Challenges in Undersea Medicine

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April 2016
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Panel Members

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- David Southerland, MD, Acting Program Manager, Deep Submergence Biomedical Development Program, Office of Supervisor of Salvage and Diving, Naval Sea Systems Command
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April 2016
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To compensate for human shortfalls in operating under water.

- **Approach**: Enhance human physiology, provide technology to do so or set appropriate operational limits
- **An ONR National Naval Responsibility**
  - Sustain robust international research capability and Navy labs
  - Cultivate pipeline of scientists and engineers
  - Provide S&T products that ensure future superiority in the undersea domain
- **Direct and immediate warfighter application**
  - Diving and Salvage: hull repair, recovery, rescue
  - Special Warfare (SEAL & EOD): stealthy ingress, route clearance
  - Submarine Force: long missions, confined space, limited senses
UMed Focus and Pathway

Basic Research Lanes
- Decompression Sickness
- Oxygen Toxicity
- Diver/Submariner Health + Performance
Funding Opportunities

• ONR is the Basic (6.1) and Applied (6.2) research agency
• General submission information for academia and industry
  – Fiscal Year Broad Agency Announcement (BAA)
  – Rolling submission throughout fiscal year
• Strong UMed small business program (SBIR/STTR)
  – Human factors of technology for divers
  – Development of research tools
• Other ONR Funding Opportunities
  – Basic and Applied Research Challenge (BRC & ARC)
  – Multidisciplinary Research Program of the University Research Initiative (MURI)
  – Defense University Research Instrumentation Program (DURIP)
  – Young Investigator Program (YIP)
  – ONR Global
Deep Submergence Biomedical Development Program

David Southerland, MD
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Apr 2016

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Opinions expressed are my own and are not necessarily those of the Naval Sea Systems Command.
Deep Submergence Biomedical Development (DSBD) Program

An integrated biomedical/bioengineering advanced development (6.4) R&D effort to enhance U. S. Navy capability in:

- Enhancement of Survival of Submariners in a Disabled Submarine (DISSUB) scenario
- Diver Health and Safety
- Biomedical Criteria for Diver Equipment/Procedures

Sponsor: CNO-97 Undersea Warfare
Manager: NAVSEA 00CM
Products: 90% Guidance and Procedures
Current projects: 14 (Each runs ~1-3 years)
Current Researchers

- Navy Experimental Diving Unit, Panama City, FL (NEDU)
- Naval Submarine Medical Research Laboratory, Groton, CT (NSMRL)
- Naval Medical Research Center, Silver Spring, MD (NMRC)
- Duke University
- State University of New York at Buffalo
- University of Wisconsin
Human
- Nonclinical
- Greater than minimal risk (usually)

Animal
- Swine
- Sheep
Award Process

- Solicitation - Broad Agency Announcement
  - [http://www.supsalv.org](http://www.supsalv.org)
    --> 00C3 Diving --> Diving R&D BAA

- Pre-Proposal

- Invited Proposal

- Technical Advisory Board (TAB)
  - Membership: Operational and technical personnel
  - Review and Rank Proposals

- Awards based on ranking and funding available
Biased toward problems I see
(Formal Gap Analyses for Submarine and Diving medicine are currently in progress.)

- **DISSUB Submariner Survival**
  - Shallow air saturation decompression procedures after escape
  - Thermal model for dry, humid hyperbaric exposures with no fluid replacement.

- **Diver Health and Safety**
  - Integrated diving and altitude decompression model
  - Helium-Oxygen decompression table update
  - Robust CNS oxygen toxicity model

- **Biomedical Criteria for Diver Equipment/Procedures**
  - Tolerable Work of Breathing limits for dry, pressurized exposures
Biomedical Research in the Navy Laboratories: Animal Models and Advanced Development

CDR Hugh Dainer, MD, PhD
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Areas of Active Research

- Decompression Sickness
  - Disabled Submarines
  - Working Divers

- Oxygen Toxicity
  - Special Forces
  - Chamber Personnel

- Extreme Environments
  - En Route Care
  - Hypobaria
  - Hypoxia
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Submarine Medicine

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Commanding Officer
Naval Submarine Medical Research Laboratory
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• Naval Submarine Medical Research Laboratory, Groton CT
• Co-located on the largest submarine base in the US
• Echelon 4 to Bureau of Medicine and Surgery (BUMED)
• NSMRL Mission: Provide innovative human-centric research solutions aligned with the Submarine Force strategic direction, to sustain superiority in the undersea domain
• Conduct research across 6.1 to 6.7 domain
• 100% reimbursable lab, $ 9-11 M/year
• Transition products directly to the submarine force
• Sponsors: ONR, NAVSEA, BUMED, NASA, SUBFOR, NUWC, USARIELM, VA, others
NSMRL: areas of research focus

- Submariner health: medical and psychologic
- Aligning submariner medical standards to evidence
- Submarine escape and rescue procedures
- Submariner microbiome
- Hearing conservation efforts
- Resiliency, performance, team resiliency
- Cognitive performance
- Screening and selection of submariners
- Submarine atmosphere and environment
- Submariner epidemiology
For additional questions after the conclusion of the conference, send an email message to usarmy.detrick.medcom-usamrmc.mbx.mmpd@mail.mil