

COMPARING AIR AND OXYGEN PRE-BREATHE DECOMPRESSION SCHEDULES FOLLOWING SATURATION AT 5 ATA

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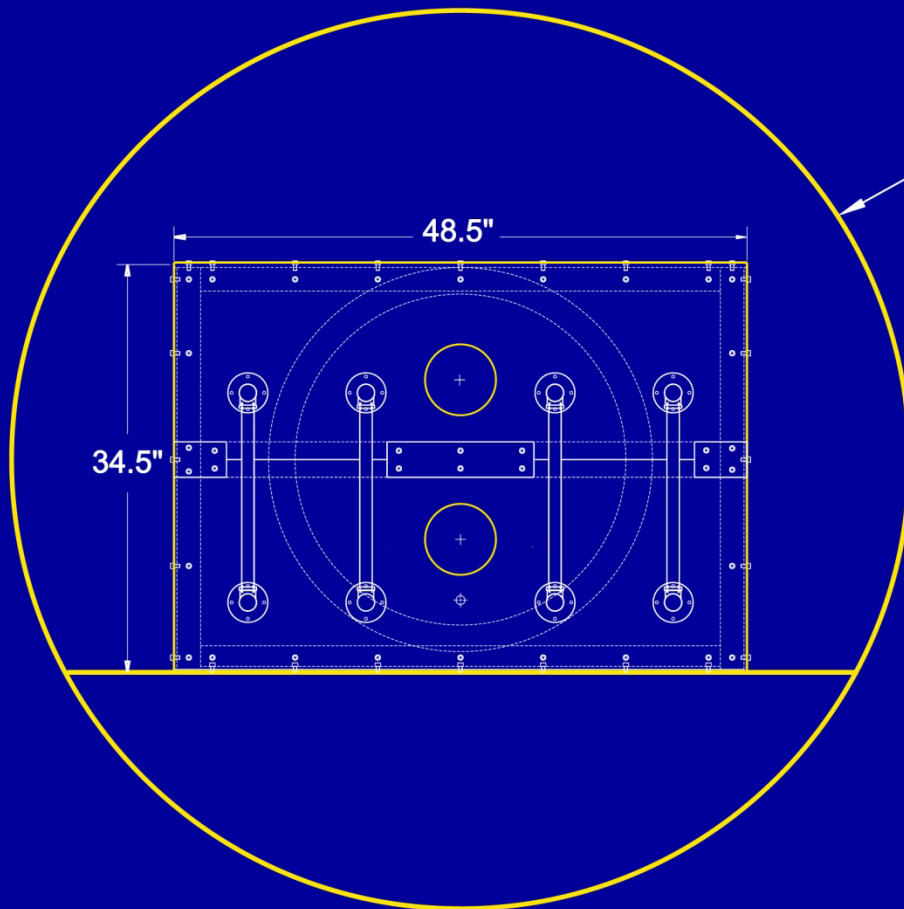
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Introduction

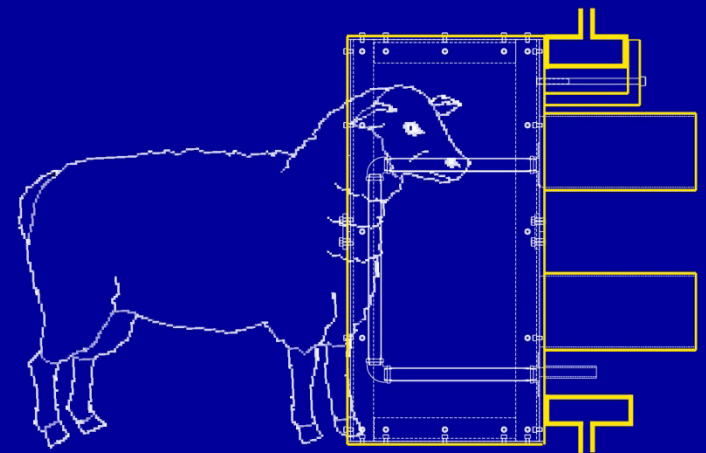
- Submarine disaster survivors can be transferred from a disabled submarine (DISSUB) at a pressure of 5 ATA to a rescue vehicle.
- However, they face risky surface decompression sickness (DCS) without recompression and an extended decompression.
- Previously we demonstrated that oxygen pre-breathe at depth can reduce decompression time from 2.8 ATA and 3.7 ATA.
- We now present data using oxygen pre-breathe from 5 ATA.

UW SHEEP MODEL



Front View

Chamber

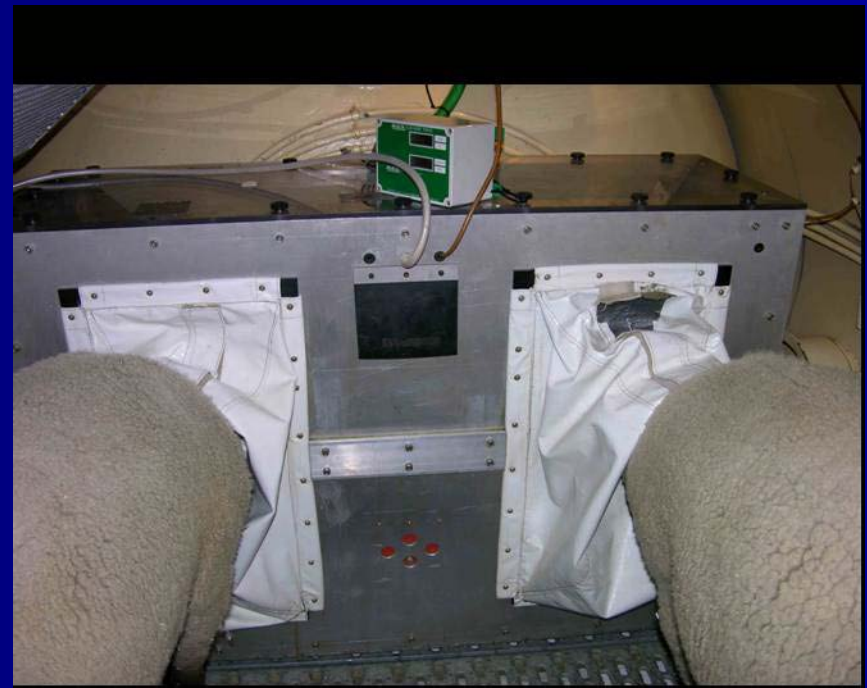


Right Side
View

UW SHEEP MODEL



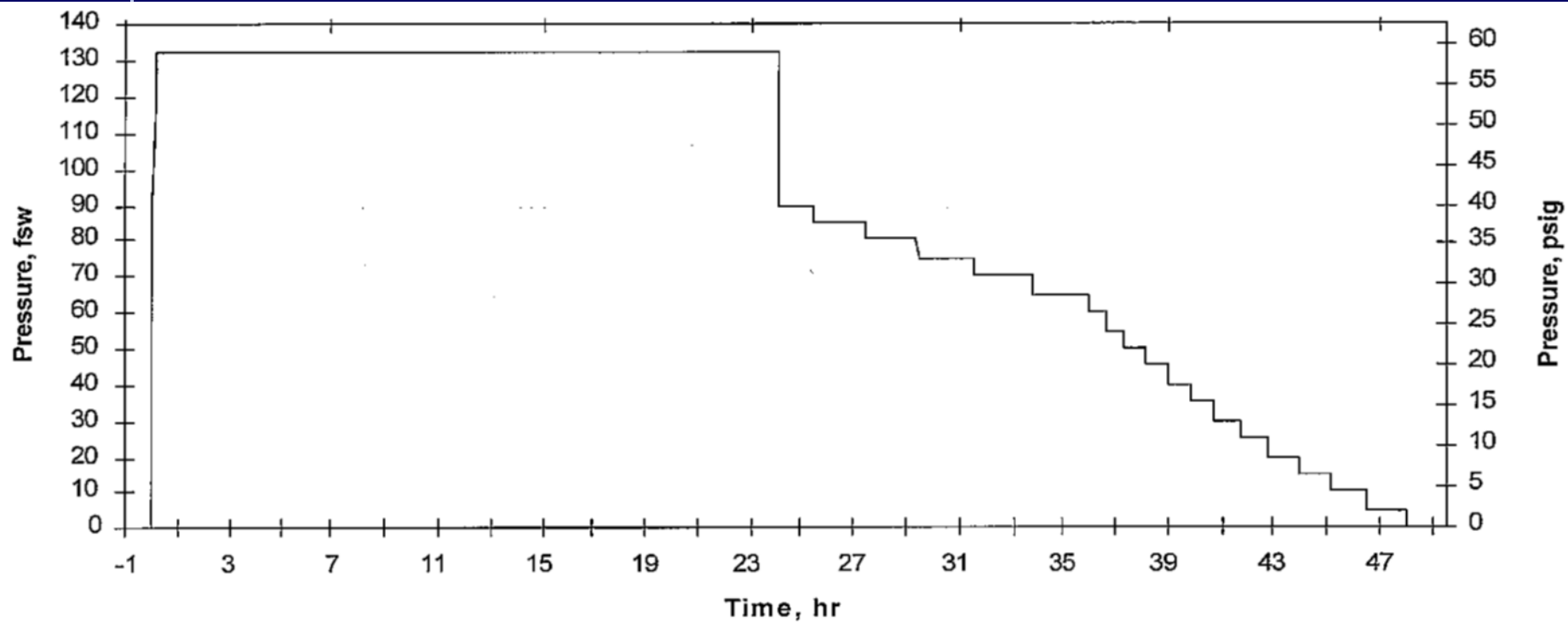
UW O₂ delivery system used to evaluate emergency decompression to surface pressure.



Materials and methods

- Sixteen adult female sheep were exposed to 5 ATA dry-air for 24 hours to simulate a DISSUB scenario
- Following saturation, 8 sheep (86.4 ± 16.6 SD kg) underwent a 16-24 hours staged decompression on air (Schedule 1).
- Another 8 sheep (86.1 ± 7.3 SD kg) were decompressed while breathing oxygen (Schedule 2):
1 hour of 50% O₂ pre-breathe at 5 ATA; 1 hour of 50% O₂ at 3.7ATA; 1 hour of 85% O₂ oxygen at 2.8, 2.5, and 2.2 ATA, and then dropout (direct ascent to the surface)
- Upon surfacing the animals breathed ambient air and were observed for 24-hours followed by necropsy

Decompression Schedule 1

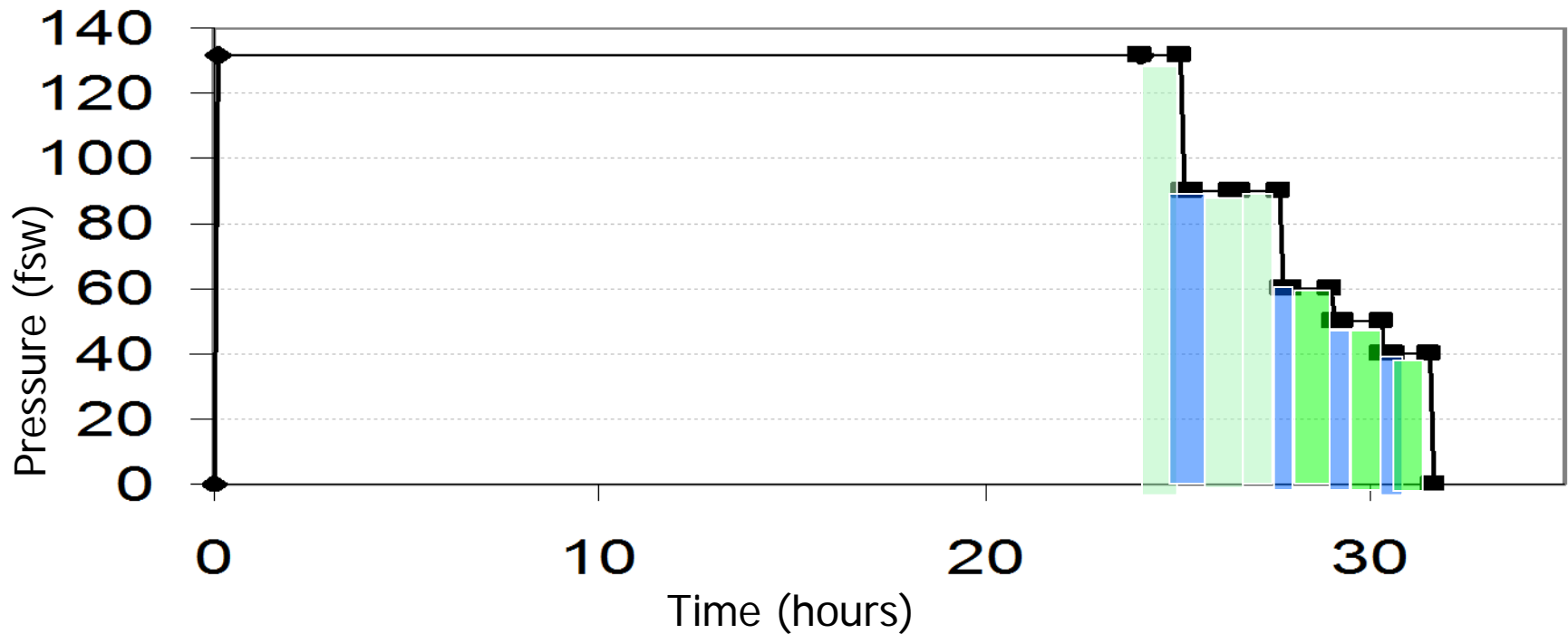


Doppler ultrasound probe detection of circulating bubbles in the decompressed sheep at the precordium



Decompression Schedule 2

Nitrox 50/50 and O₂



Results Schedule 1

- 8 adult ewes (86.4 ± 16.6 SD kg)
- 7 sheep survived
- 3 sheep: Type I DCS (signs of limb bends)
- 3 sheep: Type II DCS (tachypnea, mild labored breathing), but no treatment
- 2 sheep: Type II DCS (severely labored breathing, neck extended, recumbent), both treated with Lasix and butorphanol
- One sheep evidence of neurological DCS

Results Schedule 2

- 8 adult ewes (86.1 ± 7.3 SD kg)
- 6 sheep did not survive
- 6 sheep: Type II DCS at depth 50 and 60 fsw
- Oxygen toxicity associated seizures occurred
- 2 sheep survived decompression, Type II DCS, treated, but were euthanized after 20-22 h
- potential MRI markers of damage in the CNS
- histology to determine substrates for DTI change

Summary of Outcome

	Schedule 1	Schedule 2
Weight (kg), mean \pm SD	86.4 \pm 16.6	86.1 \pm 7.3
During 4-h observation period		
Death, N (%)	1 (12.5)	6 (75)
Type II DCS, N (%)	5 (62.5)	8 (100)
• Cardiopulmonary	4 (50)	8 (100)
• Neurologic	1 (12.5)	2 (25)
Type I DCS, N (%)	3 (37.5)	-
• Limb Lifting	3 (37.5)	-
• Pain	4 (50)	-
During 24-h observation period		
Death, N (%)	0	2 (25)
Type II DCS, N (%)	1 (12.5)	2 (25)
• Cardiopulmonary	1 (12.5)	2 (25)
• Neurologic	0	0
Type I DCS, N (%)	4 (50)	-
• Limb Lifting	4 (50)	-
• Pain	1 (12.5)	-

Conclusions

- We have previously shown protective effects of oxygen pre-breathing at 2.8 ATA and 3.7 ATA
- However, oxygen pre-breathing at 5 ATA caused increased mortality, likely due to neurologic and respiratory oxygen toxicity
- Clearly, more studies are needed to better define safe oxygen pre-breathing decompression schedules following saturation conditions at extreme depths

Thank you for attention!



A girl sheep is called a Ewe. Sheep eat grass, weeds, and grain.