and documentation of their own data accordingly.

The sealed tag, turned off at the end of the mission, shall be forwarded to the Organizers by express courier. The tag and its return to the tag provider is an integral part of the validation process.

All mission-related (including scientific) data sets (see details below) shall be forwarded to the Organizers as part of the main mission and optional bonus demonstration validation by the committee. Additional information (photographs, plots, etc.) to support the claim is welcome and strongly encouraged. Scientific data sets shall be properly geo- (longitude, latitude), depth-, and time (UTC/GMT) -referenced.

The claim shall be made available for download by the Team Leader to the Organizers as a single ZIP file (for example via a Team's own ftp server or third-party services such as www.wetransfer.com or Dropbox) and shall include:

MAIN MISSION

- an executive summary with details on claimed Prize(s) – main mission, bonus demonstration 1 and/or 2, including the exact date and time when main mission and optional bonus demonstrations are claimed to have been fulfilled
- mission LOG file in CSV ASCII files
- timed map of AUV trajectory in KML format
- evidence of navigation accuracy (see Section 7e)
- plots of temperature and salinity measurements w.r.t. time (days)
- plots of temperature and salinity measurements w.r.t. distance travelled (km)
- time-stamped photographs of deployment, recovery of AUV (full vehicle out of and in water from all front, rear, top and lateral sides, and close-up on tag (including the sealed communications port) out of and in water, from 4 opposite angles and from top)
- full mission and science data sets
- preliminary comparison of temperature and salinity data against collocated/nearby historical data sets
- if applicable, the team's awareness and own account of limitations with respect to mission completeness or adherence to the mission

requirements and specifications (see Sections 6 through 8 of this document on partial prize awards).

BONUS DEMONSTRATION 1

- plots of ice thickness/draft measurements w.r.t. time (days)
- plots of ice thickness/draft measurements w.r.t. distance travelled (km)
- preliminary comparison of ice thickness data against collocated/nearby satellite remote sensing measurements (e.g. Cryosat) from operational products and/or climate data records if available for the mission area and period
- preliminary comparison of ice thickness data against historical collocated/nearby measurements
- full mission and science data sets related to bonus demonstration 1
- if applicable, the team's awareness and own account of limitations in mission completeness or adherence to the mission requirements and specifications (see Sections 6 through 8 of this document on partial prize awards).

BONUS DEMONSTRATION 2

- evidence of repeated (at least 3) under-ice transmissions of near-real time geo- and time- referenced temperature, salinity profiles (and possibly ice-thickness observations) and availability on the GTS/WIS network
- full mission and science data sets related to bonus demonstration 2
- if applicable, the team's awareness and own account of limitations in mission completeness or adherence to the mission requirements and specifications (see Sections 6 through 8 of this document on partial prize awards).

Mission LOG files will use the following format:

TIME, LAT, LON, DEPTH, ACTION

where:

- TIME is the time from the beginning of the mission in seconds
- LAT is the latitude in decimal degrees (WGS), e.g. 44.2456
- LON is the longitude in decimal degrees (WGS), e.g. 9.8645
- DEPTH is the depth of the vehicle in meters;
- ACTION is a string communicating the relevant action or state that the vehicle performed or entered/terminated at that time and location.

Plots are to be provided in either PNG or JPEG format. Maps are to be provided, as appropriate, either as image in PNG or JPEG format, or as .kml

files. In either case, it is desirable that the data underlying any such plot or map is made available as well.

If the submitted evidence does not meet the above-stated validation criteria and/or is of deficient quality, the Judge Panel may reject the claim or call for additional evidence. The Organizers and Judge Panel accept no responsibility for transmission problems, data corruption, hardware malfunction, or other technical issues hindering data evaluation and mission verification, neither for the Competitor's own equipment nor for the validation tag nor for any components of any potential independent and alternative verification system along the provisions of Section 5.9 of the "Regulations and Standards for Installation of Mission Verification Tags" document.

For all considerations of temporal precedence of different teams' achievements, the actual date of achievement will be used (as opposed to the date the claim has been made). Once a winner for a certain Challenge mission has been validated and announced, no other claim on that mission may be made, even when it entails an earlier date of achievement.

At the discretion of the Judge Panel, the main as well as bonus Prizes may each be divided in multiple lots in case of temporally close respective and complete realizations.

As laid out in Section 8 of this document, partial awards of prizes will usually only take place after termination of the Challenge and if no complete mission has been carried out and verified. For this reason, the Organizers reserve the complete, sole and final right to consider or not consider questions of temporal precedence when determining the degree to which partial prize funds are awarded to and between eligible Competitors.

15. AREA CLEARANCE AND TRAVEL

It is the sole responsibility of Competitors to seek all necessary area clearances and authorizations to conduct operations at sea related to the Competition. Teams are advised to seek permissions to operate in Territorial Waters and Exclusive Economic Zones with sufficient notice as appropriate.

Operations in and use of national waters, Exclusive Economic Zones, international waters, land or air space for both testing and carrying out the Challenge mission are the sole responsibility of the competing Team, and must be in accordance with respective local, regional, national, and international law. The Organizers assume no responsibility for any consequences of a team's operations.

It is further the responsibility of solely the Team and the Team members to acquire all visa, passports, medical or other documents that may be necessary for travel or any other activity related to participation in or preparation for the Challenge, including attendance of any preparatory, media

or prize award events related to the Challenge. Except to confirm that a Team has successfully registered to the Competition, the Organizers shall not assist in visa requests or other similar administrative support.

16. TECHNICAL DOCUMENTS AND PERMISSIONS

It is the responsibility of solely the Team and Team members to acquire all technical, transport and export permissions related to the construction, transport, export, deployment, operation, recovery, and re-import of that Team's respective AUV(s). In particular, the Organizers shall not assist in nor assume responsibility for any matters related to export- or import-restricted technology regulations.

17. ENVIRONMENTAL IMPACT

Proposed attempts to the Challenge will have to demonstrate a best effort to minimize the impact on the environment. Any aspect of the planned mission that has an unacceptable impact or potential risk on the environment is prohibited. These activities include destructive AUV behavior, the use of abnormally hazardous substances or materials, and generally reckless and irresponsible operation. Potentially hazardous equipment or activities must be identified to the Organizers for review in the Application Form. Nuclear power is not authorized. The use of underwater acoustics, electromagnetic fields and laser beams will have to be properly documented during the registration process and shall be limited to harmless power, frequencies and ranges. No materials (except for compressed air) may be released by the AUVs into the environment. Any leaking vehicle will be deemed unsafe and unfit for purpose as far as this Competition is concerned.

18. SAFETY

The Organizers affirm and recognize that during all Challenge operations, the safety and well-being of all participating team members and associated personnel is of the highest priority. The Organizers encourage all participating teams to deploy an integrative safety approach which will ensure the protection of all team members and associated staff against risks arising from AUV deployment in polar waters, AUV construction, transport and assembly, handling of electrical and transportation equipment, and other dangers. The Organizers assume no responsibility in case of personal injury, death, injury of third parties, damage to equipment or environment, or any other damages arising from Challenge participation (see Section "Liability" in the Application Form document). The Organizers are further unable to provide logistical or other emergency support during AUV deployment, operations or recovery missions.

19. FEES

There is no participation fee associated with the Polar Challenge. Competitors are to bear all costs related to their participation in the Challenge, including the mandatory purchase and installation of the mission verification tag.

20. FUNDING

Competitors are responsible for mobilizing their own resources for attempting the Challenge. All acquisition, development, staffing, fielding, operating, and insurance costs and other related expenses are the sole responsibility of the teams. Except where expressly otherwise stated, the Organizers provide no logistical, financial or other support to a participating Team's mission. In particular, attention is drawn to the requirements on the Teams to obtain liability and other insurance as stated in the Application Form. Several organizations have expressed their willingness to offer ship time support to competitors, and the Organizers will facilitate such opportunities upon explicit requests by Competitors.

21. INTELLECTUAL PROPERTY

If the Judge Panel accepts as eligible for a prize award the quality and accuracy of a vehicle's collected data set, the respective competing team must make freely available to the scientific community the full scientific data sets, geo-located as well as time and depth referenced, within 3 months of validation of the mission, in order to uphold their candidate status for a prize award. This data set must meet expected international quality check and accuracy standards. Competitors remain free to formulate any requests or requirements for attribution that should accompany any re-publication of this scientific data set.

The full mission data set as required for submission to the Judge Panel by the above section "Claiming a prize" will in contrast not be disclosed to other parties by the Organizers, and neither any additional information given in private communications between Teams and Organizers. The Organizers further declare that they seek and will hold no intellectual or other property rights for data, technology, or other information gained through their role in the Competition and handling of participants' or Teams' information.

All other cooperating persons which are neither team members nor the Organizers and who will, for the fulfillment of their duty associated with their respective role within the Challenge, have any privileged access to a team's confidential information (e.g., members of the Judge Panel, and all other comparable roles), will be required by the Organizers to sign a confidentiality agreement which upon request can be made available to participating teams after registration.

22. DISSEMINATION AND OUTREACH

The Competition shall be referred to as the “WCRP-FPA2 Polar Challenge”, and Competitors shall acknowledge the WCRP and FPA2 sponsorship of the Polar Challenge in all their outreach and publication material.

Upon validation of their registration, a Team’s participation will be made public, including:

- a) the Team information (i.e., team name, supporting organization, members, sponsoring, and similar), to enable contacts from potential sponsors, other teams and media;
- b) the Mission description, as provided by the team in their Application Form (in the section “Executive Summary”).

With registration, every participating Team grants the Organizers the right to publish the above information in print, online, and any other media used in connection with the Challenge. The same rights are further extended to any media outlets reporting on the Challenge.

Each Competitor agrees to develop a dedicated web page, reporting progress on the Challenge implementation, mission progress and science data in near-real time whenever possible, in particular after each surfacing in ice-free zones (or contact with a relay station), so as to monitor progress on the Competition and develop outreach activities as appropriate. Each Team’s web site will be linked from the WCRP-FPA2 Polar Challenge web site. At the discretion of Competitors, sensitive information such as the exact locations of AUVs and support infrastructure devices do not have to be disclosed.

23. MEDIA AND MEDIA RIGHTS

Use of Competition name and sponsors’ logos:

The Organizers grant the Teams a non-exclusive, royalty-free, non-transferable, non-sublicenseable, revocable, worldwide license to use the Competition name and sponsors’ logos for their own media and outreach activities related to the Challenge as well as their Team’s participation.

Possibility for provision and sharing of media material:

Teams and Organizers agree to grant each other a non-exclusive, royalty-free, non-transferable, non-sublicenseable, revocable, worldwide license to use for promotion and documentation of the Challenge any text, image, video, sound or other media material related to the Challenge which has been made available to the respective other party for that purpose. Both parties agree that any media material such shared under this provision may be passed on to third-party media such as newspapers, radio stations, online news portals, etc. under the condition of proper attribution to the copyright holder. Both parties further retain the right to reproduce any media material for exhibition purposes.

It is the responsibility of solely the providing party to ensure that it is the sole author and owner of the copyright for any such media material made available under this provision, or alternatively that they have obtained permission from the copyright holders to thus provide the entries on their behalf; and to ensure that all the necessary permissions are obtained from people, technology, or other protected objects photographed, pictured, recorded or otherwise represented in the entry. The providing parties, or their respective original source, retain the copyright to all media material such transmitted.

Media material obtained during mutual activities of the Competition:

The Teams and Organizers agree that any media material relating to the Competition and taken during mutual activities of the Competition, including, but not limited to, its outreach and preparatory activities, its award ceremonies, or any AUV launch and recovery events, may be used by both parties to promote, document, publish and communicate to the public the Competition in all its aspects, in any media, worldwide, without further payment or consideration. Teams and Organizers grant each other permission to provide to third-party media outlets, under the condition of proper attribution to the copyright holder, any such material obtained. Both parties further retain the right to reproduce any media material for exhibition purposes.

Third-party claims and unauthorized use

Teams and Organizers agree to immediately inform each other in case any third-party intellectual property claims are presented to either party as arising from the use of Competition media material. Likewise, the Team and Organizers agree to immediately inform each other in case they become aware of a third-party's suspected unauthorized use of any competition media material or other competition-related intellectual property. The Organizers do not accept any liability for the misuse of any of the Team's or third-party provided media material, or the failure to comply with copyright or author attribution requirements.

24. PRIVACY POLICY

The Organizers undertake to protect all participants' private information, in particular their postal and email addresses, phone numbers as well the team's confidential technical information. The organizers exclude liability for the acquisition of participants' private information by third parties except where caused by willful intent or gross negligence.

25. NON-ENDORSEMENT, NON-ALTERATION

In no way shall any of the Challenge media material or any aspect of a team's participation in the Challenge be used, advertised, presented, understood or construed as giving rise to false endorsement of or cooperation with any other

of a Team's projects, research, grant proposals, or other activities, by the Organizer, its officers, employees, contractors and agents. Both parties shall use their best efforts to prevent any such implications in all outreach material and contact with media outlets.

Likewise shall no aspect of a team's participation in the Challenge be understood, presented or construed as altering, overriding, or terminating any other potentially existing agreement between any team, team member, or team organization and the Organizers, its officers, employees, contractors and agents.

No mention of any third-part commercial or non-commercial brand, entity, product, service, or cause within the context of the Challenge shall be construed as constituting an endorsement by the Organizers beyond the mention thereof for that respective particular aspect of the Challenge.

26. TEAM SPONSORSHIP

Each Team will make every effort to ensure that no impression arises of any form of endorsement of any of the Team's sponsors by the Organizers. This holds in particular insofar as the Team is being sponsored by one or more commercial entities.

No sponsorship agreements entered into by any team shall incur the promotion of views that are, among others, obscene, harassing, discriminatory, promoting a certain political stance or illegal activity, running counter to the Organizer's existing sponsorship agreements or the general competition goals, or violating the personal rights of any participating or non-participating person.

27. PRIVILEGES AND IMMUNITIES

Nothing in or relating to these rules and procedures shall be deemed a waiver, express or implied, of any of the privileges and immunities of the World Meteorological Organization (WMO), including its subsidiary organs.