

The deck decompression chamber being lowered into position aboard *Sea Diver*, during final preparations in Miami. This chamber would house Stenuit and Link during the 4-day decompression.

## Descent Three Preparations 1964

Edwin Link. A name synonymous with the romance of undersea exploration. Former aviation pioneer and businessman, he now devotes his life to inventing new devices to allow divers to work deep beneath the sea. A man of ceaseless energy for his passion. In recent years no one had done more to advance technology for underwater man.

I stand on a sun-washed pier in Key West. Behind me are the glittering crossroads of the open sea. In front of me is Edwin Link, walking with authority across the stern of his ship. Link makes the final adjustments to his diving gear and stands at the edge of the ship, which faces the harbour. He does not hesitate. In a motion that speaks determination, he leaps easily into the water.

I watch the bubbles released by the first breaths from his aqualung. They softly agitate the surface and then leave it undisturbed. Only quiet rings and small calms remain.

My gaze carries back to the stern of the ship. She is Link's own research vessel, *Sea Diver*, and the embodiment of all his dreams. Since 1959 she has carried Link to countless confrontations and adventures with the sea. Her one hundred feet of white gleaming length echo the same ocean confidence as her owner. She is Link's from the keel up. Every hatch and deck plate had been planned to support his undersea endeavours.

Behind the spot where Link has departed is an extraordinary array of diving equipment. It includes breathing systems, ballast trays, and a long aluminum chamber that sparkles wetness in the sun. The chamber is an underwater elevator, used to carry and protect two

divers deep within the sea. This submersible decompression chamber, or SDC, as Link calls it, has just been lifted from the water. Warm silver rivulets run down its sides and into steaming pools on the deck. Overhead, a large black lifting boom suspends long cables swinging black in the sun.

No more bubbles come from the spot where Link has dived. The harbour's surface is now unbroken except for tiny cat's paws of wind. To the casual observer it is as if Link had vanished.

He has, in fact, disappeared into a place of his own creation. Lying some thirty feet below the ship is a small underwater station. Link, who has designed it, is now inside it and sharing its air with one of his crew. There are two small strange structures at the bottom of Key West harbour. Link is in the first one, called SPID. It is a short black cylinder with an entrance hole beneath it. It is made of rubber and about the same volume as a two-man tent. The other structure is slightly larger. It is named *Igloo*, because of its hemispherical shape. It too is a Link creation, although he has borrowed the name. If an observer could lift the water away from this section of the sea he would gasp in disbelief. It is the stuff of science fiction.

For several days Link and his team have been conducting a long dive in the shallow waters beside the ship. They are almost finished. It is part of a slow crescendo of effort, leading up to the world's deepest long dive. In the protected waters of the harbour the team is trying to simulate the problems that lie ahead. It is a chance to shallow-test all the underwater systems and techniques. After eliminating the inevitable difficulties, they will move to a deeper, but still intermediate, depth. Some months from now, after repeated tests, Link and his team hope to challenge the deep ocean with confidence.

I move quietly to the corner of a long wooden crate. The sun is warm on my shoulders. I slip my shirt off and sit down to wait. I am not expected on board *Sea Diver* for the next hour, and there is a certain delight in being able to sit back unnoticed and look at my future place of work. All is quiet on the after deck of the ship. A lone figure in the deep shade of an awning watches a small control console. I can hear the muted voices of the divers below coming in over the intercom. My mind drifts back to the events which have carried me like a rushing stream to Key West.

It began soon after I left the hospital and my junior internship. I knew that the United States was the only country where I could pursue my interest in deep-diving medicine. In addition, there was only one man who was doing the kind of work that really interested me. He was a dynamic inventor, who recently had been developing systems to allow

divers to live and work for long periods deep beneath the sea. He was a living Jules Verne. He was Edwin Link.

But Link was as remote as the rings of Saturn. For months I had tried to contact him by mail and telegram, but his schedule always kept him just ahead of my reach. In addition to his own undersea development work, Link had just joined the review board investigating the sinking and loss of the nuclear submarine *Thresher*. In the fall of 1963 he was in Washington, moving from meeting to meeting. Each autumn day burdened him with more and more responsibility.

One morning I hesitantly picked up the phone and placed a person-to-person call to Link. After a three-hour search I was finally able to talk to him. I told him I wanted to come to Washington to inquire about joining his team. He agreed to a fifteen minute appointment the next day at ten o'clock.

I was exultant. After six months of trying, I would at last be able to tell Link personally how important it was for me to work for him. My mood did not last. I knew I would have to be convincing. Fifteen minutes is a short time.

We met in an old red-brick building at the Washington Navy Yard. From the window I could see the dark and icy currents of the Potomac River. In some of the nearby buildings, the United States Navy did much of its basic medical research into the effects of deep diving. Large and complex decompression chambers hummed with men testing themselves against the gas and pressure conditions found deep beneath the sea. Their findings represented the most advanced edge of manned diving technology.

As we sat down, Link fixed me with a stern eye. My shoulders sagged, as I suddenly felt the weight of confronting a man and his image.

I opened up like a verbal air hammer. In three minutes I had said everything. I told Link of my uneasy year of internship and my love for the sea. I emphasized repeatedly my concern for the bold men who wanted to live and work within it. I brushed by quickly any of my diving accomplishments. In this room, with this man, they seemed impressively pale.

Link just smiled and began to reveal some of the energy and enthusiasm he has for his work. He started to talk of his future plans.

"We'll stay here in Washington until the review board has finished its meetings. Then I'm going to take *Sea Diver* down to Key West. Sometime in late spring we hope to be ready to place two men at 400 feet on the continental shelf. We'll do it in warm clear water to minimize the difficulties of such a first step. Probably somewhere in the Bahamas. For the past few months we've been working on a small

rubber structure that will support two men for several days. Its name, SPID, stands for submersible, portable, and inflatable dwelling. We'll use our aluminum submersible chamber to carry the two men to the bottom and back to the surface. There'll be a larger deck-mounted chamber for them to decompress after the dive. It'll be a long trip home. They'll need room and comfort during decompression. Can you imagine decompressing for four days?"

The whole scheme had an incredible ring to it. It seemed an improbable, even impossible, challenge. I felt as if I was looking through a submarine telescope into the twenty-first century.

"There's a lot of work to be done, especially in physiology, but we're getting a great deal of help from both the U.S. Navy and the University of Pennsylvania. Our biggest problem is in diving medicine and life-support. How'd you like to come on board as our full-time doctor?"

The question shook me like two rough hands. My willingness must have been evident. Link laughed and said, "Good, I am counting on that huge enthusiasm you seem to carry. You'll need it, for it's a tough job ahead. During the next few months you will work under Dr. Lambertsen at the University of Pennsylvania. He knows more about diving medicine than anyone in the world. When we're ready, you join us in Key West. Then we'll go and tackle the deep dive."

I left the Navy Yard exuberant beyond belief. I had just been accepted as an apprentice into the world's most distinguished fraternity.

The exhilaration sustained me during the dark winter months in Philadelphia. Dr. Lambertsen and his staff patiently guided me through the basic problems of undersea medicine. They showed me the hazards which make man vulnerable underwater, and the preventative steps needed to ensure his safety. They outlined the steps in preparing life-support systems and treating emergencies. It was one of the most rewarding and instructive periods of my life.

Dr. James Dixon became my personal mentor for a series of high-pressure studies on small animals. The experiments were set up to test gas analysis equipment and to investigate the effects of extremely high pressures on mice. The results would provide clues to larger animal and possibly human responses. I would also gain experience with the oxygen and carbon dioxide analyzers we would use on the deep open-sea dive.

My "workshop" was a short, squat barrel of a chamber bristling with a porcupine quilt of equipment. Lights, pipes, thermistors, gauges, and wires worked weird pathways in and around its shell. A bank of high pressure gases stood nearby.

The most exciting moment came late on a March morning when I

looked into its interior to see four mice moving slowly about. The pressure gauge above the chamber read four thousand feet. Almost a ton of pressure on each square inch of white fur. Four small animals surviving pressures found almost two-thirds of a mile under the sea. They breathed a fraction of oxygen—about 100 times less than I was inhaling. The gas surrounding their small bodies was unbelievably dense. It must have felt like breathing thin soup.

The mice were not acting normally. They moved with faltering steps and squinted at me with half-closed eyes. However, the fact that they were able to survive at all suggested that man, too, might penetrate much greater depths. I knew we had a long way to go before man could step out of a diving bell at 2,000 feet, but here was the first modest indication of the kind of pressures man might be able to tolerate.

Mice are far less complicated than humans, and yet our experiments were not a simple task. We spent many long days investigating the limits of the tolerable mixtures of gas, the various internal temperatures, and the rates of compression. We had lost many mice when one of these factors was not exactly right. In order for men to reach this incredible depth, just the right life-support techniques had to be employed. It would be a long and difficult research journey.

Decompression would pose other problems. The stress effects of bringing animals back to the "surface" can be fatal. I suddenly realized how much more difficult it might be for men to survive, and I shuddered.

The warm Florida sun scatters my thoughts.

The water next to *Sea Diver* begins to boil into small pools of salt froth. A diver is about to surface or someone is venting the air space of the submerged structures. Two, and then three heads appear. It is Link and his divers. They are smiling.

I climb down to *Sea Diver's* hot grey deck and wait under the awning. Link comes easily up the ladder and over into the shade. He sloshes a trail of warm water behind him.

"Joe, I'm glad you've arrived. I'd like you to meet some of *Sea Diver's* crew." Several other young, tanned men appear from the ship's forward section.

"This is my son, Clayton, Robert Stenuit from Belgium, Dan Eden from England, and John Marguetis from Greece. We're proud of the fact that this is an international team. Your being from Canada makes it even more so. Welcome aboard."

I move slowly across the row of firm handshakes studying the young faces above them. I especially remember Stenuit: short, serious, the lead diver. Eden: tall, slender, the ship's engineer. Marguetis:



strong, stocky, the ship's cook. Clay Link, tall, blonde, resolute in stature. The whole crew has an unspoken air of purpose and camaraderie. I suddenly feel the vulnerability of the newcomer.

It is a sensation which does not last long. Within weeks I have earned the friendship of the small group of men. We grow to respect each other's skills and ambition. Our mission binds us together in the rare adhesive created when men confront a difficult objective.

We are facing some long and serious odds. There are hundreds of problems to be overcome before we can safely carry out the four-hundred-foot dive. Weeks, and then months, pass by. Each day is filled with minor successes and major delays. We often solve one problem only to find a larger one looming behind. Our preparations are more than simply "getting ready." We are, under Link's steady compass, developing new techniques and systems each step of the way.

Fortunately, the U.S. Navy experiments have already eliminated one of our most serious hurdles at their Experimental Diving Unit in Washington. Their simulated long-duration dive to four hundred feet paralleled the dive profile that Link planned for the open sea. Under controlled conditions, possible only in a laboratory, men and equipment were tested under the watchful eyes of over a dozen scientists.

After my return from Cocos, I worked at the Unit with Jim Dixon for almost a week. When I arrived in Key West, I reviewed the dive details with Edwin Link.

"Two Navy sailors climbed into one of the large chambers and were gradually pressurized to four hundred feet. They remained at this depth for twenty-four hours breathing four per cent oxygen in helium. While on the bottom they suited up and climbed down into a round pool to conduct swimming and other underwater work tasks. We saw them easily through the viewports. At all times they seemed perfectly normal. The only apparent difference from the surface was the high pitch and discord of their voices. They sounded like chipmunks in heat. I spoke to both the men after the dive. They hadn't noticed any ill effects. All post-dive tests confirmed this.

"Jim and I were primarily responsible for monitoring the oxygen and carbon dioxide levels. Jim set up the analyzers and we watched them every half-hour for almost a week. It was critical to ensure that the divers were maintained within a safe oxygen range.

"I was really impressed with the length of the decompression schedule. After twenty-four hours on the bottom the divers became 'saturated.' Their body tissues were almost completely 'full' of the gas that they were breathing. It took almost four days to decompress—an unbelievably long process."

Link listened quietly. He got up and moved across the floor. He was excited.

"Well, Joe, you saw your first deep saturation dive. I predict it's just the start. Over the next ten years there'll be hundreds. It's going to open up a new field of diving. Ours is a big responsibility. We'll be the first to confirm it can be done in the open sea."

Link is right. Military, commercial, and scientific teams will discover that the "saturation" technique allowed divers to remain at a given depth for an infinite period and then make one "final" decompression. One single ascent will replace the repeated decompressions necessary for short-duration dives. Saturation means increased time on the bottom, a savings in total decompression time, and increased diving safety. It is a major breakthrough.

Saturation was not a cure to the problem of decompression, but it did mean that the number of returns to the surface could be reduced. The danger of decompression results from the inert gas (nitrogen or helium) in the breathing mixture, which enters the body's tissues through the bloodstream. If the pressure is reduced too quickly, bubbles form in these tissues, in much the same way they do when a bottle of carbonated water is opened. Sudden decompression from a long, deep dive can be fatal; even a slight miscalculation of decompression requirements can cause serious injury to the joints or the central nervous system. A diver must therefore be decompressed slowly, according to a careful schedule, so that the inert gas can be washed out of the tissues by the blood and then exhaled by the lungs. Whereas the demands of decompression become more stringent with depth, with time they increase only up to a point. After about twenty-four hours at a given depth, the tissues become essentially saturated with inert gas at a pressure equivalent to the depth; they do not take up significantly more gas no matter how long the diver stays at that level. Therefore, if a diver must descend to a certain depth to accomplish a time-consuming underwater task, it is far more efficient for him to stay there than to return to the surface repeatedly, spending hours in decompression each time. Although this "saturation diving" is efficient, it imposes an extra technical burden, because the schedules for the ultimate decompression must be calculated and controlled with particular care.

I look out *Sea-Diver's* window and into the sea. If only she will keep a calm, serene face for us. . . .

One of our remaining problems is to devise a practical method of removing the carbon dioxide which will be produced inside the SDC and SPID. A diver exhales about a cubic foot of this gas every hour. On the



surface, carbon dioxide is quickly diluted by the surrounding air. But in close spaces, such as diving helmets and underwater stations, the gas builds up. Toxic levels are soon achieved and lead to breathing difficulties and unconsciousness. The gas must be removed with a carbon dioxide scrubber system. However, in 1964 there is no such system. We need something small and reliable. We need it quickly. Otherwise we cannot consider the deep dive.

Link's solution is typical. One day he comes on board with a small package. It is the electric motor of a standard vacuum cleaner. He places it on the work bench. It is the perfect motor. Its exhaust can be used to blow gas across the chemicals that remove carbon dioxide. We encase the whole device in a metal cylinder three feet long and eight inches in diameter. Suddenly we have a reliable scrubber. It will run for almost a full day before we need to replace the chemical. Quickly, the problem has vapourized.

Link insists on making the first test himself. He climbs into the submersible chamber and secures its aluminum hatch. He waits inside for over an hour. At this point his carbon dioxide has built up so that it is easily detected. He is beginning to feel breath hunger.

I am on deck monitoring the operation. I hear Link plug in the scrubber. Click. A faint whirr.

"Okay, topside. Beginning the test. The scrubber's on and. . . ."

Link's voice ceases abruptly. It is overwhelmed by a series of deep racking coughs. The scrubber stops. The coughs increase in intensity. Then they too stop. Silence. The sound of a body moving.

I race to the chamber and unlock the hatch. Link sits looking up at me, a snow fall powder almost completely covering his face. Tears run from his eyes. He grins sheepishly.

"After I turned on the scrubber I bent over to check the blower's effectiveness. A thin layer of fresh chemical blew right down my throat. I need some water. It tastes like old wood ashes."

He gets up quickly and clears the hatch. As he walks across the deck I hear him say to himself, "She sure throws a strong breeze."

Link tries again, and it works. He runs the scrubber under pressure and is successful. Three of these new systems are built and placed in our chambers. Two others are kept as spares.

Working on the after deck of *Sea Diver* opens my eyes to the enormous energy of the ocean world. It is tomorrow's battleground. A long rack of "k" cylinders contain breathing gas stored at over two thousand pounds per square inch. Tons of lead ballast squat in a corner. Huge lengths of rope and chain lie, coiled and free. Overhead swings the black muscled arm of the lifting boom. Under our keel waits the swift destruction of the kinetic sea.

After the shallow water trials are completed, Link decides to move his underwater structures up onto the pier. The heaviest object is *Igloo*. Its circular ballast tray holds over thirteen tons of lead.

One morning a large yellow crane rumbles down the pier. A prehensile steel animal. Its thick cable is lowered into position over the water spot where *Igloo* lies hidden. A diver drops to the bottom and shackles its free end to the centre lifting wing. He surfaces and swims clear.

The crane operator eases up the slack in the cable until he feels tension. *Igloo*'s back breaks the surface like a slow surfacing whale. Air gushes out of the broken surface of the sea. The glistening bulk lifts free of the water until the crane holds the full weight in the air. The crane operator then drops his boom slightly forward for better leverage. Six more feet to clear the dock. Up . . . up . . . slowly it comes. Thirteen tons of lead in a ringed tray beneath the black skirt of the structure. The yellow crane suddenly looks fragile. It seems to have captured a huge sea monster by a delicate thread.

The boom swings a short arc over the water. *Igloo* is over the pier. Then begins a gentle forward descent. But the slight action places too much weight on the top of the crane. Its rear wheels start off the ground, like a horse getting ready to kick. The crane operator feels the new motion. *Igloo* and the crane will topple into the water. He releases *Igloo*.

Tons of lead and rubber crash onto concrete. Air hisses from collapsing rubber walls. Heat waves shimmer.

A moan echoes across from *Sea Diver*. Whispered curses take explosive wing. Years of work lie shattered on the dock. The crane operator drops his head on his arms.

We walk slowly toward the torn rubber and fractured trays. Clay Link looks down wearily at the damage.

"A fine undersea station—but a lousy parachute."

Some weeks later *Sea Diver* departs Key West. *Igloo* is left behind. It is beyond repair. A major feature is eliminated from our deep dive program.

I quickly gain an enormous respect for the potential and kinetic energy associated with our work. I learn real reverence for high-pressure cylinders, which explode like bombs on impact. I learn to stay well away from suspended objects and to keep my unwary feet out of lines coiled on deck. A short length of nylon rope can be surprisingly lethal. If its free end is connected to an anchor and falls overboard, your body could quickly follow. Like a desperate python, the rope doesn't care whose leg it surrounds.

I soon discover that the sea does not release secrets easily. Just when

she has seduced us into believing we have control she stuns us into submission. She is always unpredictable and at times displays the malevolence of a cornered tornado.

Our journey north to Miami is a brief, but peaceful change. Key West and the constant activity of the shipyard lies far behind. It is May, and the Gulf Stream carries us gently north. The soft airs of fresh trade winds blow across the deck. To the west lies the hazy necklace of the Florida Keys. We move forward on blue skies, blue water and the breath of summer.

Near Alligator Reef we stop to carry out a dive that will give us additional confidence in our equipment. We slip out of the main currents of the Gulf Stream and anchor close to a low green island. Four anchors are laid out from both the bow and stern, so that we hang securely in a four-point moor. The hot sun compresses the ocean into swimming-pool calm.

Our task is an easy one, and we work with confidence. Our objective is to lower SPID sixty feet to the ocean floor, secure it on the bottom, and then retrieve it. First we have to lift the deflated structure over the side and gently lower it into the sea. We will fill it with compressed air and ride it quietly on the surface. It will be a simple matter to load the lead ballast. The tray will be suspended only a few feet underwater. When enough ballast has been added, the station will slowly sink. We will control its descent with a thick nylon rope fed out along the ship's boom. After SPID is on the sea floor it will be an easy task to fill the ballast tray with more lead.

The first steps are effortless. The rubber tent floats like a bloated whale, rising gently with each soft swell. Her hot black carcass is over-laced with a net of thick nylon line. This secures the tent section to the ballast tray. As we add bars of lead, the structure slowly submerges. As a precaution the nylon line coming down from the boom is shackled into the central lifting ring. It lies like a white guardian snake over the slowly receding bulk of the tent.

I take my turn loading the lead. I swim to *Sea Diver's* ladder, where someone hands me a twenty-five pound bar. Swimming is unnecessary. I drop through the blue water with an uncomfortable speed. With one hand I hold the lead. With the other I reach for the top of the tray to retard my fall. I make the rapid trip so many times that my ears begin to pinch. On my last dive I look at the heavy tray of lead and the swollen rubber skin. Eight tons of weight hang like a pendulum below a thin bubble of air.

I climb the ladder and start across the deck. The air jumps with a muffled explosion: the torn sound of escaping air. I turn to see an opening shred across the exposed rubber. SPID's skin has given way. For

a few seconds air roars out of the hole. The wounded structure gasps a huge bubble and disappears.

I stand frozen to the deck. Then begins a chain reaction. The nylon line holding SPID snakes out to its full length, and comes to a complete and shuddering stop. The boom and the ship quiver with the impact. Eight tons suddenly in the sea. The ship lists slightly and the nylon line sings with the new strain.

No one moves a muscle. Eyes travel along the newly formed avenues of stress. The nylon line, thin with weight, runs down the boom and across the deck. It then makes a right-angled turn around a large deck plate pulley. The shackle holding the pulley is not designed for such sudden loads. A steel ring snaps and the shackle tears away. The nylon line is now a giant sling shot. Several seconds later the pulley lands with a torn splash a hundred yards off the stern.

Link's voice scalds across the deck. "Cut the damn line."

Dan Eden reaches for a knife. With such an enormous weight on the nylon he only needs a few strokes. The rope parts with the crackling of distant gunfire. The free end smokes its way over the pulleys, along the boom, and into the sea.

We dive down, to find SPID limp and defeated on the ocean floor. A jagged tear runs two feet along its broken spine. Piece by piece, we return the lead to *Sea Diver's* deck. We then lift the station over the side and into its cradle. Everyone stops by to look at the gaping black wound. It had been started by the abrasion of a steel cable. Under continuous tension from the sea, the nearby cable had worn a fault into the rubber wall.

Nothing is said. Some silently wonder what would have happened if one of us had been working on the ballast tray.

We go back to work. Each of us moves within deep walls of thought. Innocence has departed.

In Miami there is more work to be done because of our unexpected failure. A new rubber hull is ordered for SPID, and *Sea Diver* is hauled up on the way for her annual refit. We work in a shipyard on the Miami River, surrounded by large boats in various stages of repair and construction. Under Link's stern eye, we continue to prepare and test the hundreds of pieces of equipment needed for the big dive.

One morning our new deck chamber arrives from New York. It comes to the docks on a long flat-bed truck, covered with dust. Within hours it has been slung in a wire harness by the shipyard's crane and placed on *Sea Diver's* stern deck.

The squat green chamber is as handsome as a compressed mushroom. However, in many ways it is the most essential of the large pieces of equipment. Within its thick steel walls the two divers will decompress



after their deep dive. Although only as large as a Volkswagen car, it will provide essential features for prolonged and safe decompression. Pressure and breathing gases can be critically controlled. Two bunks can be folded down for sleep. Food, water and toilet facilities can be made available. One wall holds a pressure lock where small objects can be exchanged between the chamber and the surface. On the other is a round entrance lock which permits a doctor or diver to compress and join the main chamber's depth. Opposite the bunks is a hatch which leads to the mating collar of the submersible chamber. Two thick plastic viewports allow us to watch the men inside. A communication system permits us to talk freely. It is simple and spartan, but the kind of shelter that ensures the life of its occupants.

A few days later a young man arrives whose life depends on the integrity of the deck chamber. Jon Lindbergh. He has made many dives in most of the world's oceans as a commercial diver and U.S. Navy demolition expert. He is unbelievably shy, but he has a quiet, almost painstaking way of insisting upon answers. Jon's arrival brings fresh insight. We are beginning to feel the fatigue which comes from working too long and too close to a difficult task. Jon's enthusiasm is infectious.

As the big dive approaches more and more equipment continues to arrive at the ship. It is almost impossible to walk across the deck and onto the shore. Extra help arrives, including Jim Dixon from the University of Pennsylvania. The pace moves up several notches.

There are many systems tests to complete before we can hope to dive. One day Link gathers us in the wheel house.

"We've still got a long way to go. Each individual piece of equipment seems to be working well, but it's how they work together that concerns me. Today I'd like to make a 400-foot dive with Jon and Robert inside the submersible chamber. I know it's going to be hot in the sun, but it'll be a good on-deck test of ourselves and the equipment."

Link was right. It was a torrid day. The summer sun flamed into the shipyard and slowed every perspiring step. We did not complete our pre-dive preparations until noon. It was obvious that the dive would turn into a fiery sauna. Yet it was important to go ahead. What it was like to be in the metal chamber that day can only be described by a participant. Here is the sensitive pen of Robert Stenuit.

"All morning long under a burning sun I worked in the submersible decompression chamber to connect up the equipment. We were forced to remove the white protective awning which shrouded the cylinder from the sun . . . because we needed access to an incredibly hidden through-hull connection. When I touched the aluminum it

burned my fingers. Its interior was a Turkish bath, and we wallowed in the perspiration which poured in rivulets from our bodies. At 11 o'clock, Jon locked 'b' hatch and the doctors increased the pressure. Initially, they bled in one atmosphere of oxygen and then eleven of helium. It was a fast compression, so that our exposure to the gas could be short and the decompression brief. I watched the interior thermometer. I saw the needle start almost immediately from its 86°F. which was the outside temperature. It veered up toward 120°F. I was gasping, and because I was sitting in front of the gas inlet I received blasts of fire right in the face. Soon the needle hit 128 degrees. I had stopped perspiring. I felt my brain was melting. At every breath I could feel new waves of flame penetrating the recess of my lungs. My legs were wobbly. I decided to ask the surface team to slow down compression . . . but what the hell, we were almost at 400. Now we were there. The reverberations of outside voices came to us as in a dream from some other world. With trembling hands, I completed the program; test the pumps and the hookah with the x valves, then with y valves inflate the suits, switch scrubbers on and off. I made notes in a sweat-soaked notebook. Then it was time for decompression.

"Temperature decreased as the gas was bled out. I felt alive again. Thirty seconds, a few degrees drop, and I was in top shape. My pulse, at the worst time, had been 120 per minute, and that, I said to myself, is bad, for my blood will have carried dissolved gas at an increased rate and will have penetrated deeply into the tissues of my body. Before crawling from the aluminum cylinder into the deck chamber, I informed the doctors and they prolonged the last decompression stops on pure oxygen. But time was to prove that this was inadequate.

"There was no mishap as the sun dropped that afternoon. In the evening, between nine and ten o'clock, an acute pain flared up inside my right ankle. It died down, but I went to bed perplexed. A mistake. At four in the morning a fierce pain woke me up which now burned the leg from the knee to ankle, and I had to wake up Joe and Jim, as well as Ed Link and Dan Eden and we went to the deck chamber for treatment. The treatment worked well, but from now on I would be plagued with concern regarding the outcome of the deep dive."

On June 15th we depart Miami. Our destination is the Bahamas and Great Stirrup Cay. As we slip downstream on the full force of the outgoing tide I climb up into *Sea Diver's* crow's nest. Tiaras of lights crowd the seawalls of the harbour, making diamond contrast with the distant blackness of the sea and sky.

Occasional freighters move their lighted hulls up the Gulf Stream searching for the currents that will hurry them north. I can almost feel

the city releasing its grasp. Soon our ship will be free and autonomous on the endless surface of the sea. In our voyage to the Bahamas we will follow the long-practiced harmonies developed between mariners and the sea. But once at our destination we will try to add a new perspective to the relationship between man and the ocean. We will challenge the dark depth dimension. It promises to be a novel and perilous confrontation.

## Descent Four Man-In-Sea 1964

I stand on the ocean floor, seventy feet down. Around me is the soaring blue gloom of infinite wilderness. High on the silvered surface is the black shadow of *Sea Diver*. It looms high overhead like a dark thunder cloud. Beside me is the stout, round shape of the small manned station. It seems dimensionless against the blue obscurity.

My diving partner is Clayton Link. We have descended together to inspect the superstructure and ballast crib of the station. During last night's storm heavy winds shook *Sea Diver* and moved her moorings. A deep furrow in the sand indicates where the station has been dragged by the scudding ship.

Clay and I hang easily in the soundless blue sea. Our initial examination of chains, lines and material has revealed nothing. We are silent, watching the gun-barrel shape of a large barracuda. He looks back at us with the toothy sullenness of a briny building inspector.

We watch him circle slowly, a living silver threat; large teeth jawing the water. His nerves are live wire springs, his course slightly erratic.

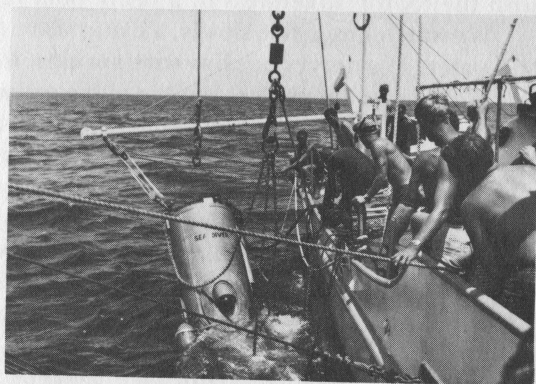
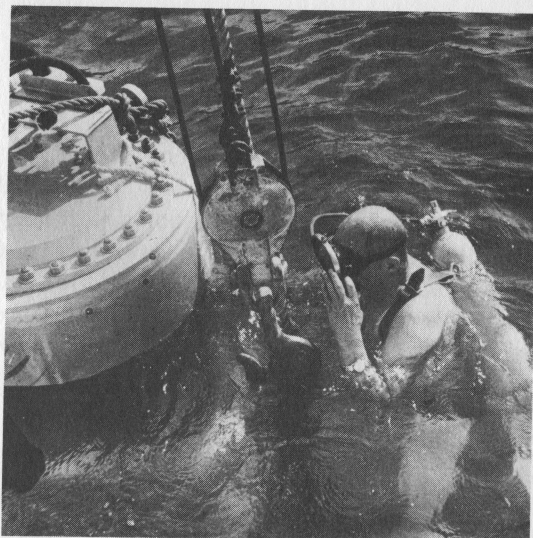
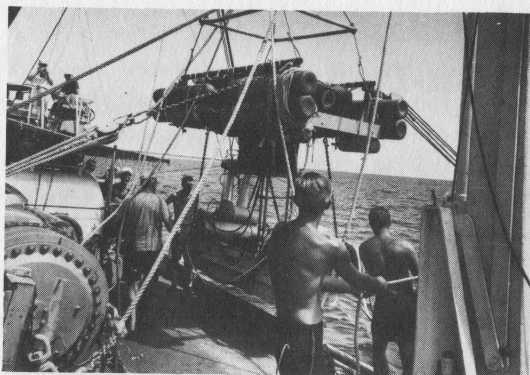
We turn as he circles. We know his game. He is shadow sparring with us; amusing himself by swimming around two fleshy forms hung neatly under gas bubble umbrellas. Air escapes easily from our regulators and we are not concerned. We enjoy the game.

The eye-to-eye is a welcome diversion. For the past week both Clay and I have been eager to quit the hot deck above. The work-pace on the ship has been devastating, the sun an indomitable monarch. Any excuse will do. Whenever possible, we drop in to enjoy the cool sway of the sea.

The barracuda turns full face towards us and flicks pea-button



Launch and recovery of the life-support systems for the longest deep dive to date.



eyes. A faint arch appears in his tail. Suddenly he unlocks and springs the coil of hysteria. His silver form cuts the water like a loosed spear. He drives directly between us, jaws agape, teeth able to tear shreds in a throat.

Like frightened squid, we tuck our legs tight to our bodies. A hidden reflex snaps and we compress as small as possible. In a trice we are compact forms hiding behind face masks. The barracuda convulses and disappears.

Clay and I look at each other in amazement. The rules of the game have been broken! It is a match often played between divers and the predator. You keep your distance; I'll keep mine. The big silver shape always stays the same distance, as if tethered on an invisible wire. A feint in his direction pushes him back to a new outpost. Then he glides in to recheck your stance. It is a covert contest and no one ever gets hurt.

Clay and I shake our heads. Something has upset the fish. Strangeness is adrift. Perhaps it is last night's storm.

I duck down to enter the station. Clay stays slightly behind to cover me. I grab the heavy lead collar of the entrance tunnel and pull myself up.

My head breaks the surface. The air in the tight little room feels stale and warm. Water dripping from my face mask has a hidden grotto sound.

I reach for the rubber floor edge and pull myself up into the main living area. The room seems airless. The white curved walls are bathed in condensation. I cannot stay long, for the carbon dioxide scrubber is not hooked up.

It is a small room. It reminds me of a two-man mountaineering tent. Two tiny port holes admit soft blue sea light. The entrance tunnel adds faint gleams reflected from white sand. It is like sitting in moonlight.

Clay's lithe form fills the tunnel. He lifts his mask and laughs.

"That old charger was a mite strange. Wonder what got into him? He's probably hung over from last night's waves."

"How does everything look?"

"Fine. Nothing seems damaged as far as I can see. The battering must have been restricted to the surface. Looks like the station just got dragged around a bit."

"Okay, I'll make one more swim around the outside and check things again. Then we'll head back to the surface. Sure hate to leave the quietness of this place."

"Roger. I'll run over things again in here. Be out in a few minutes."

Clay's tanned legs fin him away from the entrance tunnel. I turn

toward the small room and its sparse furnishings. Two white metal and canvas bunks hang against one curving wall. They are folded flush to allow more working space. A small bag of tools lies on the floor. The bag is filled with assorted wrenches, pliers, and two large vise-grips.

I look carefully over the rubber walls and give special attention to the vulcanized seams and portholes. No cracks or other signs of storm damage are visible. I quickly check the other contents of the dwelling including the closed circuit television camera. All seems well.

I see Clay's shadow working its way past the view-ports. I moved down to join him. The water is cool to the skin touch. I shiver and drop down.

The air from my regulator tastes surprisingly sweet, compared to the stale atmosphere of the tent. I remind myself to ventilate it well before the next dive.

The barracuda has returned. He hangs above us like a thin silver satellite. He does not move.

I slip out of the entrance tunnel and steady myself on the station's lifting frame. Clay is waiting, poised like a statue ten feet off the sea floor.

A third diver has joined us. Bates Littlehales, a *National Geographic* photographer, is in position slightly above the fish. He is taking pictures with the barracuda in the foreground and the station in the background. The barracuda cooperates reluctantly. He is concerned about the third manfish.

It is time to return to the surface and the steamy breath of the sun. We three swim upward in silence. Single file, following Clay.

It is an easy, graceful, slow-motion ascent. We have no decompression obligation and can return directly to the hot calm above us.

We swim easily, uneager to shed the cool blue robes. The expanding air from our lungs cascades like an upward niagara. Bubbles are everywhere, spilling, breaking, bursting in abandoned effervescence. The barracuda fades back into the wilderness like an old birch log slipping into a stream.

The sea and the ship's white hull are in a straight line. The water is like oiled glass. A long, rusty strand of sargassum weed hangs limply under the surface. We float easily over to the boarding ladder.

The steel rungs are hot on my hands. The sun has squeezed all coolness into the sea and drapes a heavy warm blanket across our shoulders. We climb the ladder and join the envious crew in the canvas shade of the stern deck.

A new ship has joined us. Her upturned sheer and cabin just aft of centre confirm her as a reconverted shrimper. A grey boom hangs lazily over a bright coloured awning.

She belongs to John Perry, who uses her to carry one of his growing fleet of small submarines. She is *Sea Hunter* and has just sailed in from West Palm Beach. She stands by to assist us with accommodation and general support.

A third ship lies on the near horizon. She is much larger and has harsh grey lines. She is the U.S. Navy's *Nahant*, a net tender from Charleston, South Carolina. Her bow arches into twin gargoyles used to recover anti-submarine nets. She seems ominous and somehow out of place on the light blue sea, for she is dressed in battle paint and white-capped sailors move along her decks.

Ed Wardwell is Link's operations manager. As we watch the new ship he describes her function. "The *Nahant* will provide invaluable support. In her holds are stored a hundred and sixty-eight high pressure cylinders of oxygen and helium. This enormous supply of gas is needed to pressurize the submersible chamber, deck chamber, and underwater station." Ed is a former Navy man. He has years of experience with the sea. "At 400 feet we will need thirteen times the volume of gas used at sea level. We have a 50 per cent reserve supply in the event of a gas leak."

The *Nahant* moves slowly away. Ed continues. "She is making a grid survey of the proposed deep dive location. Part of her task is to carefully profile the bottom and select a flat area at the appropriate depth. Once found, her crew will lay out four large anchors at the corners of a square."

The anchors, and their big orange marker buoys, will serve as a four-point moor for *Sea Diver*. The station and the submersible chamber will be connected to our ship by long and bulky cables. Any severe movement by *Sea Diver* will cause the bottom structures to drag and be damaged. The four-point moor will minimize the risk when Jon and Robert are inside.

We are anchored one mile north of Great Stirrup. The large islands look like flat green emeralds. White pockets of sand straggle along the shoreline. At the far end of the islands the pale finger of a lighthouse lifts bleached and lonely in the sky.

To the east and west lies the hidden temper of the reef. It's a gnarled forest of coral fists, washed in snowy lace.

I go back aft to work with Robert who is repairing a slight tear in the shoulder of his new diving suit. It is an experimental model, made for him by the same company that built the rubber tent.

I enjoy watching Robert work. He is always completely absorbed by the task. His hands move slowly and with care, but his mind seems elsewhere.

What is he thinking of? Is he dwelling on the dive to come and its



pageantry of risks? Is he thinking of Europe and home? Wherever his mind, it works quietly behind serious brows.

Robert is an unusual person. He has the typical qualities that make a good diver; independence, self-reliance, and the soft glow of rebellion. He is quiet-spoken and pursues a career that suits his non-conformist characteristics. Diving is only one of his talents. For him undersea exploration is a means to explore both himself and the history of man. Few people know it, but Robert's real skills lie in writing and marine archaeology. His consummate energy in both have earned a world-wide reputation.

Unlike most divers, Robert is acutely sensitive to the dangers which face him on the deep dive. He knows the long hazard litany by heart. He chooses not to ignore it—but to surround himself with meaningful activity. Like all men under stress, action helps him relax, especially if it brings the goal closer.

As we work, my own mind keeps drifting back to the litany. I see myself underwater and outside the rubber tent—only this time in Robert's place and under four hundred feet of water.

How would I feel? What would it be like to swim around under that weight of water? Would pressure and cold affect my body? What about sea life and sharks? Will animals be bigger and more aggressive at this depth?

Robert and Jon will spend much time inside their small rubber room. I wonder how cold they will get, and their reaction if their breathing mixture fails. Without oxygen the brain shuts down in less than five minutes.

Robert finishes his repairs and beckons me down into the diving locker where most of the team has surrounded the big air compressor. On this hot day the locker is dark and almost airless. Its shelves hold a line of silent scuba bottles and swim fins. A gang of muttering men has gathered around the compressor. They look down on it with the temper usually reserved for street fights.

They are not happy. The collective mood is only a linchpin away from giving the uncooperative compressor swift burial at sea.

"Damned thing. Turns over once or twice then quits like a belch going upwind."

"Why don't we push it over and use it as an extra anchor. Or maybe ballast for SPID."

"Yeah. Son of a bitch has as much compression capacity as an old hernia."

The air wobbles with phrases found in a Shanghai tavern. Then silence. A dark head swings in from a partially open hatchway. It is Jon Lindbergh.

"Let me have a look at it. We've got one of these cantankerous old billys at home. Maybe I can. . . ."

Sweat-soaked forms step back and then bend over to watch Jon work. He goes straight for the electrical system and begins to open and close a series of switches. He stands up.

"There. Let's see if we can get some breath out of this donkey."

Someone pushes the wall mounted starter button. Nothing. Again. Electricity flows. Resistance. Nothing.

A large form, naked from the waist up, steps up in front of the inert machine. He glowers at the compressor.

"I once worked with a tractor that had your same bloody manner. A slight touch of the hammer usually brought her to heel."

He bends his thick piano leg and kicks out like a mule. His foot lands squarely above the crankcase.

The motor responds. A slow whirring, and the compressor chuffs to life. Acrid blue smoke swirls in through the open hatch above us.

Robert turns to me. "You can't be too kind to these things. Otherwise they'll take advantage of you."

The team drifts back to their various jobs around the ship. Most of my attention is given to the general life-support systems for the deep dive. Safety and efficiency are the key words. At times I treat lacerations, bruises, and other injuries. All of us know, however, that our onboard activity is not limited to any particular field. In moments when my own work is not demanding, I fill in wherever an extra hand is needed. And in times of emergency all available men are called.

One night, for example, I was wakened by a soft knock on my door.

"Better scramble, Doc. We need an extra hand topside."

Lightning flashed through a porthole. I reached for my jeans and then dropped them. Rain gear and a bathing suit are a better combination. A caucus of fire hoses seem to be splashing the deck overhead. I slipped on a pair of boat shoes. The steel would be slippery.

I sprinted through the dark ship and up the companionway. Sightless darkness covered the ocean. Rain in primal gloom. For some reason the ship's deck lights were not on. Perhaps the storm.

With one hand on the storm rail, I made my way to the stern. An avalanche of thunder tore the sky. Two figures were huddled over a huge coil of cable and hoses—part of the umbilical that connects *Sea Diver* to the station seventy feet below.

The umbilical was caught on something on the deck plates. The storm was already putting a strain on the long length of cable already in the water. I pictured the station being towed across the sea floor. A slalom over the sand. If she hits something solid, she might break up and destroy herself.

The faces of the two men shone like wax in the dark. Tears of rain raged down their faces. They work over the low fire of curses.

"If we could just get some damn slack, we could free it."

A fourth man joined us. It was Ed Link. Together we heaved and pulled on the huge coil. No use. It stayed hung on the hidden grasp.

Suddenly the sea reversed itself. Waves started to smash the other side of the ship. The wind and sea pushed us slightly towards the umbilical. It began to go slack.

We quickly found the cleat where the umbilical has seized the deck. The umbilical's free end, attached to a buoyant white recovery float, was tossed over and lost in a wave.

As we made our way toward the galley, Link spoke out over the rain.

"A good job, men. I guess our starboard anchor dragged. Good thing we had the umbilical buoyed and ready to toss."

A faint smile crossed his face. He was warm and breathless from the exertion. Another crisis met and defeated. We are all bonded even closer by these confrontations.

The days slip by. Long, hot periods of calm are interrupted by squalls of angry rain. Sudden black storms rise out of the Gulf Stream and beat angry wet fists against our small flotilla. I am concerned. The deep dive needs a sustained breath of good weather.

Our seventy-foot test dive with all systems is successful. An essential element of confidence has been added. We step up to the final threshold.

*Sea Diver* slips into her four-point moor. Over four hundred feet of water lies under her keel. The small rubber station is inflated and its ballast filled with lead. It disappears into the blue shimmering sea followed by a trio of pilot fish. We track its descent on closed circuit television.

On the morning of June 30th everything is finally ready. The sea is calm and the weather perfect. *Sea Diver's* decks are extraordinarily quiet. We move as grooms just before the wedding.

Everyone's attention is silently focussed on Jon and Robert. In a few minutes they will begin ascent of their underwater Everest. They will surround themselves with the cold snows of danger.

The best view of such an experience can only come from the inside. Let us turn again to the sensitive pen of Robert Stenuit. The words are as he wrote them for the *National Geographic Magazine*. The italics will relate some of the impressions we had on the surface.

#### June 30th, 0945

The sea is calm, almost as blue as the sky. Ed shakes hands with us and wishes us good luck. It is my last sight of the surface.

We go under and swim to the bottom of the cylinder, which stands vertically in the water alongside *Sea Diver*. Jon opens hatch "a," and swings it outward. We climb in. I close hatch "a" to prevent water from getting in, then the second hatch, "b," which opens inward and prevents inside gas pressure from getting out. With both hatches shut we have locked our doors against the outside world. For six days we will not again breathe God's fresh air.

#### 1045

At the control panel aboard *Sea Diver* Jim Dixon slowly increases our interior pressure to equal that of 150 feet of sea water. We will hold that pressure all the way to the bottom. Now we are breathing 77 per cent helium, and it shows its effects . . . when we speak, we quack. Jon handles the telephone; a Donald Duck voice will be more easily understood topside without my French accent.

#### 1150

The depth indicator shows 60 feet. Through the port I see a diver working on one of our electric cables. It is Ed Link. From first to last he has insisted on checking everything himself.

#### 1215

Our descent is so slow that only the creeping depth-indicator needle reveals it. We have been ballasted slightly heavier than water so that we will sink. Braked by a safety line from the surface, we slide down a nylon guide rope that angles gently to the SPID. When the anchor hanging below us touches the bottom, we will come to rest, floating upright six feet off the sand.

#### 1230

Three hundred feet. The water is limpid, but it grows dark. Joe MacInnis phones: "We'll be taking samples for a few minutes to check your gas mixture."

*The incredible distance of pressure and depth begins to separate the divers from the surface. Only voice and television connections close the gap. I can now sense the emotions of an astronaut doctor as the spacecraft takes off.*

Even though our cylinder is autonomous. (we have our own gas analyzer, carbon dioxide remover, and oxygen supply), a backup sys-



tem can feed us gas and control pressure through hoses from above. The doctors test our breathing mixture periodically.

**1234**

"The SPID!" Jon has sighted it at last, well-placed on an even bottom. It warms the heart, this view of our little house set in a landscape that is more lunar than terrestrial.

**1300**

"On the bottom." A big smile lights Jon's face as he reports our arrival. The depth gauge at the top of the cylinder reads 415 feet. Add 11 feet, the height of the cylinder, and six for the chain between the cylinder and the anchor: 432 feet. . . .

*I am envious. We are envious. We are chained to the surface—you are about to fly free in the ocean.*

**1315**

Through the long umbilical cord that connects us to *Sea Diver*, the surface crew sends us helium to increase the pressure in the cylinder to 14 atmospheres—which is the pressure of the water outside. Then we will be able to open our double doors easily. In perfect balance, gas and water will meet at the entrance to the cylinder.

Our breathing mixture is now a cocktail of 3.6 per cent oxygen, 6.6 per cent nitrogen, and 90.8 per cent helium. The helium, under these pressures, prevents us from producing intelligible conversation. I scribble messages to Jon on the wall.

**1330**

Our diving suits are flattened and wrinkled like old parchment. I blow them up with a flask of compressed air.

**1345**

Word comes from the surface: "Okay to open hatches." I pull hatch "b" upward, push hatch "a" downward. There is the Atlantic, a circular patch of clear blue lapping at my feet. I let myself slide into it, and shiver. It feels cool, even at 72 degrees Fahrenheit. Visibility is more than one hundred feet, despite the twilight gloom at this depth.

I glance around, looking for the big sharks that we have been told to expect. Nothing in sight. Our outside spotlights pierce the gray water with two emerald beams and awaken glimmering splashes of sleeping colour on the sand. Our shelter looks all right. Its hoses and cables soar upward toward the hidden surface. But it is a bubble in the immensity of this foreign place.

It is only 15 feet away, close enough for us to swim to it without breathing gear. I glance upward. At this depth we could not hope to struggle to the surface alive. But we have a return-trip ticket: the cylinder waits to take us home.

Seen from below, the water surface inside the entry shaft of SPID is a mirror of blue silver. My head breaks through it. The gas of the interior tastes like fresh mountain air. I climb the ladder. At last, at last, I am here. Six months of delays, of dogged effort, but now I am here. What calm there is in this other world. What silence. What peace. I shake myself. I must act quickly:

My first task is to connect the gas analyzer to its waterproof batteries. The little black needles come alive: oxygen, 4 per cent; carbon dioxide, 0.025 per cent. All is well.

To avoid damage in case the SPID should be flooded during its descent, all the instruments, the electrical connections, and the interior equipment have been enclosed in waterproof containers attached to the ballast tray beneath the chamber. We must get them unpacked and installed.

**1405**

Jon has joined me. First he hooks up the wires that will establish contact with the surface. Afterwards he connects the light. The light bulb glows, burns five seconds, and goes out. We look at each other in consternation. Is it the light bulb or the current?

We continue to work in the light of a diver's hand lamp. A noise like a gunshot slams against our eardrums. The sealed-beam bulb has imploded, spraying the inside of SPID with thousands of sharp fragments. Happily, we still have flashlights.

*We detect the trip-hammer ramming of your hearts. Your coolness is amazing; your voices do not betray you.*

I plug in the radiator. Nothing, without heat for our atmosphere and our food, things present themselves somewhat poorly.

**1410**

Standing up in the narrow access well with water up to my waist, I wrestle with a four-foot aluminum cylinder. It houses a machine that will filter the gas in the SPID and remove the excess carbon dioxide. At last I get its top out of water and open the equalization valve.

This valve allows pressure inside the container sealed at sea level, to equalize with the 14-times-higher pressure inside the SPID. When the valve is opened, gas should rush into the container with a loud pssst. Only then can the lid be removed.

I turn the valve, but nothing happens. The container is full of water. Catastrophe! Our situation is definitely not brilliant; the apparatus is vital to us.

*On the surface we can tell that things are going badly.  
The silence is appalling.*

I glance at our analyzer and see that the carbon dioxide level has risen to 0.1 per cent. Our minutes here are numbered. Quickly we fetch the spare filter. It seems to weigh a ton as I thrash around on the bottom, trying to drag it behind me.

Jon hands me a line. I push and he pulls; I lift and I pivot and I manoeuvre. I come back to the entrance well to breathe more and more often, more and more heavily. At last the monster is in place, but I am completely out of breath. Our furious efforts have raised the level of carbon dioxide to 0.17 per cent.

Now we discover that this container has no pressure-equalizing valve. The surface people have put on the wrong cover. I calculate rapidly: about four tons of pressure hold that cover on. No use trying to force it off.

*A shock wave runs through me. I put that cover on. In the last minute rush I made an incredible error. My spirit collapses like a bag of loose sand.*

Can we pry it open enough to let air in under the edge? No luck. I break a screwdriver, and Jon snaps a scissors blade. A glance at the analyzer shows 0.2 per cent carbon dioxide. We are panting now, breathing too fast. The heavy pounding of my heart resounds through my whole body. I make a sign to Jon: Get out. And we return to the cylinder, to the sure refuge.

**1430**

I consider our condition. Without a gas purifier, without light, without heat, perhaps without any electricity at all, it is discouraging. I write with a grease pencil on the side of the cylinder: "In any case we will stay here 24 hours."

From the level above me, Jon signals his agreement. An entire day spent below 400 feet in the cylinder would be at least a halfway success.

We report our predicament to the surface in morse code. Link answers efficiently, as always: "We are sending you a line. Attach it to the flooded container. We have an exchange motor. We will repair and return."

**1600**

We wait. Dr. Dixon calls us. "According to our instruments, there is

now more than 0.2 per cent carbon dioxide in the SPID. You have a maximum of 15 minutes inside."

When we re-enter the place, the carbon dioxide level will climb very quickly. About 0.5 per cent, its toxic effects will be severe, and there is no rescue possible. Those 15 minutes will decide the success of the entire operation.

*You can't know how hard we are working up here. Recover the flooded motor. Repair it. Return it to the sea. I am still numbed by the scale of my blunder.*

**1700**

We wait. It is growing dark.

**1825**

Something clangs against the cylinder. The new gas purifier has arrived. I leap into the water, shivering, and drag it over to the SPID. Inside, the gas seems heavy and thick, sticky in the mouth.

I open the equalizing valve. This time gas rushes into the container. The purifier is dry. Jon's face lights with joy, but we have no time to celebrate. Six minutes have passed already. The analyzer's needle creeps into the danger zone. We take off the cover, wrestle the machine into its cradle, and plug it in. The motor purrs. The gas circulates. We have won.

**1930**

We are installed in SPID. Tonight's dinner: carrot juice and corned beef, canned water, fruit salad.

*The relief of success washes over Sea Diver. Our confidence returns. We settle into the rhythm of the watch. I make a deep mental note of the lessons learned.*

**2300**

I have taken the first watch of our first night at 432 feet. I keep my eye on the instruments and the level of water in the entryway. The radiator does not work, and Jon shivers on his cot in three sweaters.

On the surface the medical team keeps vigil in relays, scanning their gauges and observing us through the closed-circuit television. "Big Brother" is watching.

*You both look so damn cold. Two figures huddled in a fireless tent. Yet you say nothing. The courage is impressive.*



0200

I lean over the wall, and my heart suddenly rises. A huge black silhouette moves slowly against the ladder. A shark? No, it is a peaceful grouper, as big as a boar.

0900

Breakfast. As soon as we move, the temperature becomes bearable.

1000

To work. We drop down through the well and into the open sea. We test our breathing apparatus. We have no back tanks, for they would only last moments at this depth. Instead, we use a "hookah," a 50-foot double tube which feeds us breathing mixture from the SDC and carries off our exhaled breath for purification.

Jon swims around at the end of his hose, exploring the coarse sand bottom. We see life everywhere: sponges, worms, anemones, octopuses, and minute, royal-blue fluorescent fish which I would like to catch and make into rings or earrings.

The big grouper follows us everywhere, nibbling at my feet when I come down out of the access well. He accepts all our caresses.

1800

Jon has repaired the radiator and dehumidifier. After hours in the water, it is pleasant to return to a warm and dry haven.

2200

We try an experiment with voice communication. Question: Below what percentage of helium can we make ourselves understood at this depth? Jon breathes three deep gulps from a bottle containing 25 per cent helium and 75 per cent air. His voice remains nasal and deformed, but I understand him clearly and the surface does too.

He dictates telegrams to his four children: "We are in a small rubber house on the bottom of the ocean. Hundreds of little fish are swimming outside the window. . . . Two little octopuses were playing on the bottom under us yesterday. They would glide into a hole and then jump out at the fish. The fish darted away, but always came back to watch the octopuses. Then we swam out, and they all ran away. . . ."

The radio on board *Sea Diver* relays to the four children a fairy story become a reality.

Now it is my turn. I try three deep breaths of pure compressed air. The air is so dense that I can see it flow out of the regulator like a thick fog. My voice takes on human tones, but at the third gulp the SPID begins to undulate. I feel my face twisting into ludicrous grimaces. I am

drunk. I let go of the mouth-piece. I can do without nitrogen narcosis.

*So can we. You scared us for a moment. Fortunately your recovery was equally rapid. We all breathe easier.*

2315

Our last 1,000 watt exterior spotlight, which burned night and day, goes out. Our interior light brightens immediately. Ten seconds later the water in the access well is boiling. All the little fish attracted by the big light have now come around to the lesser one. They twist and turn and jump out of the water like mad creatures. At once I see why. The water is alive with tiny shrimp.

2335

A heavy blow shakes the SPID. Jon wakes up, startled. What is happening? Another shake. We hold on to the cots. It is the giant grouper, charging the fish in the well with his enormous mouth wide open. Ten times during the night he awakens us.

July 2nd, 1000

We go out to spend three hours in the water. I take pictures of Jon working on the SPID. The light of my flash attracts half a dozen giant groupers, but I cannot photograph them. They press against me, nudge the lens, bump into my legs, fill the entire field with their bovine bodies, and stir up sand with fins like ping-pong paddles.

I tore my diving suit yesterday from shoulder to waist, now my teeth chatter helplessly. But I must continue, frozen or not. If I succeed, my pictures will be the deepest pictures ever taken by a diver. When I cannot stand it any more, I return to the SPID and greedily swallow six big spoonfuls of sugar. Thirty seconds later I stop shivering.

1320

The surface is calling us. "You have spent two days and two nights at 432 feet, and all our tests have succeeded. Bravo! We will gain nothing more by extending your stay. Prepare to come up."

We look at each other. Now that we are installed and well organized and have made friends, we would willingly stay a week in our little house. It is the voice of reason, however, and we obey.

*A difficult decision. Especially for Link. But the weather looks ominous and it will serve no larger purpose if you stay much longer. Secretly we all want to see you safely on the deck.*

After that comes the routine of going up again: the elevator sealed, the needle of the depth indicator coming down across familiar figures, the water growing lighter. Then the cylinder dances on the surface, and we are hoisted aboard.

Happy faces peer in at us through the port-holes. The cook announces a steak dinner to celebrate our return.

Our cylinder is joined to the larger deck decompression chamber with its two cots and its air locks that permit supplies to be passed in to us—and a doctor, when necessary. Then we drink our first iced drinks, eat our steaks, and crawl into our cots. I stay in mine so long, and return so often that someone suggests changing the name of our project from “Man-In-Sea” to “Man-In-Bed.”

*Months of weariness have brought victory. It's the first good sleep you've had in weeks.*

Project Man-In-Sea goes well. Ed Link has triumphed again. We have stayed, Jon and I, longer at greater depth than anyone before us. We have set a new record. But what is more senseless under the sea than a “record”?

What we have accomplished is something else. We have lived in the depths—in questionable comfort, but at least in security. We have gone out and worked. To be sure, we paid for our two deep days with four days of decompression. But if we had stayed two weeks or two months, the decompression time would have been the same.

Our successors will stay in the depths that long and longer. They will colonize the sea floor, cultivating its resources instead of pillaging them. Tomorrow the colonist will survey his bottom land through the porthole of his sea-ranch kitchen while a coffeepot simmers on the stove.

## Descent Five One Hundred Fathoms 1965

I sit waiting. The edge of fear joins me like a stealthy moonbeam. The taut canvas bunk below me is cold and its steel pipe frame harsh against my skin.

My chest itches. Two round flat sensors have been glued over my heart to detect its rate and wave pattern. I can sense its quiet gallop under my rib cage. The curved white walls of the compression chamber glisten with sweat.

In a few minutes the thick round hatch beside me will swing shut and the dive will begin. I try to suppress the anxiety that keeps putting its cold hand into my lungs. My breath feels arctic and thin.

This is no ordinary dive. My companion and I are going to compress to a depth where only a handful of men have gone before us. 650 feet. The palms of my hands dampen with moisture.

I am surrounded by the tight steel womb of technology. The ribless walls of the chamber are one and a half inches thick and cold to the touch. Their iron integrity is only interrupted by two small round viewports. Through the thick plastic lenses I see the flicker of distant fluorescence.

A communications set in front of me carries the remote voices of the surface team. They stand on the other side of the rigid steel, but seem a thousand miles away. Beside me, a wall-mounted control panel clusters brightly with gauges, valves and dials. Below it, near the floor, are the ominous outlines of two moss green masks. They belong to our emergency breathing system.

I put my hand up and run it lightly over the end of a one inch pipe. Its onyx opening will soon admit the gas that will compress our bodies.





The author (left) just prior to 650-foot dive, blowing through a respirometer. The pressure chamber is in the background.

This is a laboratory dive. It will simulate all the conditions found in the sea except cold and wetness. It is an essential step, for it will tell us much about human reactions on the bottom, and the success of our newly developed decompression schedules. I have volunteered for this dive of the series because I am anxious for the first-hand experience. It is the only way to be certain what actually happens. It is the difference between knowledge and speculation.

As the seconds tick by I watch and wait. The phantom of last-minute reluctance appears and joins me in the chamber. I wonder: What am I doing here?

My companion is Bev Morgan, a commercial diver from California. Bev is an unusual explorer: he dives, invents equipment, and writes about his experiences. He sits beside me looking ahead. He does not smile.

My thoughts move sluggishly down a narrow endless tunnel. On the surface I look calm, but rumbling through my head is a quiet congress of concern. My mind flicks over the dangers like a shark seeking prey. Is the chamber pressure tight? How secure are the through-hull fittings, and their root-work of pipes? What if a viewport should fail at 650 feet? I picture everything in the chamber, including Bev and I exploding in a pressure stream through an eight-inch opening.

I carefully attempt to put away each irrational thought as soon as it arrives. I feel like a man whose work is continually interrupted by a parade of uninvited visitors. I slam the door, but the thoughts continually push it open.

The impotence of waiting begins to press in on me. I do not know it, but the relief of well-rehearsed action lies just around the corner.

The hatch swings shut. Its ivory coat of paint is unsettling; it looks so clinical and pale. I am not excited by the fact that it is also fireproof.

Silence. It washes Bev and me in long, ill-defined waves. We know the team is moving around outside our steel cocoon, but we cannot hear them. My heart moves into faster calibration.

"Let's get this thing moving," says Bev. He too seeks the comfort of meaningful action.

"If you're ready, we'll begin the countdown." The electronic message has authority. The topside team is poised. Three hours of final preparations and endless checklists are over.

"Roger, we're ready. Let's go." I try to say the words with conviction, but they arrive without muscle. My mouth has a slightly metallic taste, as if I'd just put my tongue on warm brass. The electrocardiogram detects another rise in my heartbeat.

"Five, four, three . . . two . . . one." The air explodes with the

waterfall rush and roar of helium, blowing in to pummel my ears like a sound out of control and getting louder. It is a sound like brushfire in the tree tops and makes my mind narrow-tight to the point of life. Helium molecules gather speed, compressing each other in billowing waves of heat on the skin, in the lungs and across the eyes. The tympanic membranes of my ears stretch now, and hurt with the pulse of pressure and noise. The old skill grasps hold and blows gas into the middle ear to find transient relief until it must blow again to equalize the thunder and helium that threaten to tear my eardrums. I am in an autoclave out of control.

"One hundred, two hundred. . . ."

Feet of pressure read to me by some unknown voice struggling through the noise. I try to right my brain from its new position in soft quicksand, and realize that this is not the time for poetry or mathematics or attempts on any kind of intellectual sophistication for the noise—heat—pressure tunnel is too overwhelming.

"Three, four hundred. . . ."

Numbers moving by slowly in time-frozen series. The only activity here and now is a skinny black needle climbing up a snow-white gauge, and the damn helium, a hell-fire furnace, blowing its solar breath right into my lungs so that my alveoli recoil and shrink. My heart pumps faster, in response to the stresses of the new gas environment pushing in at great speed. One hundred feet of compression a minute. Almost fifty pounds per square inch added each sixty seconds onto human tissues not designed to operate outside the narrow envelope of cool air which surrounds the soft green planet and its sea. An atmosphere so different; this sauna and its blistering heat scream right inside the tight ceramic of my brain, making my hands shake from an invisible cold.

"Six hundred."

The noise less now, but sizzling heat still pouring out of the gun-barrel gas pipe pointed at my head. I feel light-headed and dizzy, and my eyes do not track well although they see the vague lines where air, oxygen and helium meet and waver. It's like the shimmer-heat lifting above a radiator in front of a window, or where fresh and salt water mix in boundaries unknown and unmeasured as the searing, feverish wind and its hideous sister noise now suddenly come to a complete and final stop.

"On the bottom. Six hundred and fifty feet." The voice is strong and somehow comforting. Yet it is a long way away, and somehow blurred like night fog on a lake.

The first few minutes of the forty we will spend here have been set aside for "adjusting" and making notes on the six-and-one-half-minute trip that took us to a depth equivalent of the deep continental shelf. My

mind welcomes the quiet and cooling like a thirsty animal seeking water. Thoughts begin to run at old and comfortable rhythms. But, my hand still trembles like an old man with an advanced neurological disease.

I look over at Bev. He too watches the uncontrolled quiver of his fingers trying to push away from each other. We both smile and hold out all four hands for shared inspection. We giggle. There is the pale suggestion of long white shorebirds attempting flight.

Our work begins. Bev, looking at me through the steamy window of his own perspiration, gives the okay sign. Thumb to forefinger. I nod.

Bev opens his mouth and begins to speak in a voice suddenly not his own. The words are high-pitched, and utter from the swollen throat of an old shrew. It is a science-fiction voice. Helium gas playing quiet hell with human resonance. We have both heard the discordant duck quacks many times in other people. Today it is us, and we laugh.

Bev reaches down for some exotic ironmongery. Brushed aluminum plates connected to a box with hoses and wires coiling out of it. A respirometer. A device for measuring the rate, force, and depth of our breathing. Bev begins to blow into one of the hoses. He follows closely the instructions given from the surface.

We are now at a pressure twenty times that found outside the steel walls. Three hundred pounds per square inch.

But I am not aware of the pressure. It is so evenly distributed over and through my body's cells that I have no sensation of weight. If I were in the sea I would be under a column of water as high as a 50-storey building. Yet, I am not directly aware of the tower of pressure above me.

Bev works away blowing breath after breath into the machine. A twinge of discomfort crackles through my right wrist. I felt it before we reached the bottom but in the din of the descent it seemed unimportant.

It is a phenomenon that we call "hyperbaric arthralgia". It is a pain related to compression and high pressure, and usually found in the joints. I move my wrist backwards and forwards and feel a light knife scrape of discomfort. A diver once told me, "it is like having no joint juice." He's right. The pain is slightly uncomfortable but not disabling.

I take over from Bev. He monitors my breathing performance and makes notes in his log.

We both are more certain in our movements. The chamber has cooled to a reasonable temperature, and the sound of the carbon dioxide scrubber is soothing.

From some inner recess I feel a slight glow of euphoria. It is not narcosis, for helium exerts no narcotic effect even at these depths.



No, it is something different. It is glandular. It rises from a secret tide deep within and bathes me in the soft wash of well-being. It is the euphoria of achievement suddenly attained; of temporary control of the tightrope. It is a seductive luxury. I put it away. It is for another time.

I puff and blow like a winded moose. My breath disappears through a mouthpiece and down one of the python hoses. A hidden sensor in the mouth-piece detects carbon dioxide levels at the end of each respiration.

There is a bellows arrangement in the box between Bev and me. With every exhalation it sings a chronic metallic chorus. Music from another planet.

Every minute, instructions come down from topside with the slap of static.

"Breathe deeper."

"Keep your eye on the flow loop."

I remove the respirometer mouthpiece. I am dizzy from the effort.

The respirometer feeds its data along slender wires out of the chamber through special fittings. Our physiologist, Dr. Bill Hamilton, sits at an outside console looking at five automatic pens. They make long wiggle patterns on an endless strip of paper. Bev's and my readings are brothers, printed out side by side.

Bill is specifically watching my heart rate and respiratory rate. He is alert for any sudden change. His concern is comforting.

We begin the second phase of our bottom tasks. We exercise by lifting heavy weights from one part of the chamber to another. This work will simulate some of the heavy muscular movements of commercial divers working on a well-head. As we work, we talk. My voice sounds like the shrill of some knife-wielding fishwoman.

"Bev, you okay?"

"Yup. Except my eyes. At first they didn't focus quite right."

"Me too. I also got this niggle in my right wrist. It's better now."

Our lips work vainly around the strange new sounds. Vocal chords are resistant. We speak slowly in simple sentences, but the phrases have the high keen of madness.

We continue moving the lead weights. Pick up, swing, and lower. Pick up, swing and lower. The rhythm is spontaneous.

The sweat begins again. Freshets trickle off our foreheads and drip to the floor.

I wonder about temperature control in the chamber. One minute I am hot, and the next I am cold. My temperature regulating system seems to be confused. My thoughts float over the effects that pressure

may be exerting on my brain. What is "normal" for this depth? For sea-level?

The muscles in my shoulders become tired. An instant switch from effortless to effort. Manic to depressive. On-off.

Time to go. Finally. Forty minutes—suddenly unmeasurable.

We don our thick sweat suits and wait for the new countdown.

"Three, two . . . one."

Glances are exchanged between two friends hard in the grip of life-saving friendship as a new sound fills the chamber like a waterfall heard through the leafy forest. Not a huge sound like the first one but a kind of distant issuance. The helium now runs out and up a cold pipe and into the sky above us, finally free in mad molecular escape, while down below two men huddle and hunker down in a snowless cold, seeking comfort. I concentrate on breathing out, reading a sign in magic-marker ink scribbled on the hatch which says, "SING ON THE WAY TO THE SURFACE." The sign is deadly serious. To hold one's breath is to entrap air in the lungs which can only be released in a shower of deadly bubbles into the bloodstream. They can lodge in the brain, block bloodflow, and cause paralysis or death. So I breathe out easily, hoping each alveoli will safely unload its burden of expanding gas, and hoping that my lungs will hold fast and no hidden defects in tissue structure will appear.

A steam of condensation clouds the chamber as the escaping gas rushes up the frosty pipe. Thin vapours tickle my throat and reach down to ignite my cough reflex. It is an urge to be resisted, for to cough is to hold the breath. The hands swing up, cup the mouth and slow the tickle of vapour's insistent itch.

Nothing to do now but sit tight to the bunk, stay warm, relax if possible, breathe easily and let the mind wander in on itself.

My eyes move over to the pipe opening which empties the chamber. The thought of an accident and my skin trapped by the evil suction flickers across my brain. Flesh and blood vacuumed out with surgical deftness. I put the evil away and instead run over the check-list of safety procedures. It is an agenda which flashes like bold neon through each second of the dive.

The shivering becomes violent now as we hurl upward from the deep tomb depth. I hunker down even further into my cradle of cold.

Topside speaks. Prophet tones.

"Your first stop. You've arrived at your first stop. How you feeling?"

"Damn cold, thank you," says Bev. His voice is a little more familiar. The helium squeak has softened.

Our first step toward the surface has been a big one. We are at 370 feet. It's taken a little less than four minutes to travel.

From this point on, it will get more tedious. We have about twenty hours of decompression to look forward to. Twenty hours to come back from 650 feet. A time-penalty for forty stolen minutes.

For a while Bev and I sit and talk. We have the animated conversation of two old cronies trying to describe a new experience to each other. Our voices take on the bar-spirit tone found at the beginning of an evening of promise. We curse the heat and marvel amazement at the track of events so far. Then we lie in our bunks and settle down for the long ascent.

Both of us know that the toughest part of the dive is yet to come. A half-formed thought not allowed to mature. Decompression. A complex staircase of time, depth and breathing as requirements that will finally land us on the surface. Initially, the steps are brief, but as we approach sea-level pressure, they lengthen out in exponential fashion. The most difficult part of the dive profile.

It is in the shallow regions that decompression sickness is most likely. We are both aware of its fierce displays. I have seen destructive pain-shells fire through proud young bodies. I recall an old friend who had succumbed to the dark winds of vertigo. A ruthless bubble lodged near his brain. He was in such distress that he threw up. I remembered the hard grey stillness locked in my gut as we nursed him slowly back from the cliff edge of shock.

The two novitiates wait calmly. We trust men and machines. Heinz Schreiner and Pat Kelly have developed a novel method of decompression and have programmed it into an IBM 360 computer. We believe it is the most advanced approach to the problem anywhere in the world. Our topside crew is the best to be found and will follow instructions to the letter.

A bead of worry trickles down my forehead. These are tests. They are the deepest dives anywhere in the world.

Hours pass.

From my bunk I hear the muffled sounds of my teammates working quietly outside the chamber. We have worked together for over a year. Confidence and friendship are tied together in a secure knot. Time-tested. Bev and I are totally reliant on our friends. They know this and respond quickly to every request. Each man knows what it was to be inside the chamber.

More hours pass.

I first notice the pain at 50 feet. It comes like a phantom, touches the inside of my right knee, and then disappears. I move my leg. Everything feels fine.

A few minutes later I feel it again. A light gnawing sensation deep inside the bone. Nothing serious, just the breath of discomfort blowing.

I rub my knee and move my leg. The discomfort disappears.

I try to occupy myself with other thoughts. I have seen men sit in decompression chambers with nothing to do. Their minds roam. They begin to imagine illness. I start to read.

A tiny fire flickers somewhere in the marrow. A spit of flame deep inside the bone. Just like the imagined pain that blooms in the brain before the dentist inserts his drill. Or is it?

The thought hits me like a thrown stone.

Real? Imagined? If it's real, then you better not wait too long, for that bubble and its friends have blocked the blood supply and oxygen is no longer flushing into the cells. The bone may die, to leave you with an island of necrotic tissue. If the bone dies near the articulating surface of a joint, it may break down, leaving you with a painful disability and permanent limp.

I feel the bone sting of an asp.

The book drops to my lap. Reading doesn't help. I am an insomniac, caught in the thrall of cerebral argument.

If it's imagined pain, then you'll bring to a halt this test, these men, and all this complicated equipment for no apparent reason except unyielding fancy. The decompression schedule everyone's trying to validate will be that much more imperfect, and there is the possibility that invented pain will not respond to treatment. So there you'll sit, looking at the "pain" getting worse and no one able to help, as your loosed illusions take darkened wing.

I detect the sullen presence of ego in the background, whispering, "Whatever you do, don't look foolish. Mustn't ever look foolish."

We are near the forty foot stop. I arrive at the cliff edge of decision.

If the pain increases during the next scheduled pressure drop I'll report it to the surface team. If not, I'll read this damn book.

A silent wind issues from the exhaust pipe. Bev changes position in the bunk above me. I look around the chamber savouring its history. It's the same one we used during the Stenuit-Lindbergh dive. Jon Lindbergh slept here. We call it affectionately, "the white whale." The place has all the glamour of an antiseptic sewer pipe.

The pain hits hard like a tooth exploding. Both knees. A pool of acid below the kneecaps. The nerves in my legs are incandescent.

"Topside, I think we've got a problem. Looks like I've been hit in both knees."

"You sure, Doc? We're almost home."

I am sure. The acid spreads with the malignancy of hot lava. I swing my legs off the bunk and try to stand up.



My legs buckle. The pain has boiled them into soft jelly.

"Damn!"

"I think we better turn around and go back down. Hate to tell you but my knees are really hurting."

Shadowed voices crowd the intercom. Cold conversations. Consensus quickly reached.

"Okay, Doc. Stand by. Increasing the pressure at ten feet per minute. We'll pause each ten feet to see how you're doing."

My ears feel the gentle slap of pressure. In three minutes we travel back down 30 feet. A distance that took us hours to cover on the way up.

I feel depressed. I have just added infinity to the schedule.

We stop at eighty feet. Bev sits looking at me. He is concerned.

"You okay, Joe? You look a little pale."

I feel as cold as an old walrus tusk. The only sound is the running drum of my heart. The pain is not going away.

Usually if pressure is increased the relief is almost instantaneous. Usually. Not now. My optimism is gutted. My knees are unchanged. Blood, flesh, and bones cry quietly with pain.

The insomniac argues another dilemma.

Go deeper? Risk more lack of improvement, and a huge time penalty? Or wait?

The sharks continue to hold both my knees with sawtooth jaws. I decide to wait.

The pain eases. Like sun lifting fog from a pond the pain steals away. My leg muscles quiver with relief.

I sigh and lie down. The pain ebbs.

More sounds from above. New people have arrived. Voices gather like gulls following a ship.

"How you feeling, Doc?"

"Better, much better, thank you."

"Good. Now you take it easy, Doc. We can't afford to get you too banged up. Otherwise, who's going to look after us? And believe me, Doc, if you saw the shag-eared group that's outside this chamber today, you'd agree. They sure need some lookin' after."

The comment rides in on a Polish accent. My old friend Frank. He is today's chamber operator. His hands are as quick as his humour. Diving with Frank means you never know when a verbal bite will echo over the intercom.

Frank continues to lay his laughter over the dark situation. Standing beside him is a small group of men quietly outlining the fate of my decompression. They include Hamilton, Schreiner, and Kelly. I have been part of this same group for other "hit" dives. There is a set routine.

Depth and time of the accident. Gas mixtures. State of the diver. Degree of his response. New depth and time of relief. These and many other factors are reduced into numbers and estimates. The computer and the original matrix are consulted. A new decompression schedule with longer stops, slower ascents, and different breathing gases is constructed. The return journey is resumed.

Suddenly I really understand what it is like to be on the "other side of the steel." I have always been part of the topside team, looking after the divers and managing their accidents. Now, roles are reversed. I remembered the tumult of the past few hours and strongly appreciate the deep diver's vulnerability. He inhabits an alien world. He is extraordinarily dependent on the thoughts and actions of the topside team. Suddenly I see the diver's world in new perspective.

"Joe, we're going to hold you at this depth for an hour. We'll increase the partial pressure of oxygen and send you down some food. Heinz and Pat will go and talk to the computer. At the end of an hour we should have a new schedule. Then we'll start home again."

I welcome the confidence. My pain has diminished into a tiny electric trickle of discomfort. Bev leans over and smiles.

"Joe, I'm glad you had them turn around when you did. My own knees were getting pretty bad, too. I was going to speak up, but you beat me to it. As soon as they pulled the plug on this thing, the pain started to go. Not a minute too soon."

Dinner arrives. It comes with the iron clanking of the medical hatch opening and closing. Gas is vented into the small lock. When the pressure is equal to the main chamber, the hatch is swung open. Our food is still warm. It has been artfully curved to fit the small lock. Some blessed soul has stashed in two demi-tasses of wine.

The hours creep like a stagnant, weedy river. Sometime tomorrow my rubber knees will carry me out through the main hatch. The room will seem surprisingly large after the chamber's confinement.

Ahead of me lies the long road up through the shallow depths. I will spend many hours on an oro-nasal mask breathing system. It will abraid my skin. My face will come to feel like sandpaper. My lungs will burn from hundreds of liters of dry oxygen breathed through the mask. Throughout will be the threat of another ambush of pain.

But now I am content. The finger of wine rides well, and a blanket of sleep reaches for my brain stem. Tomorrow, pressure will release its grasp. I glance up at the closed circuit television eyeing me like big brother from one of the viewports. It winks back.