



U.S. Naval Undersea Medicine

An Overview

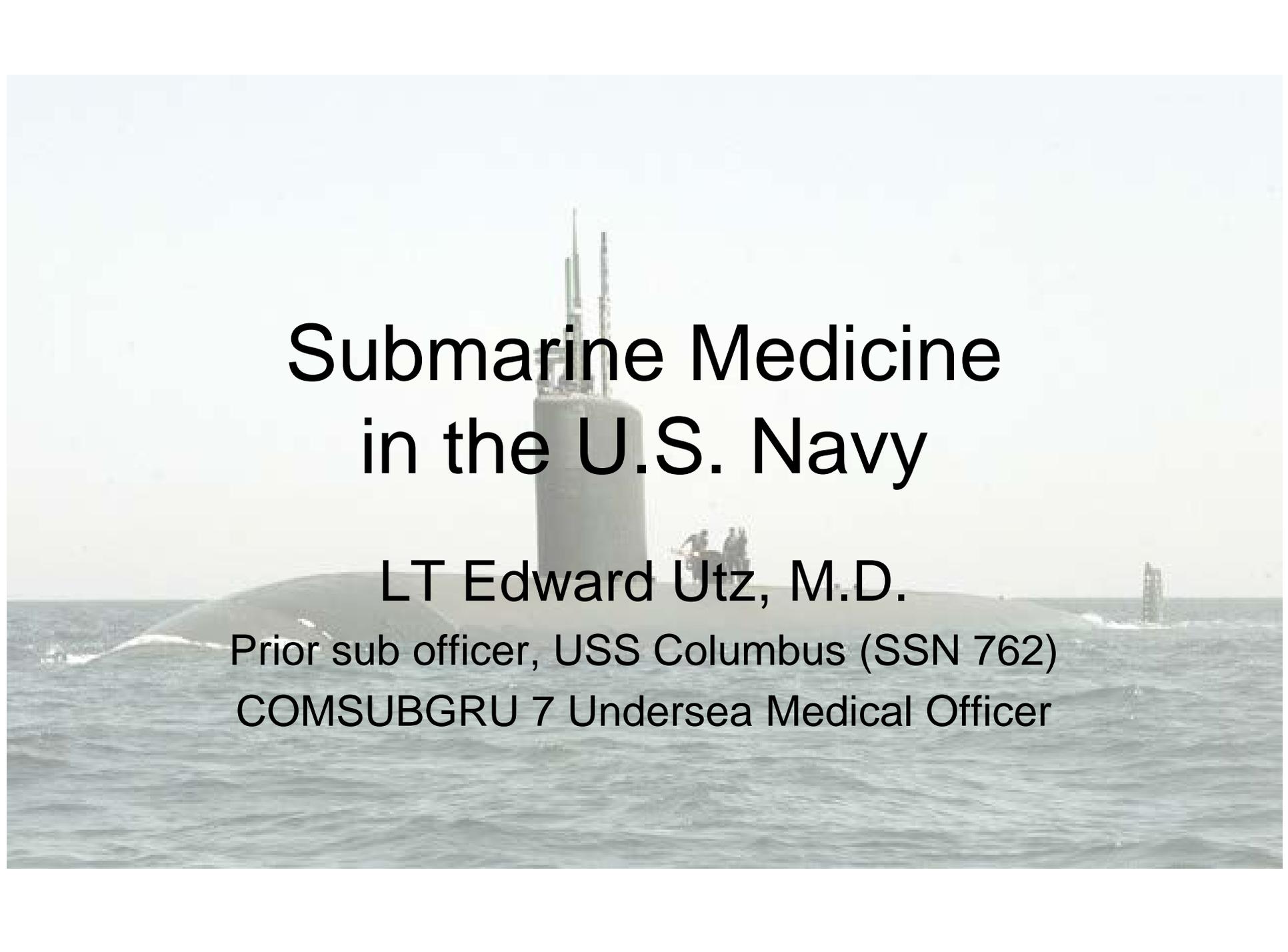
LT Edward R. Utz, M.D., UMO

LT Ryan Snow, M.D., UMO

HMC James H. Akin, M.S. (SS/SW), Submarine IDC

Outline

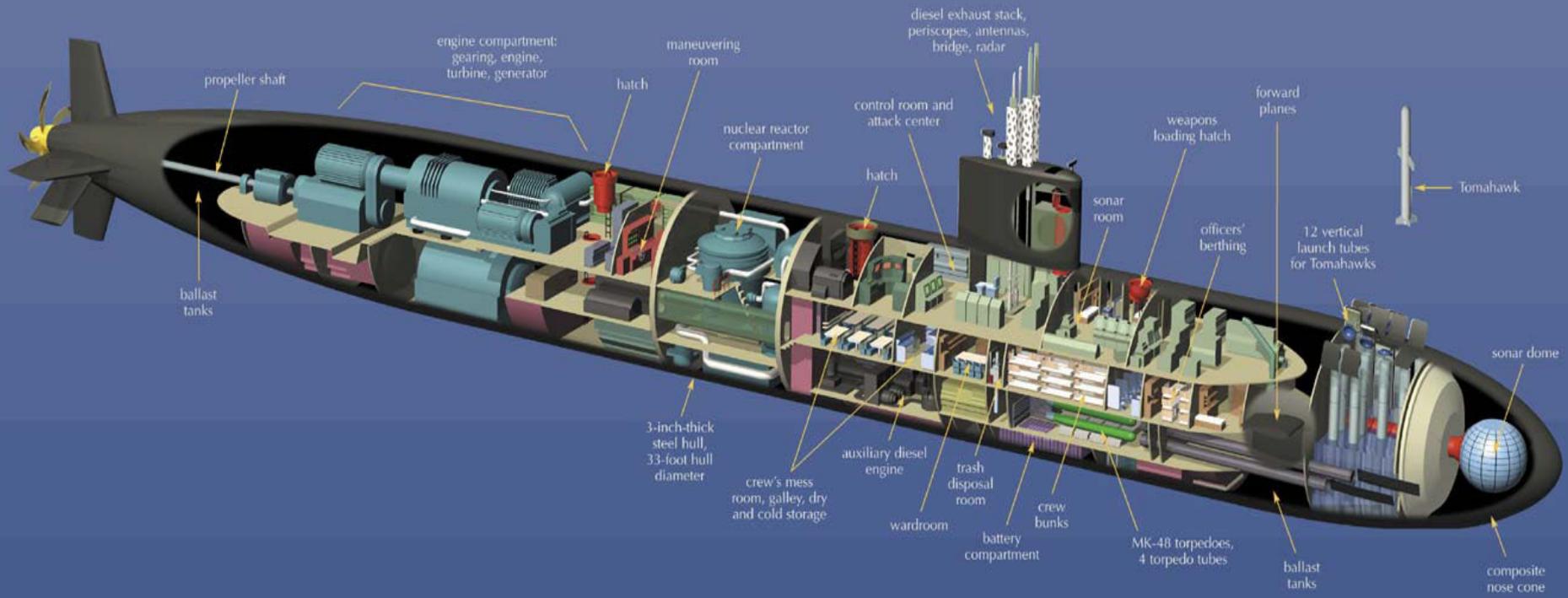
- Submarine Medicine
 - LT Utz
- Dive/Hyperbaric Medicine
 - LT Snow
- USS San Francisco Case Presentation
 - HMC Akin

A photograph of a submarine on the surface of the ocean. The submarine's conning tower is visible, with several masts and antennas extending from the top. The water is a dark blue-grey color, and the sky is a pale, overcast grey. The submarine is positioned in the center of the frame, slightly to the left.

Submarine Medicine in the U.S. Navy

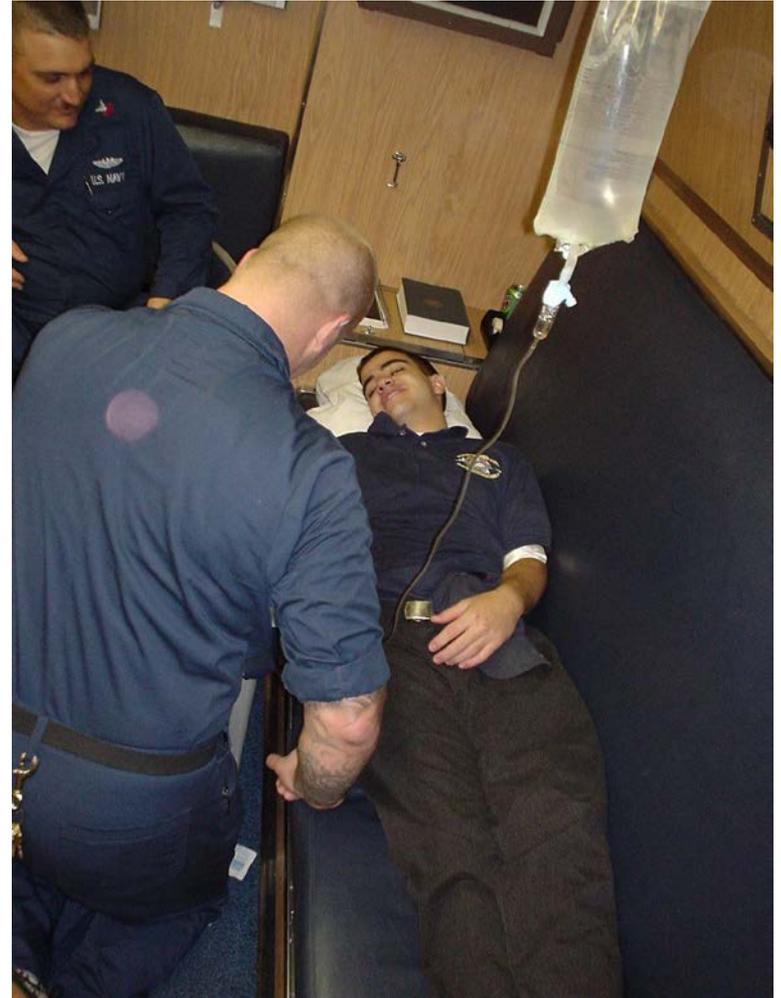
LT Edward Utz, M.D.

Prior sub officer, USS Columbus (SSN 762)
COMSUBGRU 7 Undersea Medical Officer

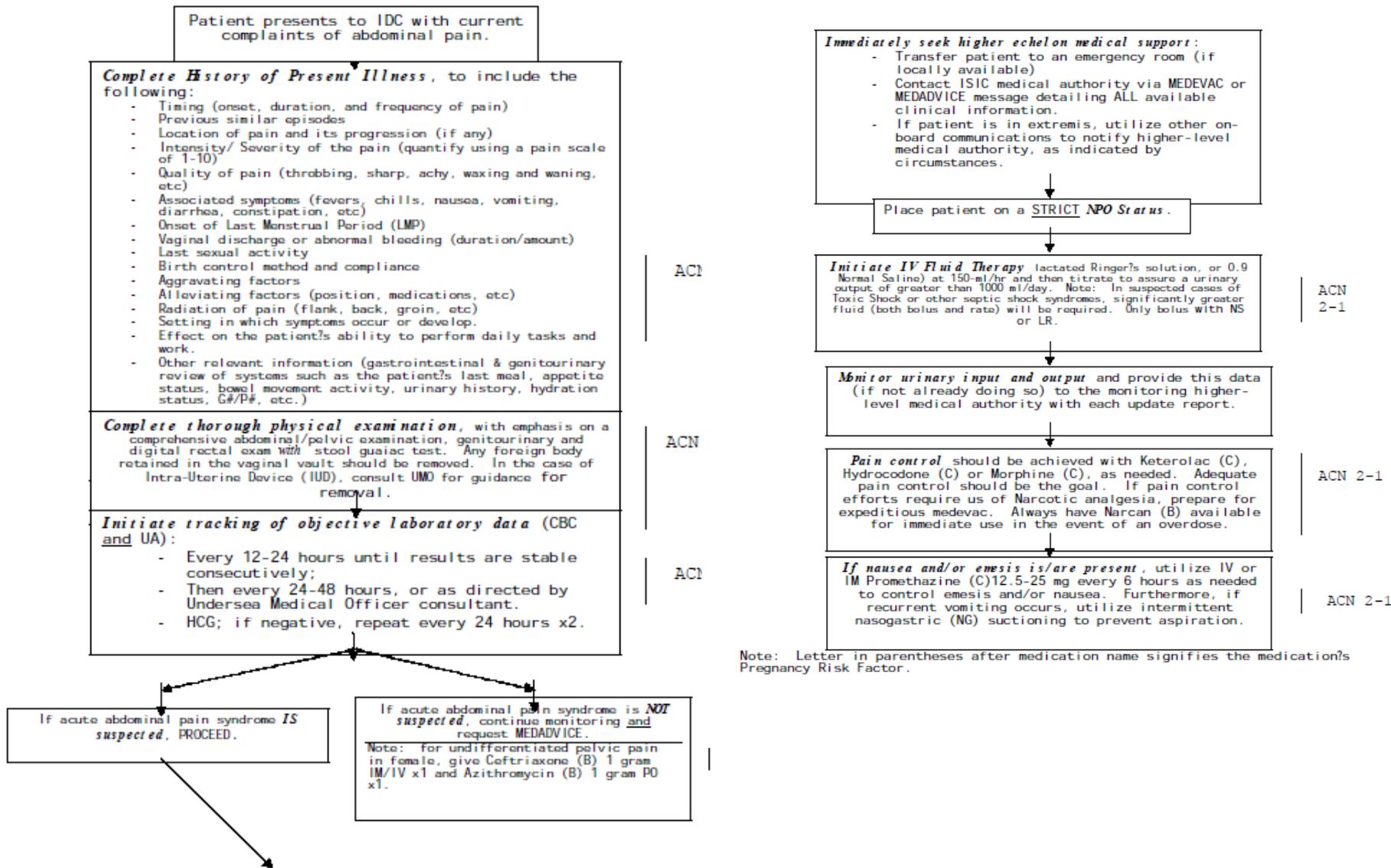


Submarine Medicine

- Onboard
 - Submarine IDC (1)
 - EMAT Team (6)
- Ashore
 - Undersea Medical Officer
 - Usually 2-3 per submarine base (20 subs)

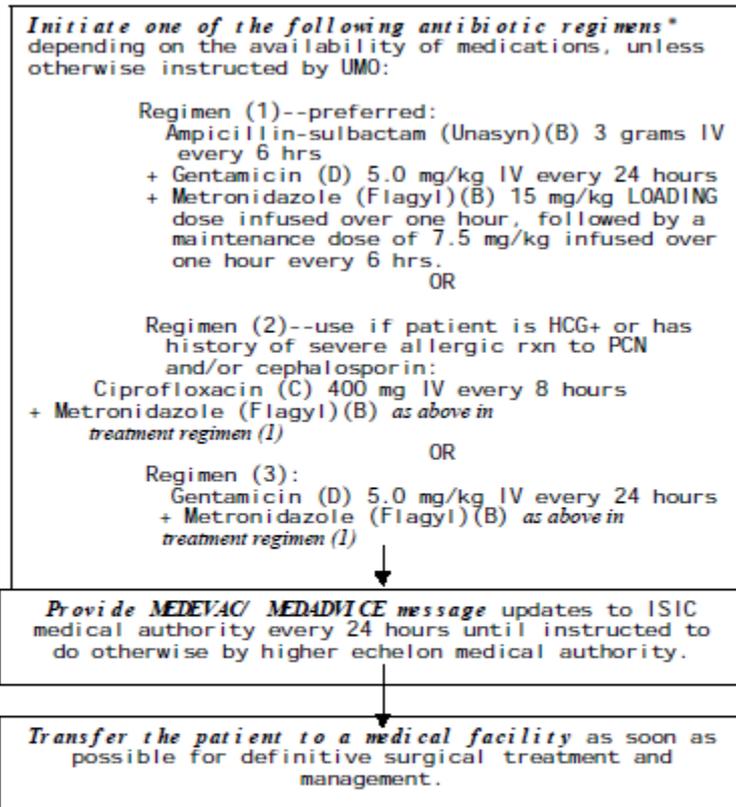


4. Abdominal Pain Management Algorithm:



Note: Letter in parentheses after medication name signifies the medication's Pregnancy Risk Factor.

ACN 2-1



5. Medical Department personnel shall familiarize themselves with the prescribing and administration data that accompanies these medications prior to their use.

6. AMALs should be stocked with appropriate quantities of medications to ensure adequate and timely medical care.

Note: Letter in parentheses after medication name signifies the medication's Pregnancy Risk Factor.

ACN
2-1

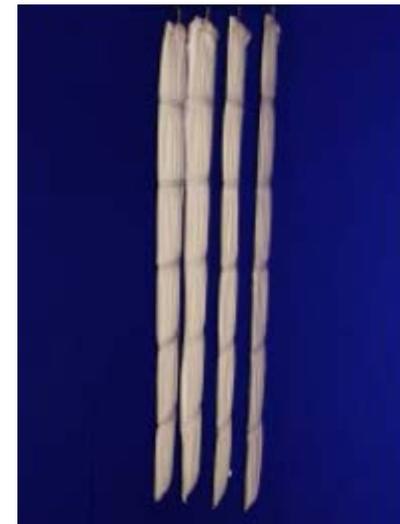
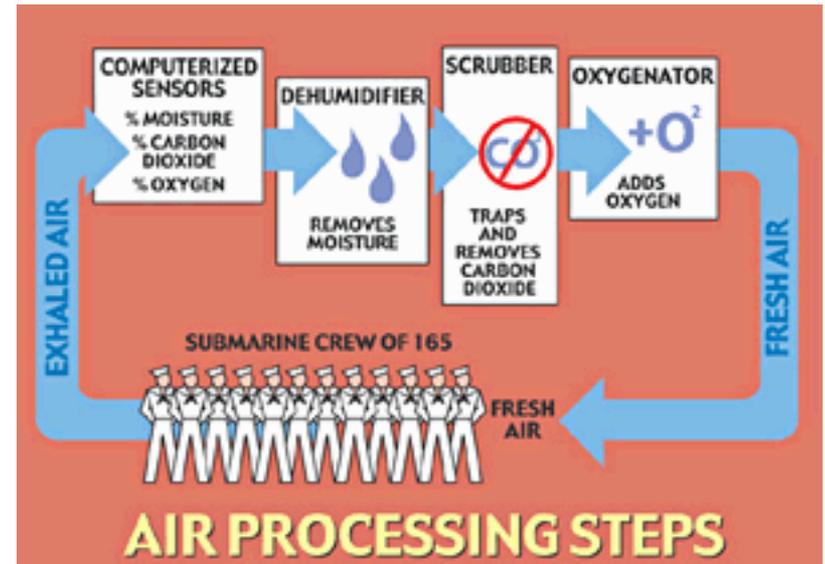
Unique Work Environment

- Atmosphere
- Space/Evac limitations
- Mental health considerations
 - Screening
 - Medications
- Nuclear Propulsion
 - Radiation monitoring
- DISSUB/Escape



Atmosphere

- Oxygen
 - Candles, hydrolysis
- Carbon Dioxide
 - Scrubbers, LiOH crystals
- Toxic gas
 - Weapons
 - Fires
- Pressure



Space/Evacuation Limitations

- IDC “Doc’s” space
- Limitations
 - Medications
 - Equipment
- Procedures
- Passageways
- Difficulty of MEDEVACs
 - Stealth
 - Egress/Sea state



MEDEVACs

- For life, limb, or eyesight
 - If IDC unable to determine problem
 - If care required exceeds IDC's ability
 - If care required will exhaust medical inventory
- Commanding Officer ultimately responsible
- 2012 COMSUBGRU 7
 - 2.6 MEDEVACs/submarine for all issues
 - 1.6 MEDEVACs/submarine for mental health issues



Mental Health Issues

- No personal space whatsoever
- No escape from workplace conflicts
- No sunlight for long periods
- Disrupted sleep/wake cycles and sleep deprivation
- Concern for danger of excessive sea pressure
- Concern for danger from enemy targets
- Socially intense, physically-closed, and potentially dangerous working environment
- Little contact with outside world
- Periods of sensory deprivation

SUBSCREEN

- 5 Major Dimensions
 - Procedural Scales (Faking, Extreme Responding)
 - Submarine Scales (Problems Submerging, Uncertain about Subs)
 - Affective Scales (Depressed Mood, Anxiety)
 - Socialization Scales (Aggressive-Destructive, Social Isolate)
 - Additional Scales (Suicidal Thoughts, Claustrophobic Feelings)

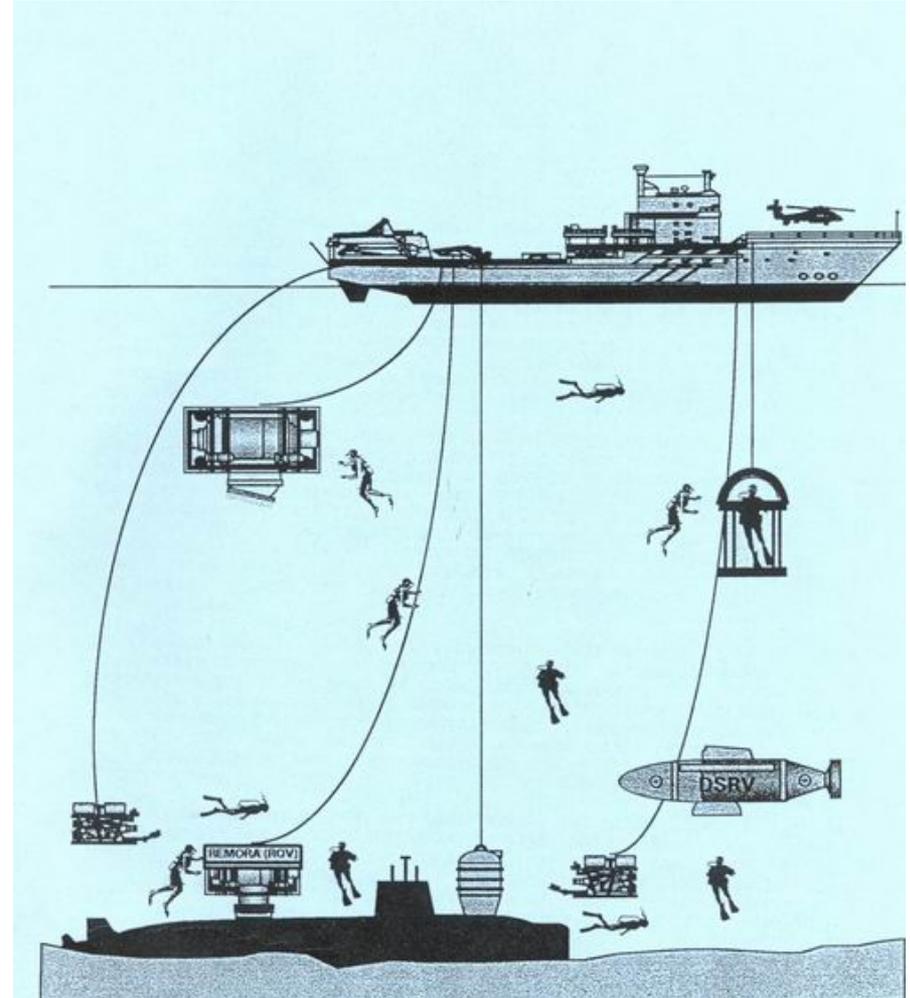
Psychological Screening of Submariners: The Development & Validation of the Submarine Attrition Risk Scale (SARS)

Presentation at IPMAAC by Dr. Mark N. Bing, SUBSCREEN Principal Investigator
co-author: CDR Eisenberg

Naval Submarine Medical Research Laboratory Submarine Base New London

DISSUB

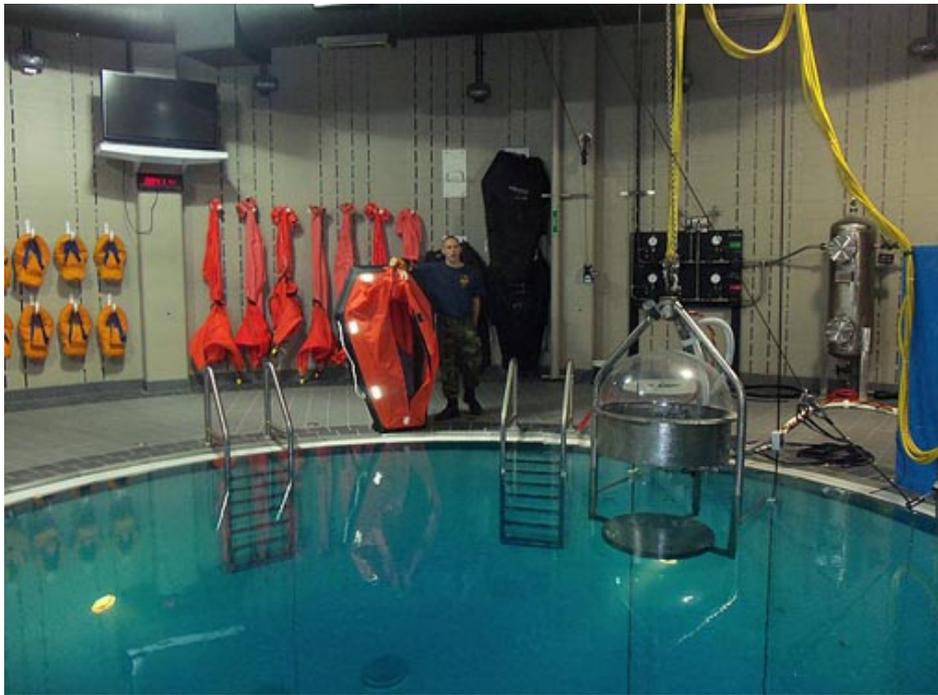
- Potential for many and varied casualties
- Submariners become deep sea divers

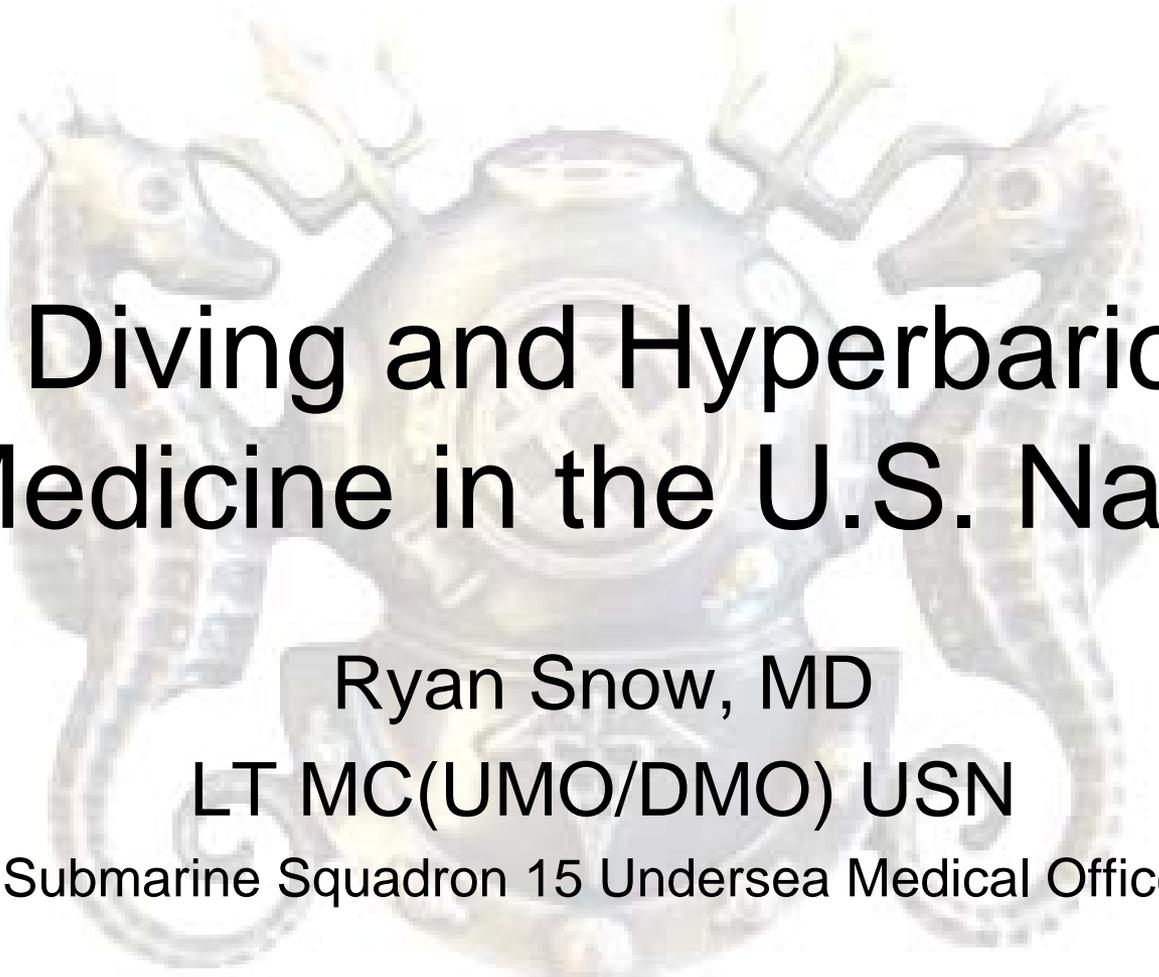


Escape

- Only a viable alternative to a certain depth







Diving and Hyperbaric Medicine in the U.S. Navy

Ryan Snow, MD

LT MC(UMO/DMO) USN

Submarine Squadron 15 Undersea Medical Officer

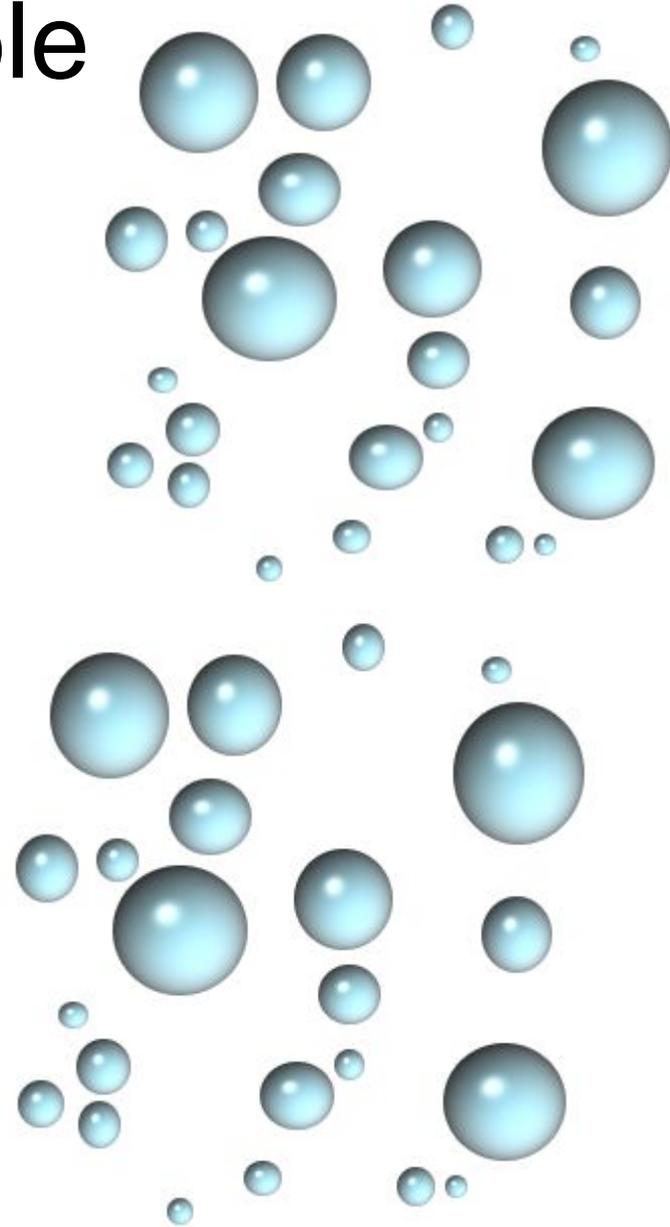
What is Diving and Hyperbaric Medicine?

- Decompression Illness (DCI) “The Bends”
- Arterial Gas Embolism (AGE)
- Barotrauma
- Trauma
- Bad gas (toxic exposure, CO, CO₂)
- Near drowning
- Shallow water black out
- Swimming Induced Pulmonary Edema (SIPE)
- Hypothermia
- *Wound care/Infection*
- *Iatrogenic air embolism*

Decompression Illness

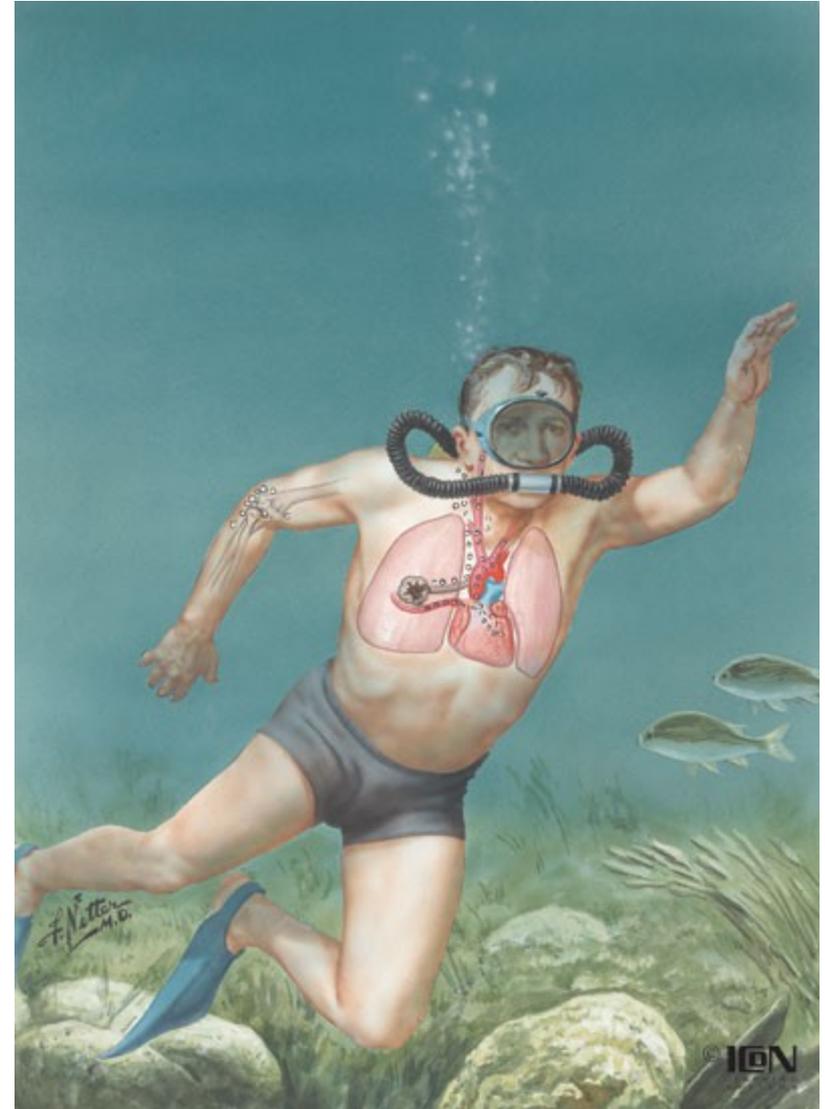
Bubble Trouble

- Bubbles thought to cause:
 - Emboli
 - Inflammation
 - Compression on local tissue



Decompression Illness Overview

- Type I DCI
 - Joint Pain
 - Skin
 - Lymphatic
- Type II DCI
 - Neurologic
 - Inner Ear
 - Cardiopulmonary
- AGE
 - Neurologic

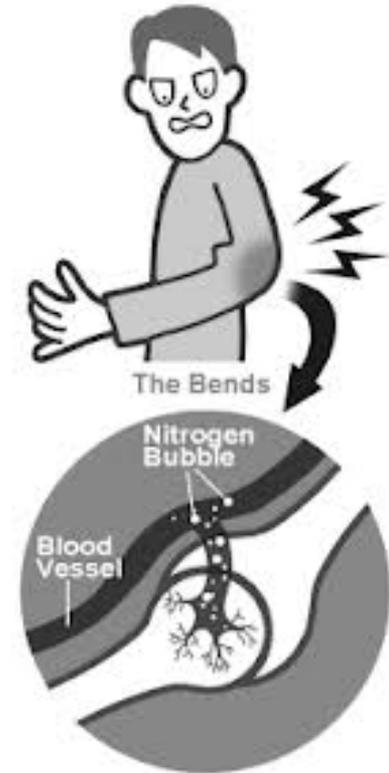
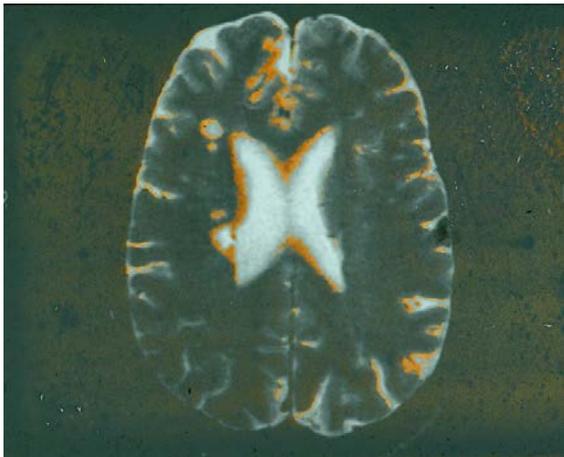


Hyperbaric Oxygen Therapy

- Delivery of increased partial pressure of Oxygen:
 - Reduce bubble size
 - Increase diffusion gradient
 - Increase O₂ delivery to damaged tissue
 - Inflammation modulation
 - Several other proposed mechanisms

Hyperbaric Treatment Indications

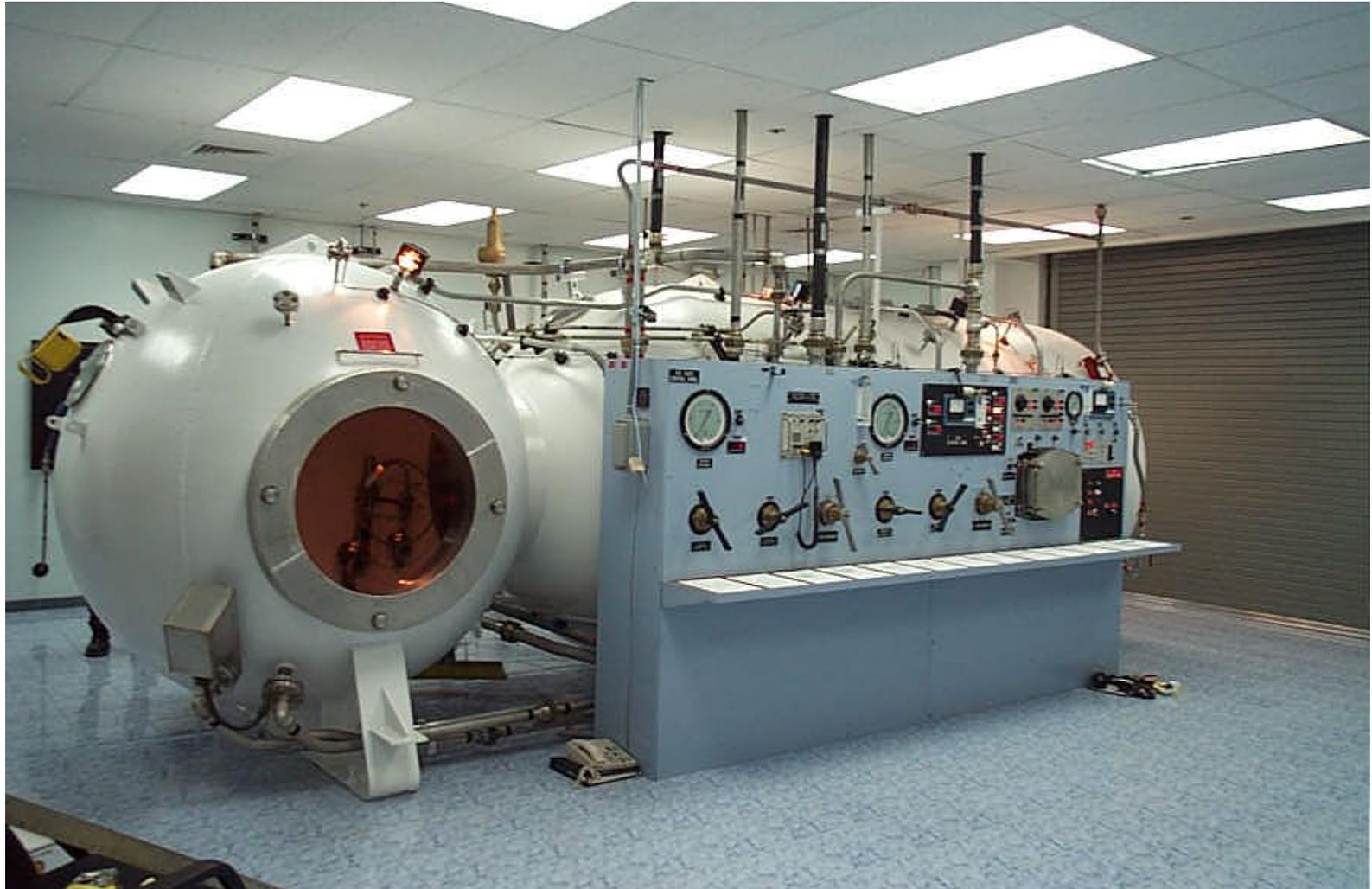
- Primary Indications
 - Decompression Illness (DCS)
 - Arterial Gas Embolism (AGE)
 - Carbon Monoxide / Cyanide Poisoning



Hyperbaric Treatment Indications

- Adjunctive Indications
 - Clostridial Myonecrosis
 - Necrotizing Infections
 - Chronic Refractory Osteomyelitis
 - Intracranial Abscess
 - Acute Traumatic and Arterial Ischemia
 - Compromised Skin Grafts and Flaps
 - Radiation Induced Tissue Damage
 - Enhanced Healing in Select Problem Wounds
 - Thermal Injuries
 - Exceptional Blood Loss Anemia

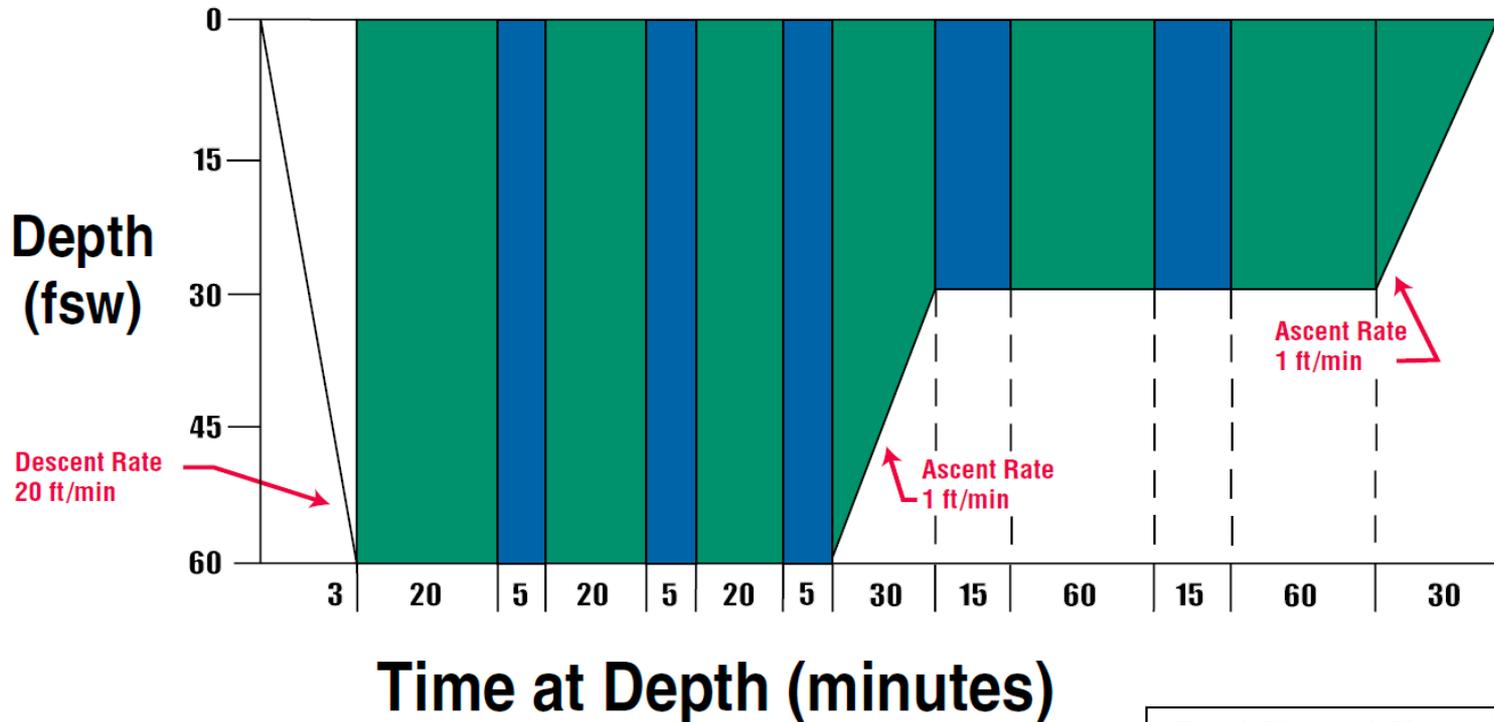
Hyperbaric Chamber Treatment



Hyperbaric Chamber Treatment

US Navy Treatment Table 6

Depth/Time Profile



Breathing Media
= Oxygen = Air

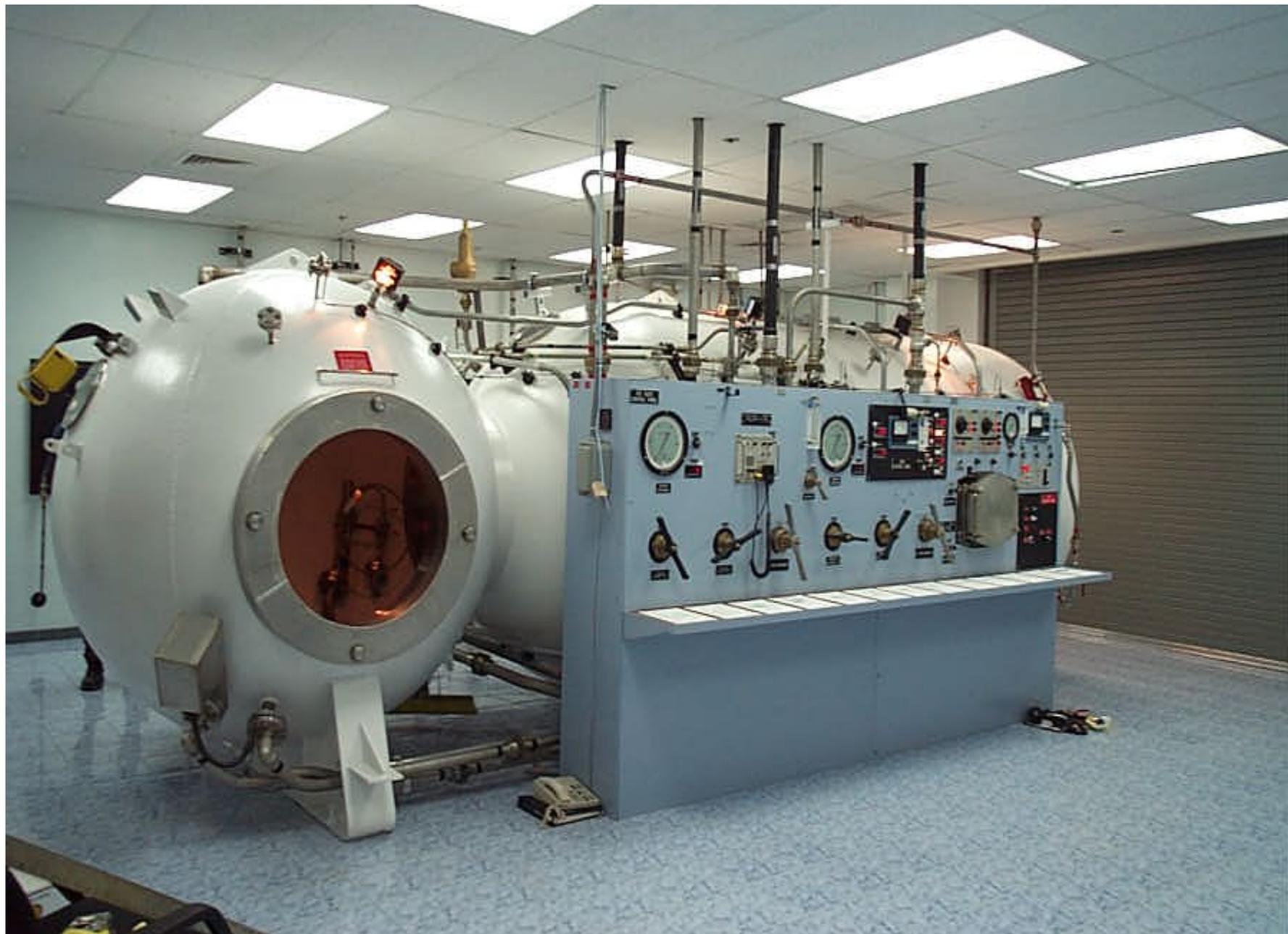
Total Elapsed Time:
285 Minutes
(Not Including
Descent Time)

Hyperbaric Chamber Treatment



Hyperbaric Chamber Requirements

- Locks: inner, outer, medical
- Communications: electrical, sound powered phone, hammer
- Atmosphere control: O₂, CO₂, temp, humidity
- Fire: cotton clothing, H₂O extinguishers
- Power: AC ideal, not required in emergency, DC or mechanical backup
- Gas requirement: storage banks (tank farm, air, O₂), compressor to recharge



Who are our patients?

- Deep Sea Divers
- SEALs
- Explosive Ordnance Disposal (EOD)
- Underwater Construction Teams
- Saturation Divers
- Experimental Dive Unit
- Submarine Rescue (DISSUB)
- Pilots
- Civilians

Navy Deep Sea Divers



SEAL Delivery Vehicle



Explosive Ordnance Disposal



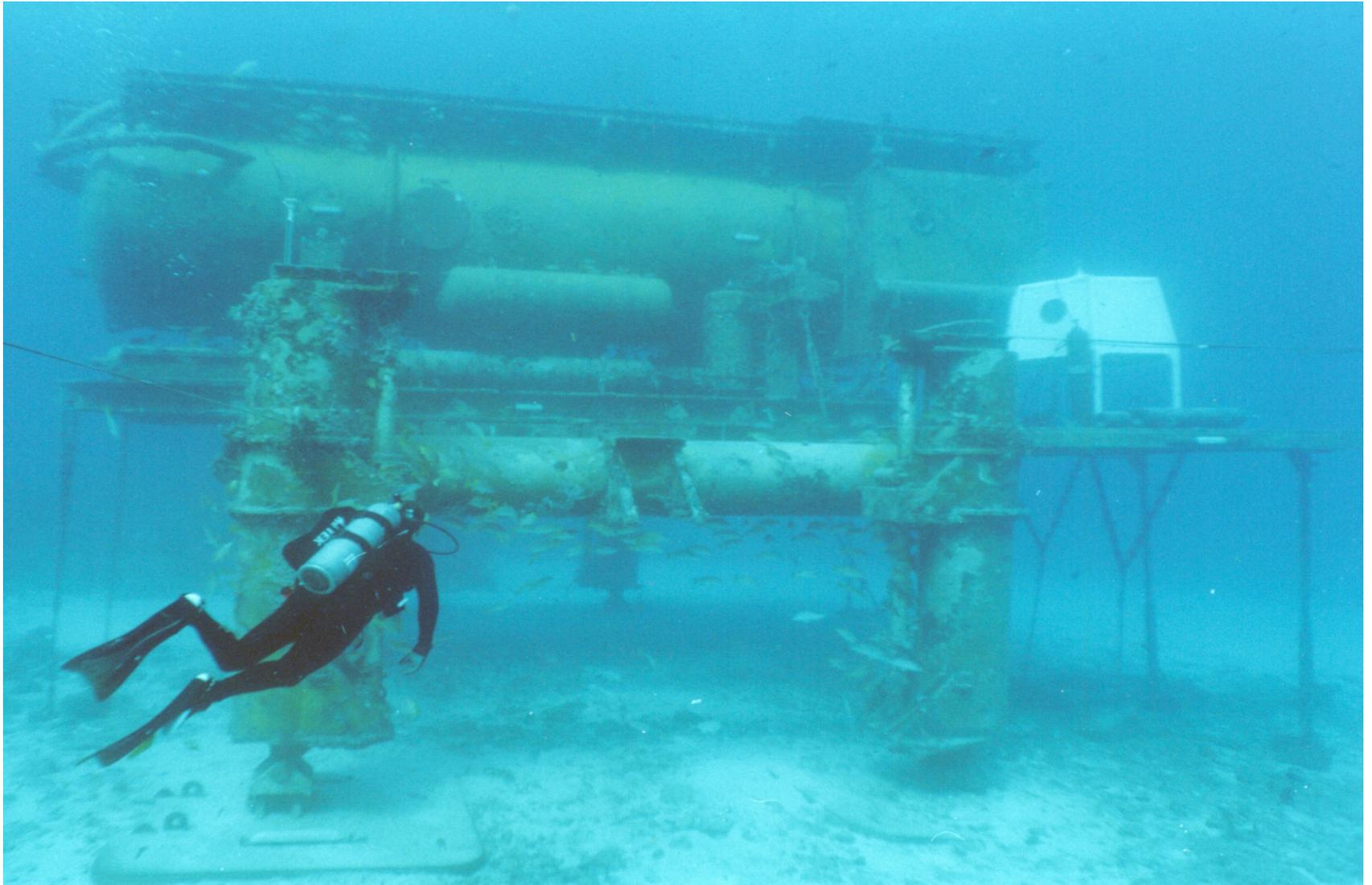
Underwater Construction Teams



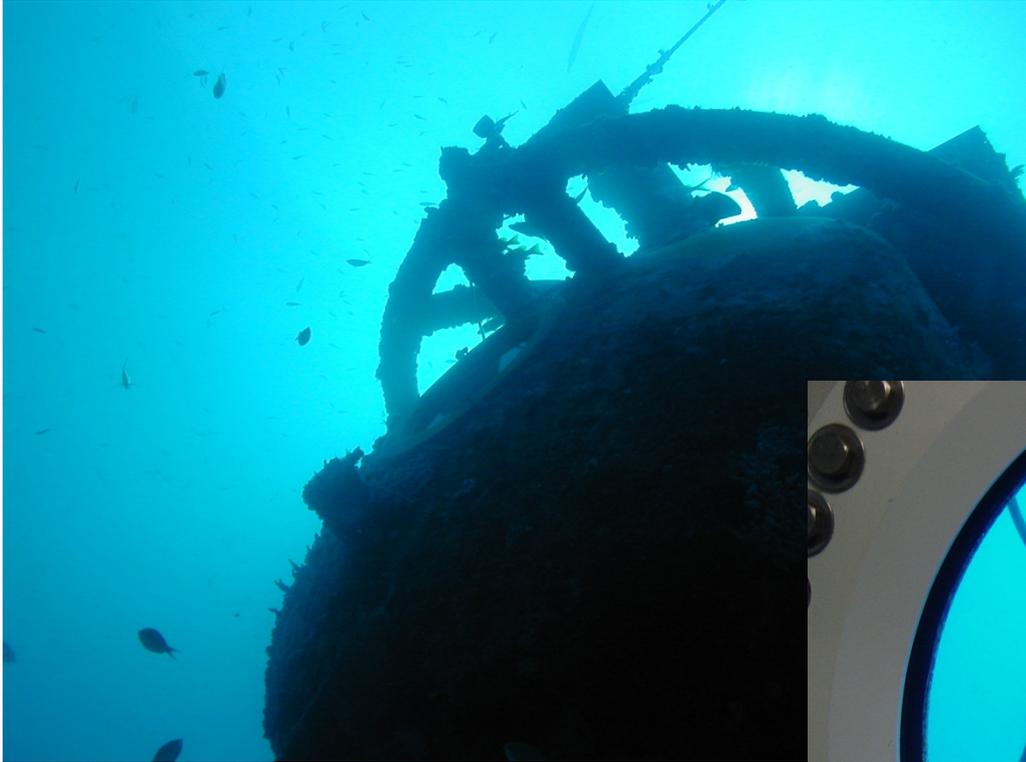
Saturation Diving



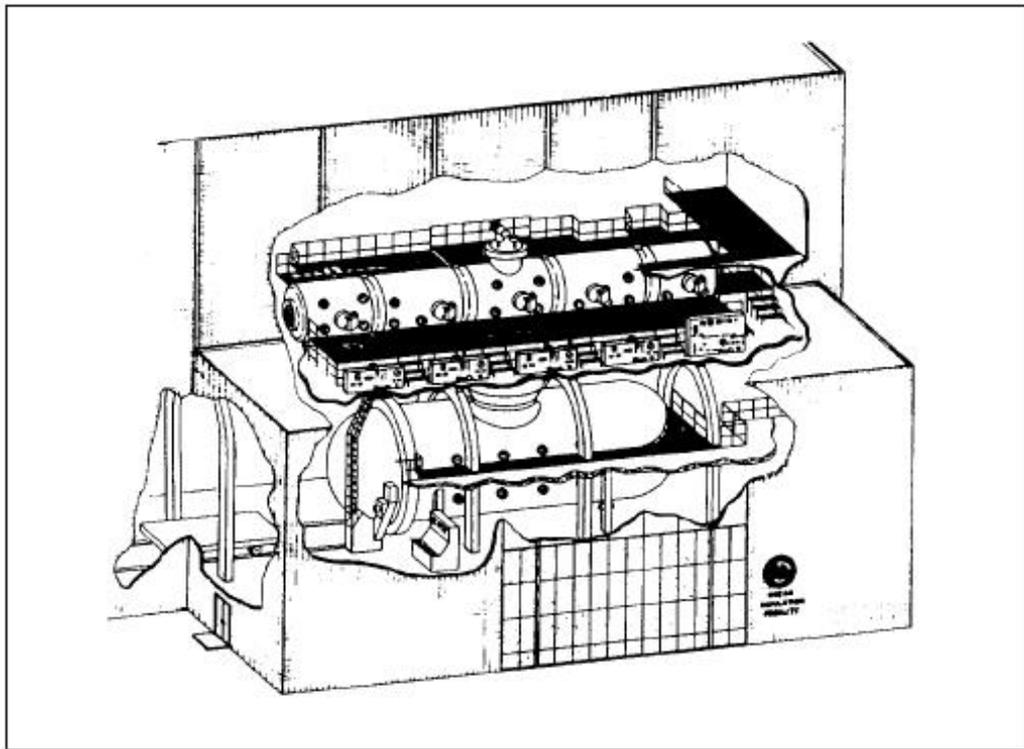
Aquarius Undersea Habitat



Aquarius Undersea Habitat



Navy Experimental Dive Unit



The background of the slide features a large, faded circular logo for the USS San Francisco. The logo contains the text "SSN 711" at the top, "SAN FRANCISCO" in the middle, and "COMSUBGRU 7" at the bottom. It also includes a central figure and a star.

USS San Francisco

Underwater Collision
January 2005

HMC (SS/SW) James Akin

COMSUBGRU 7 Group IDC

Mass Casualty in an Isolated Environment: Medical Response to a Submarine Collision

CDR Christopher John Jankosky, MC USN

ABSTRACT On January 8, 2005, the *U.S.S. SAN FRANCISCO* (SSN 711), a nuclear-powered submarine, collided with a seamount in a remote Pacific Ocean location. The high-speed impact resulted in injuries to 90% of the crew. Subsequent emergency medical response is described as well as the 3-month physical and psychological morbidity. Recommendations for medical training, equipment, and policy for workers in isolated environments are discussed.

USS San Francisco

- ~72 Injured men
- 3 severely injured
 - 1 death
- 32 with notable injuries requiring evacuation
- ~10% injury free
 - Located in bathroom stalls and bunks



TABLE I. The Most Significant Injuries Associated with the Collision

Injuries
Fracture (9)
Upper extremity (3)
Other head/neck (2)
Ribs (2)
Basilar skull (1)
Lumbar spine (1)
Concussion (9)
Shoulder dislocation (2)
Head or face laceration (23)

Total number of patients in each category is shown in parentheses.

Injury Patterns

- Most common injuries were head lacerations
 - Sharp overhead piping and equipment
- MM2 Ashley died from basilar skull fracture
 - Collision with metal locker
- Hospitalizations for laryngeal fracture, orbital fracture, and humerus fracture
- 99% of injuries were due to the body used as a projectile







60 Minutes Clip

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Medical Assistance Issues

- Sea state prevented safe small boat transfer of MM2 Ashley
- Helo transfer for UMO and a SEAL corpsman at 24hr point
- After failed evacuation of MM2 Ashley, another helo transfer took place to bring on a trauma surgeon.











TABLE II. Patients with Residual Medical Problems 3 Months following the Collision

Patients	Medical Problems
On full duty, receiving medical care while working on the submarine (4)	Herniated cervical disc (1) Unresolved thumb injury (1) Unresolved low back strain (1) Post concussive syndrome (1)
On limited duty, receiving medical care and not working on the submarine (6)	Shoulder rotator cuff tear (1) Knee injury (1) Mental health (4)
Disqualified from submarine duty (11)	Mental health (mostly PTSD or adjustment disorder) (11)

Total number of patients in each category is shown in parentheses. PTSD, Post-traumatic stress disorder.



Questions?