50 Years of Deep Ocean Telerobotic Exploration

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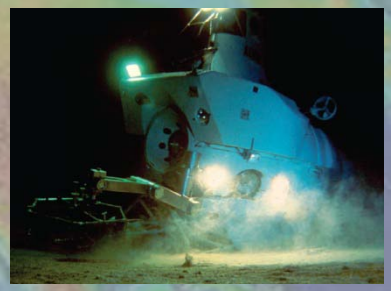
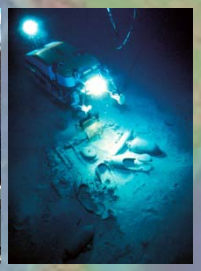
- 1964-Present: *DSV Alvin* submersible
  - *Human occupied vehicle*
  - *1 pilot, 2 scientists, 8-12 hour endurance*
  - *2 telerobotic manipulator arms*
  - *>4,700 Dives*
  - *>14,000 passengers (3 at a time)*
  - 1966: *Alvin* recovers lost H-Bomb
  - 1977: *Alvin* discovers hydrothermal vents and extremophiles



- 1985: Telerobotic vehicle *Argo* finds *RMS Titanic*
  - 1986: *Alvin* & *Jason Jr.* ROV explore *RMS Titanic*



- 1988-2001: *Jason 1 ROV*
  - *Remotely operated vehicle (ROV)*
  - *1 telerobotic arm*
  - *6,000 m depth rated*
  - *253 Dives*
  - *4683 Dive Hours*
  - *1700 km on bottom*

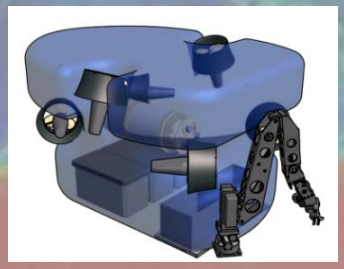
- 2002-Present: *Jason 2 ROV*
  - *2 telerobotic arms*
  - *6,500 m depth rated*
  - *>600 Dives*
  - *>10,600 Dive Hours*
  - *>4,800 km on bottom*

- 1995-2010: *ABE* Autonomous Underwater Vehicle (AUV)
  - *222 Dives*
  - *>1800 Dive Hours*
  - *>3,500 km on bottom*
  - *Discovered 5 hydrothermal vent sites*

- 2009-Present: *Sentry* AUV
  - *6,000 m dept rated, 50-100 km range*
  - *>140 Dives*
  - *>1300 Dive Hours*
  - *>3,000 km on bottom*

- 2007-Present: *Nereus ROV/AUV*
  - *Hybrid autonomy: AUV mode and ROV – fiber optic and acoustic telemetry*
  - *1 telerobotic arm*
  - *AUV mode and ROV mode w/manipulator*
  - *11,000 m depth rated, 30-60 km range*
  - *Deepest diving robot vehicle -3 dives to the bottom of the Mariana Trench*
  - *>20 Dives*
  - *> 200 Dive Hours*
  - *Discovered 3 hydrothermal vents*

- 2014: *Nereid Under-Ice ROV/AUV*
  - *For operations under Polar ice shelves and in marginal Polar ice zones*
  - *Hybrid autonomy: AUV mode and ROV – fiber optic and acoustic telemetry*
  - *1 telerobotic arm*
  - *2,000 m depth rated, 30-60 km range*



Sponsors Include: NSF, ONR, NASA, NOAA, WHOI, and JHU.

Image Source: Woods Hole Oceanographic Institution