Footage All shots are original to the project unless otherwise indicated. All archive footage is Crown Copyright or Library of Congress (copyright free).

Music. All music in the program was specially composed for the project.

Time Code	Shot Information and Source	Commentary, Interview and Sync.
10.00.00.00		CLOCK THE EDGE Front Title
10.00.20.00 10.00.25.00 10.00.30.00 10.00.35.00 10.00.39.00 10.00.45.00	Rough Sea. ©Library of Congress RUSSIAN FLEET OPERATIONS IN MEDICINE. NWDNM(m)-428-NPC-44732. Russian sailors. © DarlowSmithson. The Kursk. © DarlowSmithson. Rough Sea. © Library of Congress. RUSSIAN FLEET OPERATIONS IN MEDICINE. NWDNM(m)-428-NPC-44732. The Kursk. ©DarlowSmithson. Barents Sea. ©Crown Copyright.	The sea has no mercy. These young men are Russian sailors. Within a year they would all be dead. On the 12th of August 2000 a massive explosion thundered under the Arctic Circle. The *Kursk* a giant Russian submarine is torn apart and crashes to bottom of the Barents sea. For 10 days the Russian Navy try to make contact. The LR5 one of the most advanced rescue submersibles in the world , contracted to Britain's Royal Navy is called to the site. But it's too late. All 118 hands are lost.
10.01.12.00	Royal Navy Submarine © Crown Copyright.	The ocean is an extreme and hostile environment. We know more about the moon than we do about the deep. Submarines are the ultimate extreme machines. But what happens when something goes wrong –when a submarine sinks ? And why is submarine escape so difficult?
10.01.30.00	Royal Navy Submarine © Crown Copyright.	<u>ESCAPE FROM THE DEEP</u>
10.01.37 10.02.01.00 10.02.04.00	Frigate ©Crown Copyright Surf Vanguard and Mystic LR5 aboard Belos.	To find out we followed Operation Sedgemore, the submarine rescue exercise staged every 5 years by British, American and Swedish naval forces off the coast of North-west Scotland The principal players , – the most advanced submarine rescue craft in the world - the US Navy's Mystic and the British Navies' LR5.

10.02.16.00 10.02.33.00 10.03.11.00	All from "TAKE 'ER DOWN". © Library of Congress. NWDNM (m) 428-9294. Audio "TAKE 'ER DOWN".© Library of Congress Still: Truculent © Royal Navy Submarine Museum.	Its 100 years since the first submarines were introduced into the British and American navies. Sailors called the first submarine fleets, the 'coffin service'. In World War 2 submarines played a new and critical role. Winston Churchill said 'Of all servicemen , none face more terrible dangers than the sub-mariners'. All told almost 100 thousand of them were lost at sea. Escape equipment and training were crude. In battle - rescue was never really an option. But in peace time loss of life was unacceptable. On a freezing night in January 1950 HMS Truculent with 79 crew aboard collided with an oil tanker in the Thames estuary Truculent flooded and in a minute sank 75 feet down. Trapping her crew. Few survived, one of the few was Les Stickland.
10.03.26	Les Stickland CAPTION: LES STICKLAND HMS Truculent, British Empire Medal.	*Just before 7 o'clock the engine stopped and we had an enormous impact, the boat heeled too port sharply and we realized something was very wrong. I went to my emergency station, the control room I was responsible for diving and surfacing equipment.* *I blew the tanks trying to keep boat on a level keel…very shortly after water got into batteries we had a pyrotechnic display and then darkness.*
10.04.22.00	Int. Submarine. Reconstruction. Submarine Escape & Rescue © Crown Copyright. BDFL.	Its almost impossible to imagine the terror ….the hull breached, sea water thundering in. Fighting to close watertight hatches. Inside the Truculent the concentration of exhaled Carbon Dioxide was becoming dangerous.
10.04.42.00 10.04.52.00	Les Stickland Still: Truculent Crew © Royal Navy Submarine Museum, Crown. BDFL.	*… it kicks you out u cant remember what you are doing or think straight and we were terrified we would be poisoned and escape would go sour.* *We could hear propellers above, we assumed wrongly were rescue boats waiting for us. Our biggest concern was that we would come up under the propellers.* *We decided we would have to take that chance.*

10.05.25.00 10.05.31.00	Still: Truculent Crew © Royal Navy Submarine Museum - Crown. Reconstruction Submarine Escape & rescue © Crown. BDFL.	The Truculent crew knew their air supply would not last long. Inside the escape chamber the crew pulled down the canvas trunk to the escape hatch. They opened the flood valves and seawater filled the chamber. Once the pressure inside the chamber equaled the pressure outside the hull, the escape hatch could be opened. One by one they climbed into the trunk and kicked off to the surface. Into the unknown.
10.05.55.00	CAPTION: SUBMARINE ESCAPE TRAINING TANK, Fort Blockhouse, Gosport, England. All shots Submarine Escape & rescue © Crown. BDFL.	The desperate measure of making a free asccent is still an essential part of training. Today, at Fort Blockhouse the Royal Navy train submariners to make a free ascent in a 10 storey tower of water. At the base of the tower the trainee submariners breathe in compressed air. Rising they blow out as the air in their lungs expands. Hold your breath, your lungs will burst . But for the Truculent survivors there was another hazard.
10.06.33.00	Les Stickland.	*No problems on the escape until a few feet from the surface. No pressure on my lungs. I must have breathed out too quickly. Then I broke the surface. The feeling of euphoria breathing fresh air was fantasic.* *Then suddenly you realize that there is nothing there. No one to pick us up. A bitterly cold night. Water temperature just above freezing.* *Then very shortly after that friends began disappearing. Shouting crying screaming.*
10.07.30.00	Water surface.	The Truculent crewmen did not last long in the freezing water of the Thames. There were just 10 survivors.
10.07.41.00	Les Stickland.	*As far as I know it's the first and only time the submarine crew has escaped in its entirety. The tragedy of course is that having escaped very few were picked up.*

10.08.00.00	Rostrum: Headlines Int. Submarine. Escape Reconstruction © Crown. BDFL.	Losing so many men on the surface forced the British Navy to design a new kind of survival suit that would save lives. Today, the British designed Bofort MK10 is the state of the art survival suit. The hood fills with compressed air in the rescue chamber and allows free ascent from 600 feet pulling the submariner to the surface at 3 metres a second.
10.08.32.00 10.08.35.00 10.08.44.00 10.09.46.00	Frigate. <u>CAPTION</u>: OPERATION SEDGEMORE, Loch Alsh, Scotland. Helicopter. Zodiacs rescue Boats Parachutist into water. Beacon. Survival Suits put on. Trainees in water Int. Plane © Royal Navy Film Lib. Crown.	North West Scotland. Operation Sedgemore Day one– the Royal Navy Submarine Parachute Assistance Group, simulates a surface rescue. An RAF Nimrod picks up the SOS and GPS signal from submarine indicator buoy. Submariners put on Survival suits - watertight, thermally insulated and with a built in life raft. The Mark 10 suits give submariners give a fighting chance - keeping survivors alive on the sea surface – long enough to be picked up. As the training team wait on the water, the parachute rescue team swings into action.
10.10.02.00 10.10.12.00 10.10.11.00	<u>CAPTION</u>: Lt. Cdr PHILIP BUCKLEY, RN. Commander Operation Sedgemore. Int. Rescue Craft © Crown. BDFL. Helicopter Rescue.	*Our Primary method of support is rescue rather than escape, escape is last line of defense, these sea conditions are benign, in the middle of ocean, chance of survival is worse.*
10.10.32.00	Aerial Submarine ©Crown.	60% of the world's oceans are over 5000 feet deep. Submarines have a maximum dive range of 1000 feet -where water pressure is a quarter of a ton per square inch. Beyond they'll be crushed. It is every submariners worst nightmare a systems failure, an on board explosion or collision, a breach in the hull.
10.10.52.00	Lt. Cdr.Philip Buckley.	*We believe, majority of accidents happen on Continental shelf and rescue vehicles can get down to that depth.*

10.11.04.00 10.11.14.00	Mystic unloaded from plane © Crown. CAPTION: OPERATION SEDGEMORE DAY 2, Glasgow Airport. Loch. Belos. LR5 on deck.	Sedgemore Day Two. The US Navy Rescue Vehicle Mystic is unloaded at Glasgow Airport. Operation Sedgmore moves into the principal RESCUE phase of the exercise. British and American Command transfers to the Swedish Support ship *Belos*. On deck the British rescue submarine LR5.
10.11.36.00	CAPTION: Lt. Cdr. ALAN HOSKINS Royal Navy Submarine Rescue.	*LR5 is the rescue sub we use and exercise so in case of a submarine accident we are ready to go down and rescue and survivors. We have used it best part of 20 years have adapted it….so its one of the finest in the world. Totally flexible, we are air transportable and flexible.*
10.12.18.00	LR5 over water.	The LR5 started life not in submarine rescue but in the North Sea oil business. Designed, built and owned by commercial operators, RUMIC, she is now contracted full time to Royal Navy Submarine Rescue. The LR5's homebase is on the Clyde in Scotland.
10.12.35	CAPTION: TOM HERON Chief Pilot, LR5, RUMIC, Glasgow.	*On the front the bumper bar. Protects the front of LR5. We have a tow hook and tow beam. Above that a pinger receiver. When we find the submarine we place a pinger on the submarine this is 27KHz beacon which bangs away every second. As we turn on the noise reaches max. Then we have a heading. Above that is sonar head.*
10.13.18.00 10.13.26.00	LR5 underwater © Submarine Escape & Rescue. BDFL. Crown. LR5 out of water.	Built from steel, reinforced glass fiber and acrylic, LR5 can operate down to fifteen hundred feet. Joints and seals are tested to withstand an outside water pressure of 1000 pounds per square inch. Powered by lead acid batteries she has a maximum speed of four and a half knots . The Plexiglas viewport is a centimeter thick. Underneath the craft the No 1 hatch and a surrounding steel docking skirt. The rescue chamber has places for 17. Survival kits are ready for each rescuee.
10.13.57.00	Tom Heron contd.	*The first thing we have is lithium hydroxide. Which allows CO2 to be scrubbed from the atmosphere. Its fitted with oral mask. Both ends are removed , has its own filters, this is placed over the top, oral mask is used a lung powered scrubber. Used in emergency if life support fails.*

10.14.05.00 10.14.50 10.14.57	CAPTION: COULPORT SUBMARINE BASE Gare Loch, Scotland. Int. Coulport © Crown. Vanguard and Mystic on back. Ext. Gotland. Vanguard.	Day three Sedgemore, the US Navy Mystic arrives at Coulport submarine base. There she is mounted onto the back of mother submarine HMS Vanguard. The focus of the exercise will be to rescue sailors from the Swedish Submarine *Gotland*. Simulating a distressed submarine, she'll rest on the sea floor. The task of the rescue craft will be threefold - locate, lock on and liberate the stranded sailors from the Gotland. The Mystic is the veteran of Submarine rescue vehicles. Constructed of three steel spheres within a fiberglass skin she has a maximum operating depth of five thousand feet. The Mystic story begins in the Cold War….
10.15.38.00 10.15.43.00 10.15.52.00 10.15.56.00 10.16.05.00 10.16.17.00 10.16.20	Atomic Explosion © Library of Congress. SECURITY THROUGH SEA POWER. NWDNM(m)-428-MN-8864 USS THRESHER © Library of Congress. NWDNM(m)-428-NPC-32804. Thresher Memorial Service © Library of Congress. NWDNM (m) 428-NPC-32766 RUSSIAN FLEET OPERATIONS IN THE MEDICINE © Library of Congress NWDNM(m)428-NPC-44732. Thresher Memorial Service © Library of Congress. NWDNM (m) 428-NPC-32766 LAUNCHING OF THE DEEP SUBMERGENCE RESCUE VEHICLE © Librray of Congress NWDNM 428 NPC 43829.	A series of submarine disasters forced the US Navy to look anew at their rescue capabilities. In April 1963, the US Sub Thresher sank on Atlantic sea trials, all 129 hands were lost. In the wake of the Cuban missile crisis the Soviet navy began regular Atlantic patrols. US submarines monitored Soviet missile tests. If fragments could be picked up from the ocean floor, then maybe Soviet nuclear capability could be assessed. US Space Program scientists were commissioned to design a new craft that would not only rescue trapped submariners but also gather strategic intelligence. In 1971 the Mystic was launched.

10.16.32.00	Ocean sparkle. Mystic on deck Out to Sea Harbour Ship Mystic on deck Ocean Men up hatch	Today her primary mission is humanitarian – saving the lives of sub-mariners of any nationality. Mystic's homeport is at the Deep Submergence Unit, US Naval base San Diego. Mystic and her crew exercise regularly off the California coast. Fifteen metres long an weighing 38 tons she has a crew of four and places for 22 rescuees The standard training dive is to Deep Seat - a fixed mating plate 2000 feet down– far beyond the range of any conventional submarine. Her technology is constantly modified and up dated.
10.17.19.00 10.17.49.00	<u>CAPTION</u>: MARK NAGORNIUK US Navy Mystic Mystic lowered into water.	*This here is the transfer skirt. It mates to the submarine. Underneath metal and metal contact and a bog O ring. What will happen is the DSRV will come down onto the contact and this shock ring will actually lift up to about here and you will be sitting on the skirt.* *This here is the propeller it puts out about 15 Horse power at 800 revolutions per minute. It gives us out hair raising top speed of four and a half knots.*
10.17.57	Mark and coffee cup.	*This is DSRV1 , what we have here is a simple styrofoam coffee cup and its going down to 2000 feet inside the canopy. On top of the vehicle. And due to the sea pressure, it wont actually crush it ….and waste it into oblivion, but actually shrink it till its about that tall and a little bit narrower* *DSRV 1 and the dive number 1027 and we'll take a look at it when you come back up.*
10.18.23.00	Mystic lowered.	The Mystic is lowered into the water from her support ship
10.18.29	Sorrells.	*When we go to dive, the pilot is going to pitch the craft, at a 40 degree angle and we are going to back down. He may want all of us in the aft sphere, if he does we all go back there.*
10.18.40.00	Int. DSRV.	Before they dive ,they pitch and roll the craft, shaking out air bubbles from inside the fibreglass skin.

10.18.51.00	Int. DSRV.	At a steady 4 knots she dives to the Deep Seat mating plate.
10.18.56	Sync Mark Nagorniuk, Int. Control Sphere DSRV.	*This little white square represents the DSRV. It gives us our heading. Our direction. We can get a contact of our sonar system and it will gives a bearing and a range. A bearing in degrees and a range in yards.* *This is the forward search mode.. its good to about eight thousand yards.*
10.19.23	Sea Floor. Int. DSRV. Monitors. Mating Plate.	At two thousand feet the outside water pressure on the hull is almost half a ton per square inch. Gently the pilot rests the Mystic on the mating plate. Inside the temperature approaches freezing. Outside the craft – darkness.
10.19.55.00	Sync Mark Nagorniuk. Int. Control Sphere, DSRV.	*Being under water, it's a very hostile environment, For humans and craft like this to be in and its just a feat of engineering that we can go down to 5000 feet and explore and even 2000feet and explore. But not to loose focus our primary job is submarine rescue and although its never happened and hopefully it never will, we are here just in case.*
10.20.23.00	Port hole. B+W monitor. Port hole and divers.	Returning to the surface divers pull the lifting frame beneath the craft.
10.20.37.00	DSRV raised up.	Mark NAGORNIUK showed us what 2000 feet of pressure does to a coffee cup. *This is our little friend the styrofoam cup and this is what 880 pounds of sea pressure does to a coffee. Cup. Same writing we did not alter it in any way except its size.*

10.20.57.00	Surf. Loch. LR5 on deck. Bridge. Gotland.	Back in Scotland Sedgemore continues, The LR5 rolls down the deck of the Belos into position. The final phase of the rescue exercise begins.
10.21.16.00	Int. Gotland. © Royal Navy. Crown. Control Room	Aboard the Gotland the Captain gives the order to dive. LR5 is lowered into the water.
10.21.24.00	Ext Gotland. LR5 lowered into water. Int. LR5.	Search Sonar locks on to the Gotland distress signal and at a steady 4 knots makes her way down. Conditions match the Kursk scenario - Sea temperature is just above freezing, there is a 3 knot cross current.
10.21.56.00	B+W Underwater LR5 © BDFL. Submarine Escape & Rescue.	
10.22.02.00	Gotland Crest. Escape hatch.	300 feet down LR5 approaches the Gotland. The Swedish Navy crest is clearly visible from the viewport
10.22.11.00	B+W Underwater LR5 © BDFL. Submarine Escape & Rescue. Escape Hatch.	Working her way aft the LR5 moves towards the escape hatch. The LR5 rests gently on the Gotland escape hatch, making a soft seal. As water is drained from the LR5 skirt beneath, the outside water pressure, over half a ton per square inch, holds it to the Gotland making a hard seal.
10.22.19.00	B+W Underwater LR5 © BDFL. Submarine Escape & Rescue. Int. LR5.	
10.22.30.20	B+W Underwater LR5 © BDFL. Submarine Escape & Rescue. Int. LR5. Int. Gotland.	The pressure between them is equalized and the LR5 hatch is opened. A crewman checks that seals to make sure no water is seeping in. The first Swedish sailors climb the Gotland escape tower up to the LR5.
10.23.06.00	B+W Underwater LR5 © BDFL. Submarine Escape & Rescue. Int. LR5 Swede mariner boards.	Success.
10.23.15.23	Vanguard and Mystic on Loch. Mystic in water.	On the fourth day of exercise HMS Vanguard and the Mystic start their phase of the rescue program. For the next six days the rescue craft perform another 20 successful rescue dives.
10.23.40.00	Aerial Royal Navy Submarine © Crown. Royal Navy.	The British and the Russian navies have now started a close dialogue. There is talk of a joint exercise, just like Sedgemore, in the future.

10.24.22.00	Lt Cdr. Phil Buckley.	*We are developing close relationship with Russian Federation. They have similar ideas, the design of their submarines are similar, there are subtle difference in philosophy. But we are keen to share information, because, escape, rescue safety are areas we can afford to be very open and honest about. Because, if there is a submarine accident in any country then we would all offer help assistance and assets as freely as we could do'*
10.24.25.00 10.24.31.00	Aerial Royal Navy Submarine © Crown. Royal Navy. Kursk © DarlowSmithson. B+W Russian sailors. The Kursk. © DarlowSmithson. Aerial Royal Navy Submarine © Crown. Royal Navy.	The Kursk was a wake up call, to submarine rescue services around the world. The question remains – had a co-ordinated international rescue effort arrived in the Barents Sea within 24 hours, would the lives of the Kursk sailors have been saved? Could the LR5 and the Mystic saved the lives of 118 Russian sailors? Today the goal is to give every submariner of any nationality the chance of survival should the unthinkable happen.

10.25.00.00	End Credits **Narrator** Jonathon Morris **Thanks to** DarlowSmithson Larry Southerland David Healy RUMIC WS Atkins Robert Feinburg RN Submarine Museum Alex Leger David Dean BDFL Library of Congress **Film Researcher** Paul Gardner **On Line Editor** Matt Ramsay **Additional Photography** Hugh Fairs Jim Gibson **Music** Stuart Briner **Programme Consultants** Vyv Simson John Mair **Editor** Nigel Barker **Director Cameraman** Peter Cannon **Series Editor** Ron Blythe	