Under Ice Research: International Polar Diving Workshop

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Background

The original Polar Diving Workshop (Lang and Stewart, 1992) was supported by NSF Office of Polar Programs, Smithsonian Institution, and AAUS. The by-invitation workshop included participating scientists with specific polar diving expertise, manufacturers of dry suits and thermal protection, physiologists and decompression experts, diving safety officers and ice diving experts. Fifteen years later we found ourselves in the position of having to re-evaluate and update the 22 polar diving recommendations made in 1991 and thus, the need developed for the "International Polar Diving Workshop."

Methods

In order to avoid working in isolation and re-inventing proven methods, the IPDW was interdisciplinary in nature, and international in scope (including expertise from British Antarctic Survey, Antarctica New Zealand, Australian Antarctic Division, Canada, Norway, Sweden, Germany, Italy, France, and Finland). Advances in equipment technology for under-ice diving (*e.g.*, thermal protection and regulator design, surface-supplied diving, and dive computers), physiological knowledge of cold water effects on decompression strategies, and operational and scientific diving training procedures specific to the polar environments were reviewed. Combined with contributed papers and discussions from the commercial, military, scientific, and technical diving communities new ice diving procedures and equipment designs were evaluated in the field. Participant expertise included scientific divers, Diving Officers, decompression experts, US Navy, commercial diving experts, training organizations, and equipment manufacturers.

References

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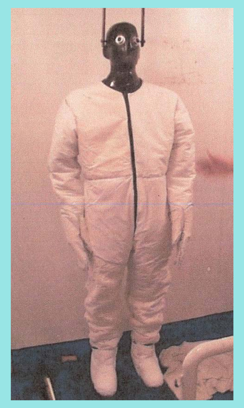
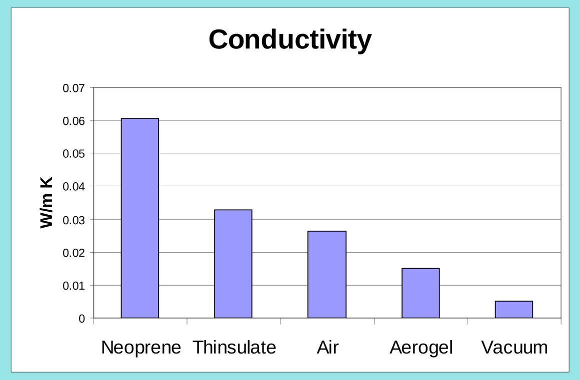
Polar Diving Equipment





Aerogel is a silica-based material, the world's lowest-density solid composed of 99.8% air with a typical density of 3 g/L and average particle size 2-5 nm. Challenges include construction and encapsulation (silica dust control); current total cost ≈ 5 times per m^2 more than traditional insulations.

Consensus Recommendations

Polar diving experience has shown that buoyancy control is the primary differentiating skill affecting safety and science.

Thermal protection

1. Pre- and post-dive thermal and hand protection must be carefully managed.
2. Adequate thermal protection must be provided to tender(s) and standby diver(s).
3. The effect of cold on DCS risk is not fully understood. However, the diver should be kept warm throughout the dive and during the immediate post-dive period external heat application and heavy lifting should be avoided.

Equipment

4. It is important that continued data be collected on the performance of regulators, buoyancy compensators and drysuits in polar conditions and be accessible to scientific diving programs.
5. Regulator model revisions require field experience or independent lab testing validation prior to adoption for polar diving use, as it cannot be assumed they will perform as well as earlier successful models.
6. Owing to the tendency for scuba apparatus to free-flow under polar conditions, a minimum of two independent regulator systems is recommended for diving in overhead environments; divers must be proficient in switch-over procedures.
7. A second-stage isolation valve used in conjunction with first stage overpressure relief valve should be further considered as a method to independently and rapidly manage regulator free-flow.
8. To minimize possibility of regulator free-flow, proper pre- and post-dive care should be followed. Proven methods include ensuring that regulators are kept warm and dry prior to diving and the minimization of regulator breathing prior to immersion. Purge valve should not be activated prior to immersion, upon entry or during the dive.

Operations

9. A drysuit must be used with a buoyancy compensator for polar diving in general. It is recognized that conditions may exist in which the diver would be more at risk with the buoyancy compensator than without one. In such cases, a buoyancy compensator will not be required.
10. A tethered diver who is deployed to work independently, must be equipped with full-face mask, voice communications to the surface, and redundant air supply.
11. During pack ice diving operations, tenders must constantly monitor changing ice conditions to ensure rapid diver exit.
12. A recompression chamber should be within a traveling distance that is concomitant with the risks associated with any particular diving operation. Where no recompression chamber is available, the risk must be managed in a way that significantly reduces the potential for decompression illness. Sufficient oxygen must be on site as an emergency diving first aid treatment.
13. Generally, divers under ice should be tethered by life lines. It is recognized that conditions may exist where high visibility and lack of currents obviate the need for tethers.
14. Appropriate measures for safeguarding all personnel from predatory mammals (*e.g.*, polar bear, leopard seal, walrus) must be considered and implemented.
15. Diving under ice requires additional gas management considerations.

Training

16. Divers in polar regions should be proficient in the use of drysuits, thermal insulation strategies and weighting, and should be highly experienced with the particular system and equipment they will use.
17. When lifelines are used, divers and tenders must be trained and proficient in their use.
18. A polar check-out dive is essential to determine competency.

Polar Diving Issues


surface-supplied ice diving

"It's better to finish your dive before you finish your gas"
Roberto "Bob" Palozzi


USCG HEALY Arctic West Deployment 06-04


Swim fin design

Contents

IPDW Dive Computer Use - UWATEC

Diver	DC ID	Dives	BT min	Max D fsw	Max BT min
DA	29	6	203	90	46
SD	40	2	42	48	26
JF	42	5	189	68	47
BF	36	5	152	59	39
EG	37	6	201	59	41
HH	41	7	236	67	45
YH	33	5	141	90	33
ML	32	7	202	58	34
DL	34	4	139	50	44
WL	43	6	169	75	43
CM	45	2	74	40	44
SM	23	5	127	77	30
EO	31	7	194	58	36
OO	25	5	96	58	27
RO	26	3	101	62	40
RP	44	6	152	70	29
LP	22	7	193	69	38
LQ	24	4	98	46	28
KR	39	7	188	58	36
MS	46	4	82	59	27
BS	30	3	87	44	31
		106	3066		764
			51 hr	**62 fsw**	**:36**

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