S. HRG. 109–379

ROUNDTABLE ON COMMUNICATION AND MINE SAFETY TECHNOLOGY

HEARING

BEFORE THE

SUBCOMMITTEE ON EMPLOYMENT
AND WORKPLACE SAFETY

OF THE

COMMITTEE ON HEALTH, EDUCATION, LABOR, AND PENSIONS

UNITED STATES SENATE

ONE HUNDRED NINTH CONGRESS

SECOND SESSION

ON

EXAMINING COMMUNICATION AND MINE SAFETY TECHNOLOGY ISSUES

FEBRUARY 15, 2006

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C O N T E N T S

STATEMENTS

WEDNESDAY, FEBRUARY 15, 2006

ADDITIONAL MATERIAL

ROUNDTABLE ON COMMUNICATION AND MINE SAFETY TECHNOLOGY

WEDNESDAY, FEBRUARY 15, 2006

U.S. SENATE,
SUBCOMMITTEE ON EMPLOYMENT AND WORKPLACE SAFETY,
COMMITTEE ON HEALTH, EDUCATION, LABOR, AND PENSIONS,
Washington, DC.

The subcommittee met, pursuant to notice, at 10:00 a.m., in room SD–430, Dirksen Senate Office Building, Hon. Johnny Isakson, chairman of the subcommittee, presiding.

Present: Senators Isakson, Murray, Kennedy, and Clinton.

OPENING STATEMENT OF SENATOR ISAKSON

Senator ISAKSON. Good morning. I would like to welcome everybody to this subcommittee hearing, and for the benefit of everyone that is here, let me tell you what the ground rules are. This is not a situation where members of the Senate are coming to make speeches. I talked to the other members who will be coming, and when Senator Murray arrives—she is my ranking member—she will make a brief statement, and I am going to make a brief statement, but beyond that, this is about learning about the technologies that exist, the ones we hope will exist, and mechanisms to get to the existence of those technologies to make mine safety in the United States of America even better.

The reason we asked the Senators not to make opening statements is so we could get the information from this very, very distinguished panel. What set the stage for this hearing was a trip that Senator Kennedy, who is arriving now, myself, Senator Rockefeller and Senator Enzi took about a month ago to the Sago mine following the tragedy that took place in early January.

In going on that fact-finding trip, which included an extensive 2-hour visit with the families, we learned there were critical areas of need to improve mine safety, technologies that were maybe emerging but did not necessarily exist. I felt compelled as chairman of this subcommittee to create a forum where we could be prospective in the future about what we can do to make mining more safe rather than retrospective in trying to find blame for an incident that has happened and is being investigated.

I will reduce my remarks to one simple thing. This is a picture of Junior Hammer. Junior—this was taken on the day after Christmas of last year—I sat next to his daughter when we met with the families in West Virginia. As I was getting up to leave, she slipped this picture into my hand and she said whatever you do, try and

make sure no other young lady loses their daddy the way I lost mine. And I think for all of us that this meeting is about Junior Hammer and the other individuals who have lost their lives in mining accidents.

Last point, at the Sago incident, in particular, because that is where we visited, it was quite clear that technology for two-way communication or better communication from the surface to the mine could possibly have saved lives. It was also important to understand that accessibility to more than 1 hour's oxygen in one method or another could also have saved lives from the standpoint of the miners trapped being able to get out, more so than the miners on the outside and rescue teams being able to get in.

So we are here today to hear from each of you, and Senator Kennedy, thank you for coming. We are waiving opening statements to get right to the information.

Here comes my ranking member now. Her timing is always impeccable. Ladies always know how to make an entrance.

Senator MURRAY. That is right.

[Laughter.]

Senator ISAKSON. I have said my 3 minutes and yours are allocated, and it is a pleasure for me to introduce my ranking member, Patty Murray, for her statement.

OPENING STATEMENT OF SENATOR MURRAY

Senator MURRAY. Mr. Chairman, thank you so much for organizing this roundtable to help us look at all the ways that we can help protect America's miners. There is a lot of really impressive technology that we could be using to help make mining safer, and I really look forward to working with our chairman today to explore some of those ideas.

Families in West Virginia have really endured tragedies that very few of us can weigh. We cannot undo what happened and we cannot know what they are going through, but we can resolve to work together to give our miners better protection, and this is why we are all here today.

Mr. Chairman, I do want to say I really appreciate the bipartisan way that you and your staff have worked to put together this forum today and I always appreciate your inclusive leadership here on this subcommittee, and I want you to know I look forward to working with you to review and update some of the mine safety laws and regulations that are on the books.

The tragedies in West Virginia have really focused our Government's attention on the thousands of brave men who enter our coal mines everyday to produce the energy that our Nation relies on. We have to do more to make sure that if there is an incident, they have access to oxygen and that they can communicate with others and come out alive.

These tragedies have brought out the best in our fellow Americans who are interested in looking for ways to reduce or prevent the loss of life in the mines. Over the last month, my office has been contacted by numerous engineers, scientists, and health and safety professionals with a lot of new ideas and advances in mine safety technology. I look forward to hearing from our experts on

our roundtable this morning and seeing some of the new products and technologies that are going to be demonstrated.

We are also working on legislation. Our colleagues from West Virginia have already introduced legislation to bring new mine safety technologies into the industry, and I know that Senator Rockefeller has developed legislation to provide tax incentives for coal mine operators to invest in some of the new safety measures.

Mr. Chairman, I hope that as we move forward, we will not allow the perfect to be the enemy of the good. We know that every technology has limits and nothing is foolproof, but if there are steps we can take to make progress, I do not think we should hold back.

So we have an important mission and I again want to thank our chairman and Senator Kennedy who is here as well and all of our witnesses who have come to share with us new ways to help make and keep our miners safe.

Thank you very much.

Senator ISAKSON. Thank you, Senator Murray.

At this time I would like to submit a statement for the record from Senator Enzi, Chairman of the Committee on Health, Education, Labor, and Pensions.

[The prepared statement of Senator Enzi follows:]

PREPARED STATEMENT OF SENATOR ENZI

Thank you, Senator Isakson. Let me begin by noting how much I appreciate your leadership and work in organizing this roundtable on mine safety technology.

A few short weeks ago, Senator Isakson and I, along with Senators Kennedy and Rockefeller, traveled to West Virginia to meet with the families of the miners who perished at the Sago mine. It was, for all of us, an emotional experience; and, one which reinforced our commitment to do all that we can to ensure the health and safety of miners everywhere.

Coming from Wyoming, I have had a long-standing interest and concern for all those who earn their living in the mines. Wyoming is rich in the earth's natural resources. It is, for example, the largest coal producer in the Nation, shipping some 1 million tons of coal a day. Because mining is so central to our way of life, all of us in Wyoming share a bond with miners everywhere, including those who lost their lives in West Virginia.

Today's roundtable is one more step in translating our concern into action. While the investigation of the recent mine tragedies in West Virginia are not yet complete; and, while it is therefore not appropriate to engage in speculation, these tragedies have already made amply clear certain areas that demand our immediate attention. Of all these areas perhaps none is more important than the role of technology in making our mines safer.

One of the most disappointing things I have learned as I have taken a closer look at the underground coal mining industry is what the current technology cannot do. There are no devices to allow wireless two-way phone communications in an underground mine. Nor are there devices that would allow two-way text messaging; so that miners could let the surface know what happened, and where they are, and so they could receive directions to enhance their chances of survival. The current portable oxygen devices do

not contain enough oxygen to sustain miners for long periods of time. Even the rescue team members oxygen supply is less than it should be. I understand the enormous difficulties of making technology work under hundreds of feet of rock. However, like many of my colleagues, I am baffled by the fact that the tremendous technological advances of recent years have apparently not been more significantly translated into new mine technology.

As the witness list for today's roundtable indicates, some of the technology innovations of recent years have come from Australia, another nation with a thriving mining industry. Companies there have developed methods to send text messages deep underground using extremely low frequencies, to track what underground areas miners have been in from the surface, and have created mine refuge systems capable of sustaining life for up to 36 hours.

While some U.S. mines are already using these or similar products, since this year's tragic spike in fatal accidents, mine companies across the country are looking at new technologies and determining what would work best in their mines. In fact, it is my understanding that the Australian company here today, Mine Site Technology, was founded in response to a mine accident in Queensland that killed 12 miners in 1986. It is impossible to ignore the sad irony that fatal accidents spur new developments. This is something I hope to address as the HELP Committee considers its legislative response to these issues.

Like the families of the victims we met with at Sago, I want to know why. I want to know why technology has not advanced farther than the current level; why the best technology available is not more widely utilized; if MSHA is doing enough to quickly review and promote new technologies; and how the millions of taxpayers' dollars which have been invested in research to protect miners safety and health have been spent. Getting the answers to these questions is critical to our shared goal of improving miner safety through technology.

But we must also be careful not to cast out false hope. In the period since the Sago tragedy, much has been said about the mine technologies which were not in use there. Not all of it has been accurate. Even more dangerous, legislative proposals have been offered, and some even adopted, which mandate the use of technology which simply does not exist. We all wish that it did exist, and I believe it will some day soon. Yet, a mandate which is impossible to fulfill is no help at all to those who go into the mines everyday.

As Congress and the Administration act to correct the deficits exposed by this year's mining tragedies, we must keep two tracks in mind. First, we must look to the future and encourage the development of better mine technologies. Second, we must be realistic about presently existing technologies. Overstating something's capabilities does not make it so, it just offers false hope. Mandating costly technologies that have no chance of saving lives in another mining accident will not save lives, it will merely eliminate jobs by driving some mines out of business.

The 19 miners who have lost their lives this year, and their families, deserve more than false hope. I look forward to working with my fellow HELP Committee members and the Senators from West

Virginia to find real ways to develop and encourage utilization of new technologies which will make our mines safer.

Senator ISAKSON. Here we will proceed as follows. In just a second, Mr. Campman, I will recognize you first to introduce yourself.

We would like for you to take about 3 minutes to introduce yourselves and say any statement that you would like to as far as your interest in this to kick off the meeting, after which time we intend to have a dialogue of exchange between the members and yourselves or yourselves together talking prospectively about what we can do to make mining more safe given your area of expertise or the products you might have or have developed.

So with that said, we will start with Mr. Campman.

STATEMENTS OF BOB CAMPMAN, PRESIDENT, GRACE INDUSTRIES; PAT DROPPLEMAN, PRESIDENT, OCENCO CORPORATION; DR. R. LARRY GRAYSON, CHAIR, DEPARTMENT OF MINING AND NUCLEAR ENGINEERING, UNIVERSITY OF MISSOURI-ROLLA; WES KENNEWEG, PRESIDENT, DRAEGER INDUSTRIES; DR. ROY NUTTER, PROFESSOR, COLLEGE OF ENGINEERING AND MINERAL RESOURCES, WEST VIRGINIA UNIVERSITY; DENNIS O'DELL, ADMINISTRATOR, HEALTH AND SAFETY PROGRAMS, UMWA; SAM SHEARER, PRESIDENT, CSE CORPORATION; DR. STARNES WALKER, TECHNICAL DIRECTOR, OFFICE OF NAVAL RESEARCH, U.S. NAVY; AND GARY ZAMEL, PRESIDENT, MINE SITE TECHNOLOGIES PTY. LTD

Mr. CAMPMAN. Thank you, Senator. It is a both a pleasure and privilege to be here and I think that we are going to show you some technologies here that really will help mine safety. My name is Bob Campman. I am the Vice President of Research and Development for Grace Industries Incorporated. We are a company who has designed and developed many personal life safety products, particularly catered to the firefighter service, however, the product has direct application to mine safety.

Our company has been in business over 30 years producing these types of products and our specialty is bringing the forefront of technology into product form to improve life safety. Some of the products that we have brought with us, which I will elaborate on later on in our meeting here, certainly will improve miner safety and also I think workplace safety in general.

So with that said, Grace Industries, again, being in business for 30 years, producing these types of products, recently after our 9/11 disaster, our company was contacted by the New York City command staff to come up with an evacuate system for firefighters. As we know, over 100 firefighters lost their lives in the collapse of the second tower.

The incident commanders came to Grace and wanted a standalone evacuate system for firefighters. After a couple of years of development, about 4 years ago, we delivered on our promise, and developed what we call our T-PASS 3 system. And what this is is a high performance radio signaling system used by firefighters as a panic button alarm, as a motion sensing man-down alarm. By the way, PASS is an acronym for Personal Alert Safety System. And

of course to send an evacuate signal to these firefighters in the event of an emergency.

Our company, since we have introduced the T-PASS 3, has sold this to over 350 departments so far nationwide in the past 3 years. The product has direct application to mine safety. Recently we have begun some testing in working with NIOSH and MSHA on a very initial preliminary basis here the past couple of weeks to set up some testing for our product in mine use.

Some of the strengths our company has and our products have are they are intrinsically safe which means they can be brought into a methane environment, which is very common in a coal mine.

Other products that we have include locating technology, which we are currently developing, that could also be used to track and locate miners within a mine. Later on in the meeting, I would like to elaborate and show you some of the technology demonstrated for you and perhaps indicate how I think our system can improve mine safety.

Thank you.

Senator ISAKSON. Thank you, and I commend you as a witness. The red light went off and you were finished. Can you see the red light?

Mr. CAMPMAN. Yes.

Senator ISAKSON. That is what the red light means. Some of us do not pay much attention to that, but we are delighted when you do.

Mr. Droppleman.

Mr. DROPPLEMAN. Thank you. Thank you, Senator, for inviting me and for including our company in this important discussion. I have prepared a written statement and have submitted it for inclusion.

My name is Pat Droppleman. I am President of Ocenco Incorporated. Our company is headquartered in Pleasant Prairie, Wisconsin. I happen to be a native of West Virginia from Doddridge County, West Virginia, and I grew up near Farmington where the Farmington mine disaster took place in the 1960s, and I have monitored and watched and been involved in the mining industry since 1970.

Our company operates from 12 locations in ten countries on four continents and we are involved in mine safety in most of those locations. We build compressed oxygen breathing apparatus for firefighters, for military applications. We build bailout units for fighter aircraft. Every F16 pilot has an escape breathing apparatus that we manufacture. We make very sophisticated rebreathers for mine clearance work for the Navy. We can take a diver to 91 meters, keep him underwater for 5 hours, and do that totally stealth and totally silent.

In all of the applications from our medical company to our firefighting to the mine escape breathing apparatus to shipboard escape apparatus, we have chosen to use compressed oxygen technology because we believe that it offers the greatest opportunity and the greatest flexibility in terms of performance and reliability.

During the discussions, I am sure you are going to hear a lot of discussion about chemical oxygen generators versus compressed ox-

ygen generators. I do not think that is the issue here. I think the issue here is, there are two basic fundamental problems.

The first problem is that the current regulations do not recognize the difference in performance between approved 60-minute self-regulators. It is absolutely fundamental to escape——

Senator KENNEDY. Could you say that again? I did not hear it.

Mr. DROPPLEMAN. I said the current regulations do not recognize the fundamental differences between approved 60-minute self-rescuers, and that is critical to understanding and developing an escape strategy in the event of a fire and explosion, and I will come back and address that.

The second fundamental problem is that the regulations do not speak to protecting the miner from where he is in the mine to a place of safety, preferably to the outside. Those of us that have spent our career in mining know in the event of a fire and explosion, we have one objective: if we survive the initial incident, we want to be outside. And that will always be the number one objective of a miner.

The regulations should recognize that and should support efforts on the part of mines to protect the worker from where he is in the mine to the outside. That is not possible with one belt-worn 60-minute self-rescuer.

Those two issues, if we address those two issues in terms of self-contained self-rescuers, then we will take a huge step toward protecting miners.

Thank you.

Senator ISAKSON. Thank you very much.

[The prepared statement of Mr. Droppleman follows:]

PREPARED STATEMENT OF J. P. DROPPLEMAN

Ocenco, Incorporated is pleased to have the opportunity to participate in this important discussion about coal mine safety and the use and deployment of Self-Contained Self-Rescuers (SCSRs) in underground mines.

Ocenco manufactures SCSRs, or EEBDs (Emergency Escape Breathing Apparatus), for military, marine, industrial, aviation and mining applications. In addition, we manufacture sophisticated rebreathers for military mine clearance work and Self-Contained Breathing Apparatus (SCBA) for professional firefighters. Ocenco's Erie Medical Division manufactures a wide variety of oxygen valves and regulators for medical oxygen therapy applications. Ocenco's Interspiro Division has been the leader in CBRN (Chemical, Biological, Radiological and Nuclear) hardened SCBAs for the first responder market, and our ABMS-3 (Automated Breathing Metabolic Simulator) is used by NIOSH, Aberdeen Proving Ground and the U.S. Navy for both breathing apparatus approval and research.

Mine Worker Safety Objectives

Our Nation's goals for mine workers, as they relate to respiratory protection during escape from fires and or explosions, must be to get all underground workers to a place of safety—preferably the outside.

Technology of SCSRs

There are two basic technologies currently being used to provide oxygen to miners for escape from fires and or explosions: (1) compressed oxygen and (2) chemical oxygen generators.

In all applications—mine escape, underwater mine clearance, fighter aircraft bail out systems, firefighting apparatus and medical oxygen therapy—Ocenco has chosen to use compressed oxygen technology because it offers the greatest flexibility and reliability in terms of design and performance.

Ocenco does not recommend that Congress or MSHA select only one of these technologies for use in underground mines. In fact, we believe it is essential to allow mines to choose among competing technologies, not only those available on the mar-

ket today but those that may be developed. *However, it is essential that any system be evaluated based on performance under realistic conditions.*

Successful Escape Factors

There are four requirements that must be met to effect a successful self rescue from a mine fire or explosion.

1. Accessibility—the miner must have access to an oxygen supply device.
2. Training—the miner must know how to use the device.
3. Performance—the device must work.
4. Duration—the devices must provide enough oxygen to get the miner to a place of safety—*preferably the outside.*

It is essential that policymakers and the public understand that the performance of breathing devices varies dramatically. There is a tendency to assume that the usefulness of a device can be measured simply based on the rated duration of the oxygen supply. For example, one might assume that a 1-hour breathing device mounted on the miner's belt is better for the miner than a 10-minute device on the belt. That is not true. The issue is what is available to the miner when disaster occurs—not simply the device on his belt, but the reliability of the device and the proximity and performance of breathing devices stored nearby. In making this determination, policymakers must be realistic about what miners do every day. Large and heavy devices interfere with the ability to work and encourage the miner to remove the bulky device from his belt. In addition, large devices are subject to damage from shock and impact when worn on the belt.

Current Regulations

The current regulations for approved SCSRs are found in 30 CFR §§ 75.1714 through 75.1714-3. Today, MSHA regulations give mines three choices to protect miners from loss of oxygen. For each miner and authorized visitor, the mine can choose to provide any of the following:

1. A 1-hour SCSR, which is carried by the miner. Once this device is provided, the mine needs to provide no additional protection. § 75.1714-1(a). Ordinarily, the miner should wear the device, but under some circumstances the device can be kept nearby. § 75.1714-2(b)-(e).
2. A SCSR of not less than 10 minutes and a 1-hour canister stored nearby. § 75.1714-1(b). The 10-minute device is ordinarily carried by the miner. The 1-hour canister must be available at all times to all persons when underground in accordance with a storage plan submitted by the operator of the mine and approved by the District Manager. § 75.1714-2(g)(2).
3. Any other self-contained breathing apparatus which provides protection for a period of 1 hour or longer and which is approved for use by MSHA as a self rescue device when used and maintained as prescribed by MSHA. § 75.1714-1(c). No additional protection has to be offered.

Weaknesses in the Current Regulations

There are two fundamental problems with the current regulations:

1. The current regulations do not recognize the significant performance differences among approved 60-minute SCSRs.

The regulations have been implemented based on the assumption that a 60-minute breathing device will necessarily and completely protect the miner. That is not true. The regulations, regardless of the device used, should focus on performance and the benefits for the miner, not arbitrary breathing times. It is impossible to determine performance without testing under realistic conditions.

Example: One 60-minute approved SCSR supplies 157 liters of oxygen while another 60-minute approved SCSR supplies 82 liters. Clearly, there is a significant difference in performance for these two SCSRs. The 157 liter compressed oxygen device will last over 7 hours if a miner remains at rest. A 60-minute SCSR using a different technology lasts a much shorter period.

2. The current regulations do not require each mine to have an approved plan that ensures the miner will have enough oxygen to reach a place of safety—preferably the outside.

Every mine should be required to submit a plan for protecting the miner from loss of breathable air—regardless of the type of SCSR used. MSHA should review and approve each plan to ensure that the miner is protected. This is not the case now.

The bottom line is that miners must have an approved plan and equipment that allows them to survive a disaster. The regulations should not force a "one size fits all" solution.

Ocenco's Recommendations

Ocenco recommends the following:

• Neither Congress nor MSHA should mandate that a particular SCSR technology be used.
• The regulations should require all mines to submit a storage and escape plan that gets the miner to the surface. This requirement should apply regardless of the duration or technology of SCSR used.
• The storage and escape plan should be verified using in-mine escape trials with mine personnel. The test should be designed to demonstrate that SCSRs will perform under real-life underground mining conditions and get the miner to the surface.

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SEARCHING FOR ESCAPE BREATHING APPARATUS?

THE OCENCO EBA 6.5 IS THE U. S. STANDARD

Since introducing the EBA 6.5, Ocenco Inc. has sold more emergency escape breathing apparatus to the U. S. mining industry than all other manufacturers combined.

The EBA 6.5 can be donned in 15 seconds or less.

Why? Because the EBA's oxygen supply is long-lasting. The EBA 6.5 supplies the wearer more than 90 minutes of oxygen during a typical mine escape — up to 8 eight hours of oxygen at rest — a performance that exceeds all MSHA and NIOSH standards. (Oxygen delivery ranges from 1.5 l/min constant flow up to 100 l/min demand flow.)

The EBA 6.5 uses compressed oxygen as a source rather than generating oxygen from chemicals. The oxygen content indicated on the gauge is always visible for inspection through the clear, tamper-proof sealed case.

The apparatus can be refurbished for a service life of up to 15 years and provides a lower cost per year of service than any comparable unit.

The EBA 6.5 is a highly reliable breathing apparatus tested in life-threatening situations throughout the world. Thousands are currently in service in mines in Australia, Canada, Chile and South Africa as well as in the United States.

THE EBA 6.5 IS:

Quick to don – can be put on and be fully operational in 15 seconds or less.

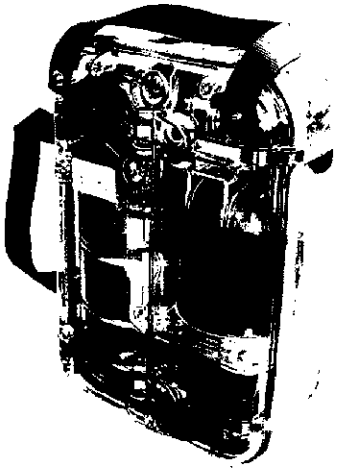
Easy to operate – turning the valve on activates the system; turning off permits conservation of oxygen.

Long-lasting – over 90 minutes oxygen in demand mode; up to eight hours in conservation mode.

Light-weight – donned weight 8.0 lbs (3.17 kg). With composite cylinder only 7.0 lbs (3.17 kg).

Compact – at 8.5" x 11.8" x 4.5" (21.6 cm x 30 cm x 11.4 cm), it stores easily and is easy to retrieve.

Easy to inspect – simple visual inspection confirms that unit is ready to use.



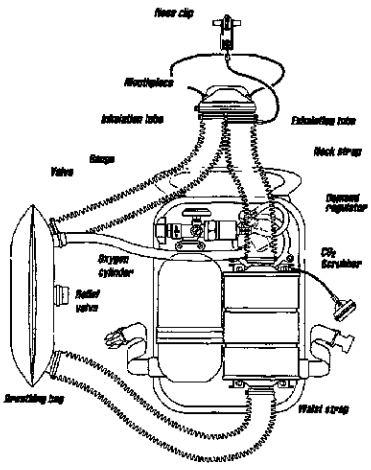
The EBA 6.5. In its clear, polycarbonate case, is durable and easy to inspect.

EBA 6.5 PHYSICAL CHARACTERISTICS AND PERFORMANCE DATA

Approvals	Approval Numbers	Approval Duration
MSHA/NIOSH	TC-13F-104	60 minutes
Republic of South Africa	GME 14/6/14/3	90 minutes
Australia		
Queensland	QMDA-6693	60 minutes
New South Wales	1899	100 minutes
	MDA BA 2742	100 minutes

Performance duration	110 minutes
Rest duration	8 hours
Time to don/activate	15 seconds, or less
Total weight	9.2 lbs (4.17 kg) Aluminum cylinder 8.2 lbs (3.72 kg) Composite cylinder
Donned weight	8.0 lbs (3.63 kg) Aluminum cylinder 7.0 lbs (3.17 kg) Composite cylinder
Dimensions	8.5" x 11.8" x 4.5" (21.6 cm x 30 cm x 11.4 cm)
Storage temperature range	10° F to 140° F (-12° C to 60° C)
Liters of oxygen available	157
Repair/refurbish after use	Yes
NIOSH service life	15 Years
Oxygen delivery system	Compressed oxygen On/off valve Constant flow/demand regulated
Cylinder pressure	3000 psi (207 Bars)
CO_2 Scrubbing material	Lithium hydroxide
Inspection	Visual

EBA 6.5 SELF-CONTAINED SELF RESCUER



THE EBA 6.5 CIRCUIT

Oxygen from the breathing bag is inhaled through the inhalation tube and the mouthpiece. Breath is exhaled through the mouthpiece into the CO_2 scrubber. Scrubbed breath enters the breathing bag and is mixed with oxygen from the oxygen cylinder via the demand regulator.

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At just over six inches square, three inches thick, and 3.3 pounds, the Ocenco M-20 is the smallest self-contained self-rescuer in the world! This compact, ergonomically designed SCSR isolates the user's lungs from the surrounding atmosphere and utilizes compressed oxygen to provide respiratory protection for up to 32 minutes.

But that's not all! The M-20 can be donned in seconds. To activate, simply unlatch the case, pull out the unit, apply the nose clip and mouthpiece, and start breathing.

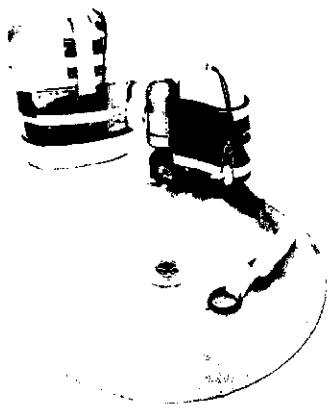
The Ocenco M-20 was designed with safety in mind. That's why the user can quickly check the oxygen supply through the clear case. What's more, the durable M-20 can be refurbished for up to 15 years, and is perfect for use in mines, tunnels, confined spaces and chemical plants.

Compact, light, and ergonomically designed, the M-20 can be comfortably worn in confined spaces.

The Ocenco M-20. It's not only the world's smallest SCSR, it's a life preserver you wear on your belt.

The World's Smallest Self-Contained Self-Rescuer

The user can quickly and easily verify the oxygen supply by viewing the pressure gauge through the clear carrying case.



THE M-20 IS:

Extended respiratory protection – provides up to 32 minutes of respiratory protection.

Belt wearable – so light and compact it can be worn comfortably on a belt.

Easy to use – simply pull the unit out of the case to start oxygen flow.

Quick verification of oxygen supply – user can quickly verify oxygen supply by viewing the pressure gauge through the clear case.

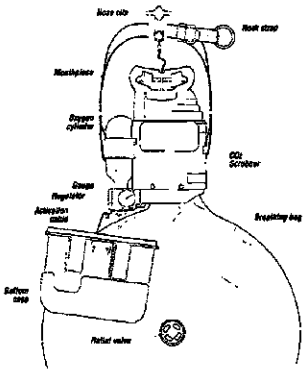
Superior to Filter Self-Rescuers – The M-20 protects the users from oxygen deficient atmospheres as well as toxic gases and particulates.

M-20 SELF-CONTAINED SELF-RESCUER

M-20 PHYSICAL CHARACTERISTICS AND PERFORMANCE DATA

Approvals	Approval Numbers	Approval Duration
MSHA/NIOSH	TC-13F-269	10 Minutes
Republic of South Africa	GME 14/6/14/5	24 Minutes
Australia	MDA BA 2804 1899	18 Minutes 18 Minutes

Performance duration	15-20 minutes
Rest duration	32 minutes
Time to don/activate	8 seconds, or less
Weight	3.3 lbs (1.5 kg) Total weight 1.9 lbs (.86 kg) Donned weight
Dimensions	7.2" x 6.5" x 3.1" (18.3 cm x 16.5 cm x 7.9 cm)
Storage temperature range	10° F to 140° F (-12° C to 60° C)
Liters of oxygen available	27
Repair/refurbish after use	Yes
NIOSH service life	15 Years
Oxygen delivery system	Compressed oxygen Automatic valve Constant flow/demand regulated
Cylinder pressure	3850 psi (265 Bars)
CO_2 Scrubbing material	Lithium hydroxide
Inspection	Visual



THE M-20 CIRCUIT

Oxygen flow begins when the M-20 is pulled from its case. Oxygen is inhaled through the mouthpiece from the breathing bag. Breath is exhaled through the mouthpiece into the CO_2 scrubber. Scrubbed breath enters the breathing bag and is mixed with oxygen from the oxygen cylinder.

ACCESSORIES

M-20T Trainer – complete with two extra mouthpieces. Teaches donning from both the worn and stored position.

M-20 Belt (Part No. 930021) – 2" belt with accessory strap.

M-20 Belt Extender (Part No. 930022) – uses hook and loop fasteners to wrap around the M-20, securely holding the M2-20 on the wearers belt.

M-20 Pouch (Part No. 930023) – Rugged nylon with a large belt loop.

ocenco INCORPORATED

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Senator ISAKSON. Dr. Grayson.

Mr. GRAYSON. Yes, sir. I will read mine into the record. Dear Honorable Committee Members: I would like to dispense with other than a very brief introduction of myself and just suffice it to say that I was a coal miner, production foreman, and also a superintendent of about a 500 person underground mine, and I deeply cared for the miners under my charge.

I am still very close to my friends in my former UMWA crew, and it was that admiration and respect for good people that led me to mine safety as an area of research emphasis in my career. I hope that all of us involved in reshaping the mine safety provisions this

year will focus intently on increasing significantly the odds of survival for all underground miners in times of emergencies.

Emergency situations actually vary widely by location in a mine relative to where the workers actually are, the extent of the damage wrought from very local to very large spatially, and then finally in their probability of trapping the miners from escape.

Thus, a combination of information age technologies, rescue and response procedures, and technology and preparedness training are demanded in order to reach a new level of protection for our underground coal miners.

I have come to know that technology, no technology can actually work perfectly all the time as you had stated. Even the very good ones have blips from time to time. Every technology does have flaws. It is developed during a bad manufacturing run or possibly evolving over time, and vulnerabilities to certain conditions, especially fires and explosions.

Thus, as we seek new safety implementations, I believe it is important that we examine in detail the various emergency situations or scenarios that have occurred, discern where and how the miners became vulnerable, and then couple these scenarios up with the technologies that can best increase significantly the odds of miner survival in these specific situations, and admittedly there will be no single answer. It is going to be a combination.

During today's proceedings, I will do my best to respond to your questions and blend optimism for specific technologies with reality concerning steps needed to ensure that the technologies will deliver on what will ultimately become, I believe, an implied guarantee to our underground miners that they will not have to worry so much anymore when we are done about emergency situations.

Recognizing the role of technology and how it must play to advance mine safety, the National Mining Association announced the formation of an independent Mine Safety Technology and Training Commission. I have agreed to chair the commission. The commission will have a balanced membership that will bring a full range of perspectives to address these issues.

Yesterday, it was announced that eight of the nine members have already been confirmed and soon will complement the group with the additional communications technology person. My goal is to report the commission's preliminary findings by early July and have a final report by the end of September. I assure you that the commission will be keeping its independent information-gathering deliberations and recommendations focused on what you are focusing on today.

Thank you.

Senator ISAKSON. Thank you very much.

Mr. Kenneweg.

Mr. KENNEWEG. Yes, thank you for inviting Draeger to this important——

Senator ISAKSON. Make sure the microphone is close to you.

Mr. KENNEWEG. Again, thank you for the invitation to be part of this discussion. My name is Wes Kenneweg. I am the President and CEO of Draeger North America. Draeger is a worldwide company that primarily manufactures or develops and manufacturers respiratory protection equipment and gas detection equipment.

This includes mine rescue breathing apparatus, oxygen self-rescuers, refuge stations, gas detection equipment for combustible gases such as methane, carbon monoxide, toxic gases and oxygen deficiency.

The company is 117 years old. North America's base is in Pittsburgh. We have been there since 1907. Primarily we are based in Pittsburgh because of the concentration of mining in that area so it has been a big part of the Draeger philosophy to provide products and use our engineering and technology for mining.

And I have worked with Draeger for 23 years, partly in the U.S., in Canada, and also in Australia, and all those locations I was involved in mining and regarding mine rescue. What we have to offer, and we can discuss in more detail later, is our expertise in self-rescuers.

These are some self-rescuers here, two oxygen and an older filter device, which is also still in use in the mines. There are some things I think with the approvals, the test standards, the testing equipment, the regulations that require certain duration time limit on the oxygen rescuers underground. Those need to be possibly more flexible and that would give the manufacturers an opportunity to make better use of their technologies.

Thank you.

Senator ISAKSON. Thank you very much.

Dr. Nutter.

Mr. NUTTER. Good morning. My name is Roy Nutter. I am a professor of computer science and electrical engineering at West Virginia University. I have done research in underground communications and applying computers and automation in underground mines, coal mines, since about 1969, I guess.

A few things I would like to say as we begin. One of the things that I hear happening when we start talking about communications, and I am going to put my education hat on here if it is all right, is I draw the line at incident, at the explosion. Pre-incident, pre-explosion, people are coming out of the woodwork to communicate pre-incident. There are many companies selling radios, leaky feeder cables, underground telephones, all kinds of equipment, and some of the mines, many of the mines have these installed.

At incident or at explosion, though, I describe it as looking down the barrel of a shotgun. The thing goes off and all the infrastructure, all the cable, all the wires, everything that is under there is gone, destroyed, shot out of the end of that gun.

Now is when we need to communicate, postincident. Before is an issue, but postincident is more important. What we are hearing is, and I will talk about PED for a minute, is essentially a pager from above ground to underground. That is fine, and that is certainly a first step. We do need to communicate, though, from underground to above ground as well postincident.

One of the problems, and you will probably hear this later, one of the problems with these type systems is noise affects them. Mining equipment noise, powerline noise, atmospherics affects it, so they are not always reliable in all places. Unfortunately or maybe fortunately, after the explosion, power is off. A lot of that noise goes away. So bi-directional communications is probably much more doable postexplosion with power off.

And I think with that, I will stop. Thank you.
[The prepared statement of Roy Nutter follows:]

PREPARED STATEMENT OF ROY NUTTER

I am Roy Nutter. I am a Professor of Computer Science and Electrical Engineering at West Virginia University. I hold a BS, MS, and Ph.D. in Electrical Engineering from West Virginia University. After completing my Ph.D. in 1971, I spent 2 years with NCR developing microprocessor based equipment for the banking industry, I returned to WVU to teach electrical and computer engineering where I have remained in various capacities since 1974. While a graduate student, I worked under Dr. M. Dayne Aldridge on research in underground communications. Following my return to WVU in 1974, I concentrated on applying computers and communications to underground coal mining. I was named a Fellow of the IEEE in 1993 this work in mining. I have published many papers and hold several patents in areas of communications and computer controls.

Background

Before answering your questions about underground communications, let me set the stage for understanding better the communications situation in underground coal mines. Consider dividing the problem into *"PRE" incident and "POST" incident*.

The pre-incident situation is the normal everyday coal mine that is in production. The normal methods of communications work and work fairly well. These include wired standard telephones, mine pager phones, trolley phones, and leaky feeder radios fed by an infrastructure of repeaters and cabling.

Once an incident becomes an explosion, it is like looking into the barrel of a shotgun. Once it goes off, ALL infrastructure that is in the mine entry is blown out and destroyed. Little survives the explosion in the immediate vicinity. If the gas explosion stirs up enough coal dust, a coal dust explosion then goes off as well further clearing out any items that remained in the entryways. Entries far away from the explosion area may or may not be affected.

Postincident then is the postexplosion, immediate postdisaster coal mine. Telephone lines and communications infrastructure are simply gone; trolley lines and track can be blown out; overburden may have collapsed into the entryways and escape-ways; and the explosion can be so strong as to blow a wooden 2x4 lengthwise through a steel I beam. Electrical power is now generally off all over the mine since power cables are down.

Ventilation may or may not exist depending upon whether stoppings have blown out or overcasts have collapsed. In other words, it is a disaster.

Now the Job Is To Communicate

Now let me try to address the issues your questions are raising:

Let me first address communications in general. *Communications is needed in BOTH directions not just from the surface to underground.*

There are, at this time and to my knowledge, exactly no commercial products that can communicate both directions after the explosion.

Let me first address **the PED equipment**. From the information I have, PED, presently the most talked about equipment, is only a paging device. It can only page from the surface to the devices underground. The devices underground can not communicate to the surface with this equipment.

Interestingly, PED appears to be somewhat unreliable during normal mine operation. This in itself is not surprising because of the frequencies used by such devices. Modern underground mining equipment using variable frequency drives, generate these very same frequencies in normal operation. This then understandably interferes with the paging equipment. In warmer weather, atmospheric noise can also interfere. In fact, there have been some complaints from present users that the PED devices create interference themselves to already installed mine telephones and trolley phones.

On the other hand during a postdisaster situation, powered equipment will normally be turned off or de-energized. This stops some of the interference and should improve the possibility of paging an individual device underground. This it does NOT guarantee that the paging system will work in all applications. Ground conductivity, placement of antenna equipment both above and below ground as well as nearby steel structures and equipment can greatly affect the ability of this equipment to communicate.

Can PED be useful to trapped miners and rescuers? Yes. The important thing is that the underground miners be given enough information to be able to escape the mine on their own. This will require that the outside transmitter personnel have

good and valid information about the conditions in the mine postincident. This is certainly not the normal situation.

Apparently at the Sago mine the crew from section 2 had knowledge about the location of fresh air in the escape-way after a certain point in the mine because they had just escaped. They were in effect the scouts for information. If this information could have been communicated reliably to the miners in-by at section 1, those miners may not have decided to barricade themselves and wait.

If a mine has an installed mine-wide ventilation monitoring system that is measuring ventilation flows, differential pressures, and gas concentrations in the ventilation system, it is likely that good information can be provided to those miners still underground via their individual PEDs. It is very unlikely that a mine will quickly send a real person into harm's way to "scout" the ventilation system and the mine. That is the job of the rescue team and takes several hours of precious time to get started. Information about the ventilation system, gas concentrations, and what parts of the ventilation system are working is an immediate need postexplosion.

Is bi-directional communications possible? Yes, but, the next question you should ask is whether such equipment can be built that can provide bi-directional communications between the surface and underground. The answer is yes with qualification. At reasonable depths of a few hundred feet, communications by voice and data is very possible and in fact has been in use by cavers for at least 20 years.

This equipment is designed and built for the most part by radio amateurs for use by cavers. This equipment is usable but not presently permissible by MSHA standards, of course, and is not available in commercial quantities at all. For example there may exist less than 100 radios in total, constructed during the last 20 years by these ham radio operators. Could more be built? Yes of course. Can it be done in 1 year or less? Doubtful. This equipment is presently of briefcase size with antennas that are not easily carried (one meter diameter loop.) It may be possible to place such equipment in the safety barrel with the self contained self rescuer breathing equipment for use only postincident.

Can *commercial communications equipment* be built for individual coal miners and sold to the mining industry? Yes. In fact, in the longer term, this will probably have the best impact. One problem is however that most radio manufacturers are not willing to develop and build such equipment for such a small market as mining.

I am aware of only one company that has begun to develop such equipment. That is Kutta Consulting in Phoenix, AZ. Kutta has been developing, under an SBIR for the Department of the Army, a radio technique used by cavers and tested in caves. They have expanded that technology and have now applied for patents on new developments. An SBIR means that development is fairly slow and not well funded. Typically such work involves only a very meager effort by a person during the development. Again the market is relatively small for such equipment for coal mining. Kutta believes that they can also market to emergency responders for communications in areas of collapsed buildings and to DOD for the military's use in caves.

In my opinion, **the immediate best hope for postincident communications** for the next year or even two is to go ahead with equipment such as PED while keeping in mind that this equipment is not ideal and may become outdated quickly. The MSHA Web site notes that the company will require 6 to 9 months to produce enough equipment for 50 mines. [http://www.msha.gov/Techsupp/PEDLocatingDevices.asp] This means that once more modern two way communications gear can be developed and tested, that the PED pagers may need to be replaced with more modern bi-directional communications gear.

Another question that you should consider is **how to codify a requirement for** such communications devices such as PED or others. Requiring a specific manufacturer's product that is only doing half the job (only communicating one way) may be a reasonable quick solution, BUT, one should ask what will happen when better equipment becomes available. Will a coal mine operator simply say, "I already conform to the requirement" and wave a PED device at the inspector? If it is chosen to write rules, then it is my opinion that the rules must be broad enough to allow multiple solutions from multiple manufacturers and not put our miners in a bind in a year or so when better actual two way communications equipment becomes available.

Now, let me address **tracking of miners**. The tracker equipment that is being proposed depends upon a large infrastructure of underground equipment and cable or fiber and wire. Since the chance of this underground equipment surviving an explosion is very small, the only information that will be available will be that collected before the incident and any that might still be powered and communicating out-by the destroyed area.

The use of through the earth radio gear that can be utilized in both directions can be used for tracking as well as communications instead of requiring under-

ground infrastructure to be installed to do so. The cavers have used this ability for many years to map caves from above ground. They can locate a caver rather accurately in three dimensions and tie that to surface GPS coordinates. This presently requires real people active with receivers above ground who have an initial idea of the general location of the person underground. This past weekend, cavers were mapping a cave near Riverton, WV with people outside in the snowstorm locating the in ground cavers using such equipment. They were tracking XY to within 1 foot with a depth of 300. Is this equipment commercially available? No, as stated above, these are essentially radio amateurs building their own equipment.

Can this equipment be commercialized? Of course. Such equipment will need to be developed for commercial use, approved by MSHA, and produced. All of the problems sited above for getting communications equipment into the coal mines exist with this equipment as well.

So What Action Should Be Taken by Congress?

1. *Financial support* should be provided to speed up the developments being proposed by Kutta Consulting, West Virginia University, and other entities. I would suggest that support be provided to underwrite the expense of producing at least the first wave of equipment into the coal mines. I doubt that otherwise, a communications company will choose to develop new equipment, get MSHA approval, and produce such a small number of units to support our miners.

Beyond this immediate goal, there are additional longer term high technology additions to this base radio equipment that are more research and development. These will improve and expand the application of these through the earth radio communications systems and make such systems easier to use. These include automatic sensors that might automatically determine from the surface, the condition of a miner who is underground. Automating the tracking of miners and equipment should be done using the through the earth technology. Presently this is manpower intensive and can only be used during emergencies. Reliable and automatic communications equipment for data and voice postdisaster must be developed and supported. As time goes on, hybrid equipment can be developed that will combine the commercial pre-incident equipment with the rescue postincident equipment to create a self healing network of equipment to give the coal miner a better chance at survival.

2. A *review and possible modernization of MSHA tech support's methodologies* of evaluating electronics equipment. Modern electronics is extremely low power in general and does not necessarily require the same scrutiny and analysis that tube type electronics required for permissibility in years long ago.

3. *Rules changes* that require that coal mines have a method of communications postincident both to and from the miner. This should allow options as much as possible. Provisions should allow for innovative ways of communicating. If one is going to allow a one way pager for example, then one might install a set of geophones permanently above ground with computerized readouts at a central location that can locate a miner pounding on a rail or rib. One might simply install a bore hole with an explosion proof and survivable telephone whose cables can not be blown out the bore hole. Allowance should be provided for innovative and reasonable solutions to communications to and from underground that can survive incident conditions.

Thank you for your time.

Senator ISAKSON. Dr. Nutter, thank you.

Mr. O'Dell.

Mr. O'DELL. Senator Isakson, Senator Murray and Senator Kennedy, I appreciate you putting this forum together today and having me a part of this. My name is Dennis O'Dell. I am the current Administrator for the United Mine Workers of America. I represent their health and safety department.

I was born and raised in Fairmont, West Virginia, educated in Fairmont, West Virginia. Prior to me becoming the Administrator, I was a field representative in health and safety for 10 years in which I covered a large area of the United States, but more importantly than that, the thing that I am very proud of is that I actually worked as an underground coal miner for 20 years.

And with that, I sit here before you today and tell you that it sickens me to see what we are going through, that it takes such a tragic accident such as what happened at Sago and Aracoma, and

other instances where we have miners being killed to get to where we are. It has always been written, and I can remember as a young boy when Farmington No. 9 blew up, what those families went through because I was 20 minutes from Farmington, and I was at the Sago mine and saw what those families went through.

I am happy to see the representatives that are here today. It encourages me to see that there are some people out there who are willing to push some technology and develop new technology for the miners underground. It troubles me, though, to look at some of the self-rescuers that you see before you today, and when I started in the coal mine in 1977, these are the same self-rescuers that I wore. Nothing has changed since then.

So that is something that we definitely need to look at. The industry has been stagnant as far as pushing technology for new development on safety gear. We have gone a long way on production, but we have been stagnant on pushing safety improvements. It seems like the industry and the Government has been satisfied with status quo because we have had lack of new rules to force the technology of new developments.

Part of the problems are underfunding of NIOSH, underfunding of MSHA. They need to have a budget that allocates money toward the development of new technologies so that we can have better safety protection for our miners today.

Another problem is there seems to be no communications between government agencies that already may have technology that exists. NASA, the Pentagon, there may be technologies that they have already worked with that can be applied to the mining industry today and there needs to be an open communication between those agencies and the mining industry.

But to make all this work, there has to be an attitude, there has to be proper funding, there has to be an attitude of an industry and a government and the agency that oversees the mine health and safety that says these things will work. We cannot go into this with an attitude that this will not work. We have to take the attitude that these things can work and we can push the development of making them perfected.

A price cannot be put on a human life. I found it very troubling today to learn that one of the most important people that should be at this table today is a representative from NIOSH, and the Government did not allow him to be here today, and there is a lot of valuable information that could have been put before this team of people today that could have been learned upon, and I see I have a red light. So I will be open for more discussion later.

Senator ISAKSON. Mr. Shearer.

Mr. SHEARER. Good morning, Mr. Chairman, and Senator Murray and our Senator Kennedy. As founder of CSE Corporation, I appreciate having the opportunity to appear before you today and am pleased to be of assistance to this subcommittee as it explores emergency safety equipment for miners in underground mines.

CSE has from its inception been intentionally focused on this very important aspect of workplace safety. CSE began operations in the 1970s. Its major focus has always been to provide the most effective and conveniently portable self-rescuer for miners that

would meet the 1-hour minimum duration requirements established by law.

This was in response to a specific mandate of Congress in section 317 of the Coal Mine Health and Safety Act of 1969, reenacted in the Federal Mine Safety and Health Act of 1977.

From the outset, the goal was to produce a unit that was not merely a filter, like the belt-wearable filter devices in use at the time, but rather a unit that would provide a source of oxygen independent of whatever gases might be in the mine's atmosphere.

The self-contained self-rescuers used in mines today meet that goal by providing a totally self-contained breathing circuit that provides the miner with oxygen that is generated within the unit itself and is not dependent in any way on the composition of the mine's atmosphere.

For many years, our focus and the focus of others has been to make the legally mandated self-rescuer as convenient as possible and specifically as conveniently wearable as possible. Early units were quite large. We had one. We introduced the AU9 in the first go-round with the breathing apparatus and that unit weighed 11 pounds. It was not wearable. You had to store it.

The presently used SR-100 is a truly portable and belt wearable unit. The wearability means that miners have an oxygen supply immediately available for an emergency. Another critical part of developing self-rescuers has been to make them mine durable. They need to stand up to the harsh mine environment where they are regularly subject to potential exposure from physical trauma, moisture and sometimes significant temperature variances.

This is the unit that the miners are wearing, our unit, and I would be glad to take questions later on about that. CSE has made great strides in addressing all of these issues critical to providing each miner with a completely reliable self-contained self-rescue device. For some time now, we have been working toward developing the next generation of self-rescuers for miners.

Not only do we plan to make our new unit more compact, we hope to include a device that will permit oral communication without interfering with the clean air supply that the unit provides the miners.

Of course, any unit we produce must meet all of the approval and certification criteria and testing of the National Institute of Occupational Safety and the Mine Safety and Health Administrations.

As improvements are made, new standards may be needed for approval and certification. We're saying we think that has to come soon. As with all lifesaving devices, training is critical. Frequent training can ensure that all mines are completely ready to deploy a unit if ever the need should be.

I cannot emphasize enough how important this is. CSE has been pleased to work with the Government, mine operators, and miners on training programs for the current SCSR and we look forward to continuing these efforts. We spend a lot of time in this area. It is so critical.

I would like to offer a written copy of my statement for the record and will be pleased to answer any questions you may have.

Thank you, sir.

[Prepared statement of Mr. Shearer follows:]

PREPARED STATEMENT OF SAM SHEARER

Good Morning Mr. Chairman and Senator Murray. As founder of CSE Corporation, I appreciate having the opportunity to appear before you today and am pleased to be of assistance to this subcommittee as it explores emergency safety equipment for miners in underground mines. CSE has from its inception been intensely focused on this very important aspect of workplace safety.

CSE began operations in the 1970's. Its major focus has always been to provide the most effective and conveniently portable self-rescuer for miners that would meet 1 hour minimum duration requirements established by law. This was in response to a specific mandate of Congress in Section 317(n) of the Coal Mine Health and Safety Act of 1969, reenacted in the Federal Mine Safety and Health Act of 1977.

SELF-CONTAINED SOURCE OF OXYGEN

From the outset, the goal was to produce a unit the miner could carry at all times that was not merely a filter (like the belt wearable filter devices in use at the time), but rather a unit that would provide a source of oxygen independent of whatever gases might be in the mine's atmosphere. The self-contained, self-rescuers used in mines today meet that goal by providing a totally self-contained breathing circuit that provides the miner with oxygen that is generated within the unit itself and is not dependent in any way on the composition of the mine's atmosphere.

LIGHTWEIGHT, BELT-WEARABLE UNIT

For many years, our focus and the focus of others has been to make the legally mandated self-rescuer as convenient as possible, and specifically as conveniently wearable as possible. Early units were quite large in comparison to the reduced size units we are now able to provide. The early units could not be worn by miners while they went about their daily work underground. Those units had to be stored while the miners carried small filter-type breathing units on their belt to provide protection until they could reach the stored units. In the event of an emergency, the miners would have to locate the cache of stored units, take off their filter self-rescuer and don the self-contained self-rescuer before they could begin their escape from the mine.

The presently used SR-100 is a truly portable unit. It is lightweight and is designed to be carried on the miner's belt. Thousands of miners carry one everyday in the mines. The wearability of this type of self-contained self-rescuer means that miners have an oxygen supply immediately available for an emergency. The small size of the current SCSR also means that, in addition to the unit worn on the miner's belt, more units can easily be stored at strategic locations in the mine to provide additional oxygen supply capability, should that be needed.

The portability of the unit also obviously facilitates an easier escape of the mine. If the way is clear, miners need to be able to exit the mine on their own, in the event of an emergency. If self-rescue is possible, this is far better than waiting in the mine for a rescue team to arrive. The belt-worn SCSR provides the capability for self-rescue, and also provides a reserve of safe air to breath in the event the miner cannot exit on his own.

If needed during self-rescue, additional SCSR units can be picked up from storage caches along the escape route and carried until they may need to be donned. The portability of self-rescuers makes it easier to carry additional units while walking out of the mine. In the event the miner has to wait for a rescue team to arrive, a portable supply of oxygen, as provided by an SCSR, will enable the miner to travel to a safe location to await rescue.

MINE DURABLE

In addition to making them as compact as possible, another critical aspect of developing self-rescuers has been to make them mine durable. They need to stand up to the harsh mine environment where they are regularly subject to potential exposure from physical trauma, moisture and sometimes significant temperature variances. CSE has made great strides in addressing all of these issues critical to providing each miner with a completely reliable self-contained self-rescue device. Over the years, we have incorporated new component materials to enhance the unit's durability and we have added to the units indicators that will provide the user with important information about the unit's operating condition.

TRAINING

As with all life saving devices, training is absolutely critical. Frequent training can ensure that every miner is fully ready, without hesitation, to deploy a unit if

ever the need should arise. Training once per year is not enough. Training for miners should be conducted frequently on how to don the SCSR, how to shift from their first SCSR to their second unit, if necessary, and how to care for and inspect the unit. I cannot emphasize enough how important each of these things is. CSE provides training materials, including training units, to the mines for use in training programs. CSE has been pleased to work with the Government, mine operators and miners on training programs for the current SCSR and we look forward to continuing those efforts.

NEXT GENERATION PORTABLE BREATHING UNIT

For some time now, we have been working toward developing the next generation of self-rescuers for miners. We are working on developing units that can provide air supplies of lengths other than the currently mandated 1-hour. We also are planning to make our new units more compact, and we hope to include a device that will permit oral communication without interfering with the clean air supply that a unit provides to the miners.

Of course, any equipment we produce must meet all of the approval and certification criteria and testing of the National Institute of Occupational Safety and Health and the Mine Safety and Health Administration. Since we are looking at new uses of technology for our next generation of self-rescuers, we anticipate that new standards will be needed for the approval and certification of these devices. We have been working with the agencies to keep them informed of our development efforts and we are hopeful that the necessary approval and certification will be in place for these new types of units.

I would like to offer a written copy of my statement for the record, including the attached information on the SR-100, and will be pleased to answer any questions you may have.

Senator ISAKSON. Thank you. And all statements submitted prior to and afterwards, we will leave the record open, they will be included for the record.

Dr. Walker.

Mr. WALKER. Thank you, sir. I am Dr. Starnes Walker.

I am the Technical Director and Chief Scientist for the Office of Naval Research. As you all know, we were created by statute in 1946. Our corporate laboratory, the Naval Research Lab, has been in existence since 1921.

Our mission is to take science and technology, and make it real for our sailors and our marines. We operate in extreme environments, all the way from the deepest part of the ocean to space. In those environments, we have to maintain communications; we have to maintain survivability; we have to operate and meet the mission. In maturing science and technology, we take basic research, move it to applied research to advanced technology development.

We provide that science and technology element to the fleet and the force. In the environment that we operate, which is not dissimilar to what we have to do in mines, our Navy SEALs and other operators have to work within this. The good news is that we are maturing technologies; we are delivering technologies that have applications in this area. Our enhanced communications in these environments, the things that we are maturing are robotics that we provided. Each of these areas will have benefit to this, and so I think with those short statements, I will wait to talk a little bit more on that.

Senator ISAKSON. Thank you, Dr. Walker.

Mr. Zamel.

Mr. ZAMEL. Thank you, Mr. Chairman, Senator Murray, Senator Kennedy. Good morning. My name is Gary Zamel. I am the President of Mine Site Technologies, Incorporated. I am a mining engineer, and I have been in the mining industry for 35 years. I began

as a coal miner at the age of 18 while going to the university, and for the last 27 years, I have primarily had my focus on mining technology and its developments.

I appreciate the invitation to appear before the subcommittee, to offer assistance and information on underground mine safety communications and underground mine tracking equipment as available today, as well as the new technologies that we are developing for the future.

In particular, there are two systems that have been developed by Mine Site Technologies that have been subject to recent attention. Both have been designed to improve mine rescue capabilities. They are the personal emergency device and the miner tracker tagging system. The personal emergency device provides the underground miner with a means of receiving a text message from the surface. This is accomplished through a powerful low frequency transmitter on the surface that sends a text message to miner's battery packs.

The digital display on the battery pack can tell the miner that help is coming or where a bore hole may have been drilled or how miners can best exit the mine, which travelways are clear at a particular time. In other words, any text message can be sent to a miner.

The other device I have been asked to talk about today is our tracker tagging system, and this consists of a small unit that the miners carry on their person. When he passes by beacons located in the mine, this allows persons on the surface to determine what area or what zone of the mine the miner has gone into.

This type of information can be invaluable at the time of a miner's rescue. It gives rescuers critical information on where miners are likely to be located. I estimate that we have over 10,000 miners around the world who are wearing our PED communication system today, as we speak.

Mine Site Technologies is also working on research and development which is a continuous process for our company to provide important advantages in these technologies. Our R&D are directed to both providing two-way communications and improving proximity protection. The key to the success of our technologies is that the device be able to function after a catastrophic event at the mine, such as an explosion.

Much of our time and attention is being focused on ensuring optimum performance and reliability in all types of emergency conditions. We stand in support of your requirements and we seek the opportunity to work further together.

Thank you.

Senator ISAKSON. Thank you very much, Mr. Zamel. In the interest of being a southern gentleman, I am going to recognize Senator Murray first for a question, but give her a chance to think about that.

Dr. Nutter made a statement which I think is very instructive for us in terms of this information, and that is that our discussions really should be about a postincident environment. We learned explosions or tragedies in mines are not scheduled, they are not anticipated, and we wish they would never happen, but this hearing is about if and when that does happen, what we have available or

what we need to make available to put those miners in the best position possible.

Second, I would like to acknowledge the presence of Jeffrey Kohler, Dr. Jeffrey Kohler, from the National Institute of Occupational Safety and Health, and appreciate his attendance today. Thank you, Dr. Kohler.

Senator Murray.

Senator MURRAY. Well, thank you, Mr. Chairman, and I really appreciate everybody being here today to help us understand what is available and what we need to do as a Congress to help provide incentives to improve it.

Mr. O'Dell, you made a statement that the self-rescuers are no different today than many years ago when you were in the mines. I am seeing a lot of items on the table here. If you could tell me what you would expect, what do you think should be there that is not there? And maybe some of the other people who are here with some of their devices could tell us what they are. That would be great.

Mr. O'DELL. I think the key is that every miner who works underground should be afforded the opportunity or to have access to as much oxygen as it takes them to get from the furthest point of the mine to the outside, and sometimes that is hard to say just how much that would be because a lot of these units are based on physical characteristics of a person.

This unit may be good for 1 hour for some people. Maybe it would be good more than an hour for some, less than an hour for others because of their physical characteristics, as well as the units that are on the table to the right of me. These self-rescuer units and these three are all the same thing we wore when I worked in the mine for 20 years, started in 1977.

I think you have to look at a way—there is currently some folks that are working on new developments. They are looking at a smaller unit, maybe able to get 2 hours out of each cache, but even with that, I think the key is to be able to place those units underground strategically so that if I am in section A and I need to get to the outside, and the outside is 4 miles away, that I have enough units that I can pick up or carry or get to the outside with if need be.

Senator MURRAY. That is not available today? The technology is not available to store oxygen like that underground?

Mr. O'DELL. You can store these units. You can place them throughout the mine in different areas. There are other units that you do not see here today that are stored in the mine. There are some mining companies that have a storage, an underground storage plan, that are placed.

Senator MURRAY. Is it not required? Why do we not do that today? Why do we not have more oxygen stored underground?

Mr. O'DELL. Well, because you can either go with a belt-wearable, because the requirement today is just to have a 1-hour supply, a belt-wearable unit, or if a company does not want to provide these type of units that miners wear on their belt, they have a larger unit, a cache, that they can place strategically throughout the mine, that a miner can pick up such as Ocenco or different unit.

Senator MURRAY. If any of the people who are here can give me some more information, that would be great.

Mr. KENNEWEG. Yes. Wes Kenneweg with Draeger. It is partly tied to the regulations. The regulations, as I understand them, require at this point in time that each person underground have one self-rescuer available to them, and that has to be within 25 feet. If it is more than 25 feet, then they can have them stored and then they can use a smaller unit. This is an old filter unit which filters carbon monoxide, changes it into carbon dioxide which is less toxic.

With these units, we need to have oxygen present. If you do not have oxygen in the atmosphere, then this does not help you. But if you have the unit stored more than 25 feet away, then you can, if MSHA approves this plan, you can use this unit, or there is a smaller oxygen unit that is also available to get to the stored units. But the key is the quantity of stored units would probably be equal to the amount of people that are there, so you would have possibly 1 hour.

These units are demand responsive in that you can get, if you are waiting to be rescued, barricaded, they can last up to 3 hours.

Senator MURRAY. What is hard for me to understand is that at least the visible mining accidents that we all are aware of, it takes, it seems like, a day or longer to rescue people, so an hour just seems like too short an amount of time.

Mr. KENNEWEG. Unless you are going to get out—the other option is, as you saw in Canada recently, the refuge chambers where someone can go to an area and wait there and some of those rescue chambers can provide oxygen for up to 24 hours.

Senator MURRAY. But we do not mandate those in this country?

Mr. KENNEWEG. No. There are some rules and regulations regarding that, but I think MSHA could probably best discuss that. The other option would be to provide more self-rescuers in strategic locations underground so that you could get from point A to point B to point C.

Senator MURRAY. Like they do in a submarine.

Mr. KENNEWEG. And make your way out.

Senator MURRAY. Dr. Grayson.

Mr. GRAYSON. Yes, Senator Murray. Concerning expectations, if you could visualize just for a moment that in a number of mines, I mean a pretty good number of mines, they may be in seams that are only 3 feet high. And a 1-hour supply if that is it, you know, crawling out, two and a half miles or three miles like at Sago is an impossibility.

So certainly having more oxygen available, and caches is one way to do it. Another one, as the gentleman had just mentioned from Draeger, is the refuge stations, and I know that there is some debate on that, too, but you can actually get refuge stations or construct them yourself even out of the coal seam, and we mine rock above and down below at times for other things. We could actually establish refuge areas and have 40 hours of oxygen or more and possibly even establish communications straight down to the refuge area. And if there is need for medical assistance, we could do that.

Senator MURRAY. But we do not have that today because?

Mr. GRAYSON. There is nothing that mandates it and because it had not been mandated and historically, especially on the coal site,

because of the nature of the fires, it just was not pursued in the past.

Senator MURRAY. But we do have the technological capability of providing that today safely?

Mr. GRAYSON. Technologically we are capable of providing that and we could provide heat resistance and stuff like this after it is down below grade or above grade out of the coal seam itself with technology like on the space shuttle.

Senator ISAKSON. On this subject, Mr. O'Dell. You have already spoken once on this so——

Mr. O'DELL. But just as a follow-up, you asked if there is anything that mandates the use of chambers underground. Actually there is. There is a provision in the Mine Act that says that the Secretary may require operators to put in mine chambers and it talks about that specifically in the Mine Act. But the key word is that the Secretary "may." It does not say that she will. So there is language there that can get this done.

Senator ISAKSON. Senator Kennedy.

Senator KENNEDY. Thank you very much, Senator Isakson, for having this meeting here and for your strong interest along with Senator Murray's helping to guide our committee, and I think all of us should take, at least the miners take a sense of satisfaction. I know the chairman is strongly committed to doing what we can legislatively, and I think this has been true of other members. Senator Rockefeller and Senator Byrd and many others are strongly committed as well. So we want to make sure that we get some action.

In listening, and this has been enormously useful, very, very helpful to me, it seems that there are a number of sort of bottlenecks here. One is a careful review of the regulations to find out what enhances safety and what hinders it in terms of the modern mine. You talked earlier about the progress that has been made in terms of mining and the technology that has been used there.

Have the rules and regulations really kept pace with that in terms of safety and security? I think that that is something we ought to sort of think about.

Second, I think there are a whole range of different technologies. I mean we have not had the chance to consider. I am someone that spends a good deal of time at the water, and I am always interested in the problems of the communications that they have at sea and the difference between going into deep areas of the oceans and also deep areas of the earth.

I am a member of the Armed Services Committee and I remember in Grenada the difficulties that the Navy had in terms of communication between air, sea and submarines, and this was something that has gotten a lot of focus and attention, and they have made extraordinary progress. But when I hear that they can keep someone at 93 meters for 5 hours with oxygen in the ground, you know, they are doing some very, very interesting things in terms of these technologies.

So, Mr. Chairman, how do we find out? And who has the responsibility to really be doing this sort of thing virtually every single day to find out where these technologies are and where are our companies that are doing it? What companies would do if they get

additional kinds of incentives, and might they be willing to do some additional kinds of things as well, and who has long histories in terms of this?

Is that NIOSH? Are we depending on them? Are they really doing what needs to be done, but clearly this is something, a review that ought to be ongoing and continuing, whoever is taking responsibility in safety and security of mines.

Third, who is going to pay for it? We find out we are enormously interested in what is happening in fire departments over the past years and we are just getting the figures. My memory is tht funding for purchasing fire equipment was about $500 million last year. We will find out before long and I will put the right figures on in. But who is going to pay for this? Is this going to be the miners? Is this going to be the mines? Is it going to be the Federal Government?

I mean or is it going to be some of each? You know if you find out that we are going to have some resources that are going to be out there where people are going to be incentivized to try to get some breakthroughs, I think you are going to find some additional kind of action. I think we have got to try and figure out where we are going with this.

I mean are we prepared as a country and a society—I think we should be—to make sure that we are going to have safe and secure, as safe and secure workplaces, under OSHA, mines, under MSHA, as we can, and do we not have some responsibility? Clearly, the mine companies have responsibilities on this, and we have got to sort of think about who is going to do what here and try to develop some policy kind of determination so that those that are out there, you people that have been doing these things, you have got to know what the name of the game is.

Are there resources? Where are the resources? How much is going to be there? What are going to be the standards? And how are those innovations and how is that creativity going to be sort of recognized within this? So that we can incentivize all of you. I think you are all doing enormously interesting different work on it and it is all enormously important. So I thank the chair.

Could I ask Dr. Walker just a question about what you might be able to tell us about, you know, the depths and communication? You know obviously submarines, probably a lot of this stuff is classified in terms of what you are doing with the diving submarines or how you get ahold of them under the ice caps and things like that, but what can you tell us generally about earth and depth? Are we talking about two entirely different subject matters or are there lessons that we can learn?

What do you think that from your own experience in terms of survivability of people at depths, rescue areas at depths, you know, with the submarines? You do a lot in terms of those types of activities. Could you expand just briefly?

Mr. WALKER. Senator, you are exactly correct when you talked about where we have been and where we are today in terms of communication. One of the challenges that we have had is to be able to provide a seamless set of communication across the water and into the depths of the ocean.

The types of communications without going into a great level of detail extends all the way from low frequency to storage of information and then burst capability, linking it to satellites, so that if you are a SEAL in the water or you have a Virginia Class submarine or you have a warship on the surface, that you have that seamless communication and situational awareness of what is going on.

Likewise, at the same time, as you look forward in terms of the sailor, marine, and the ability to biometrically determine the health of the individual in real time and communicating that along the same links, that is another value added. So as you look as an operation takes place, you know, one, where each of the assets are, all the way from the individual, the diver, the submarine, the warship, as well as being able to provide information on threat as well as the operation as it advances.

All of that is there and, from my perspective, it is not an issue of developing new technologies. I believe we have things in place today that would apply to a mine capability, as Mr. Zamel described, in terms of a data highway and being able to geo-locate correctly where the people are, the health of the miners. I think that is all very doable today. And that is certainly where we are in terms of the Navy and Marines.

Senator KENNEDY. Chairman, I am sure my time is up, but I think this is an enormously instructive panel, and I think we are learning a lot and I hope our staffs are learning a lot, too. This is a great opportunity, I think, to make some real difference.

I would just mention last year, in the Fire Act, they purchased—it was $500 million that was available to firefighters for the purchase of different equipment, and I think we are finding out that they—I just know from traveling around my own State, and I have seen it in other parts of the country—that they really have moved up in terms of very advanced kinds of technology in communication. It is absolutely valuable.

We lost eight firefighters in Worcester, Massachusetts, going into buildings 5 or 6 years ago, and they kept going back in to try and find the other firefighters. All of them ended up getting killed.

And it was rather interesting up in Natick where they do a lot of research, you know, in terms of body armor and helmets, and one of the things they detected is like medics in the Vietnam War were going out, and one of the three that these medics were going out under fire to try and save had already died. So to have the information in terms of what the condition of people at depths in order to protect those that are quite willing to risk their lives as we heard down in West Virginia is something that is very important as well.

Thank you very much, Mr. Chairman.

Senator ISAKSON. Thank you, Senator Kennedy. Yes, Mr. Shearer.

Mr. SHEARER. May I make a comment?

Senator ISAKSON. Yes.

Mr. SHEARER. In response to Senator Kennedy's comments on seeing a need and how do we do some of these things, I would like to give an example of what I think can be done. We had, I mentioned earlier, that we are working on a new apparatus that is smaller, lighter, and going to be appreciably longer duration.

We are doing that at our cost. We are doing it then at our time. That is one thing that financing can certainly help speed the process. We are doing the best that we can in working forward on it. We are working with both NIOSH and MSHA because one of the other things, assuming we are successful and come up with this product, it is going to take some changes in the regulations, and I just feel that now is a nice time to start thinking about those, and so if there is funding—certainly we would like funding to be able to do these projects—but we are doing it regardless. If you think it is important enough, you just proceed and do the best you can and that is what we are doing.

Senator KENNEDY. Could I mention one thing, Mr. Chairman, just one final point here?

Senator ISAKSON. Yes, sir.

Senator KENNEDY. I would suggest to any of the companies, there is a program. It is called the SBIR, Small Business Innovation Research Program, out of the Commerce Department. It gives awards to smaller companies, up to two or three people for, you know, breakthrough technologies on that, and it is not vast, but it is over time, it is several hundred million dollars a year, and I just offer that thing.

And if there are some of those that are working in those areas, you know, we might just write over there—it is done through the Commerce Department—and say that we hope that there are new technologies. We hope that at least they would give some additional kind of sympathy to breakthrough technologies, if we could help in some of these areas. But I just mention that. A lot of people do not know about it.

Thank you.

Mr. SHEARER. I appreciate that. But another area that we have worked on with this apparatus and in this came on to the market in 1990, and over the course of time, and it is out in the field being exposed to whatever, things happen. So then what we have done is come up with devices that we put on that we can tell when it exceeds conditions that are not good for the apparatus. The apparatus will not function as well. It may still function, but not as well.

So we do these things because there is a need, and so, you know, a lot, I think is being done, and it just maybe does not get around that all of this is occurring. So if we could do something. As I say, we went to the Government and said here is what we are doing; we think you need to be looking at regulations and, you know, I believe they are doing that.

Senator ISAKSON. Yeah, I think I want to pose a specific Sago scenario in just a second and ask Mr. Zamel a question, but with regard to all of you who are here with products—Senator Kennedy and I talked about this on the plane coming from West Virginia—we are aware that there are many things that can be a catalyst for product development. Sources of money is one. Ability to pay for it is two. Government requiring it is three. But sometimes any one of those three things without the ability to reasonably do it does not matter.

So we are looking, and appreciate your comment, in ways we might be a catalyst to be an incentive to research and development

and expansion for new technologies. In fact, the platform for this meeting is for the public to be able to see and for us to be able to see what is there and what is being done, but equally what could be done if.

With that scenario, I want to, Senator Kennedy and I, when we went to Sago, we learned something very interesting that I really have not read that much about in the reporting. And let me just share it, and then I am going to ask you the question, Mr. Zamel.

In the Sago mine, there were two mine teams that went into that mine, Team I and Team II. That mine if you could visualize in your head was a reverse F. It was a long 2-mile, 10,000 foot mine at a depth of about 267 feet at its deepest point, and at the deepest point, there was a chamber off to the left at the end, and then a second chamber a little bit closer to the front of the mine, which formed the letter F, if you look at it backwards.

The first team got to the last chamber going to the left. The second team got right to the closest chamber. When the explosion went off, Team I was close to the chamber and they ended up going to the end of that wing and putting a barrier, which ultimately between their 1-hour breathing apparatus and the barrier they were able to put up, which I think was either polyethylene or some other material, one miner we know lived 10 hours and one miner survived.

Now, the other team got out, and when they got out, they had valuable information. They tried to go further to rescue the miners that they knew were ahead of them, and were stopped by the obvious problems of lack of oxygen, carbon monoxide, methane, etc.

But they then came out with a wealth of information about how far you could go, what was going on, etc. Our difficulties were the following: we could not communicate with those miners at the end of that second chamber to tell them if they could make it so far, they could walk out. Had we been able to get that information to them, and given they had a 1-hour apparatus, it is possible, timeliness, they could have gotten out.

Second, if we could have known where they were, it would have been immensely helpful. Neither one of those things in the Sago incident were possible, and from a communication standpoint, I have not been able to find anything that tells me it would have been possible for two-way communication even now.

I am aware, Mr. Zamel, that I believe you produce two products. One is a paging communication that in a postincident environment works wirelessly. And second, a tracking product. Given the scenario I just described, which was, I think, accurately, Senator Kennedy, the Sago incident, would you address what your technology does? And I am not selling—I want to tell everybody here—I am not selling his technology and nobody came here to sell their technology. They came here to save lives.

So after you talk about that, I would like anybody else, who either on the oxygen side, the location side, or the communication side, has a comment to please chime in.

Mr. ZAMEL. Thank you, Mr. Chairman. Our technology was developed after a similar incident in Australia to what Sago has incurred, and the whole purpose of our design has been to allow us to keep our infrastructure out of the mine in the best case scenario

and have our transmission system on the surface. So what we ideally aim for is to have no transmission equipment underground, no cabling underground. It is all done from the surface.

The only thing that is carried underground is the receiver and the unit that I have here is a fifth generation receiver. So our design has continually advanced and improved to being lighter and more functional, and this is now the latest development which has been launched in Australia in the hardrock mines over the last year, and it has now been finally approved in Australia for use in coal mines and will be issued to MSHA in a matter of days for approval for the U.S. industry, and all of our previous approved items have been designed to meet the higher standards in the United States, so we have no problem with them.

That would allow a text message to be sent just in the same way that a pager on the surface can be carried, and a digital display will read out a message. So that first crew of guys coming out of the mine, the information that was made available, messages could continue to be sent to the individual pagers for those trapped miners.

So this system does offer a way of being able to communicate to personnel underground regardless of where they are located underground.

Senator ISAKSON. Let me interrupt 1 second. Now, they were at a depth of 267 feet and a length of 10,000 feet into the earth, but that communication was still possible?

Mr. ZAMEL. Yes. We have systems working in Australia over 2,000 feet. So considerably deeper, an order of magnitude deeper. The low frequency transmission system that we have designed and developed, which has now been proven in 140 mines around the world, in a broad range of geology from coal to hardrock copper, lead, zinc mines, potash salt, has given us an enormous wealth of experience.

The sort of transmission that we use is, in fact, even lower in frequency than that that is used in the naval industry from my understanding.

So the opportunity exists to be able to communicate, and in Australia, where I have worked for most of my career, or all of my career, virtually every underground coal miner carries one of these devices on his belt.

Senator MURRAY. How much does it weigh?

Mr. ZAMEL. It weighs, this unit weighs about .8 of a kilogram so just over a pound. It is a third of the weight of the existing lead acid batteries. It incorporates lead acid technology which has been developed through the mobile phone industry, and our electronics, which is that unit there that sits on the top, is a sophisticated receiver that also now incorporates a tracker unit, so we have currently approved, MSHA approved, tracking device, and now we can also incorporate it in this same pack. So that——

Senator MURRAY. You can locate the person even if they are unconscious? You can track where they are?

Mr. ZAMEL. No. What we are capable of doing is identifying where men are underground in zones. So they go past a beacon. So this is a different technology. The tracker system requires a different means of backbone of telemetry, and it is a cabled system

of beacons, and as the miner goes past that beacon, he will be recorded on the surface.

So in the event of an emergency, the last known location will be recorded on the surface so everybody will be known at the time of the incident, and the greater chance would be that not all of the beacons are taken out. So it would only be where an explosion, for instance, or fire might have occurred. So as they come out of the mine, they could be being tracked by the beacons out by the working face.

Senator ISAKSON. They are wireless, the beacons?

Mr. ZAMEL. The beacon, from the tag to the beacon is wireless. The beacons are hard-wire connected.

Senator ISAKSON. If the wire was severed by an explosion at a depth place, would the other beacons working their way back toward the entrance still function?

Mr. ZAMEL. Yes, the out by beacons would still function, and I think there is a lot that still can be done in building in redundancy to be able to separately power in the event of an emergency these beacons through a UPS, interruptable power supply type of approach, that will allow power to come on to a beacon for a particular period of time in the event that cable is taken out.

Senator ISAKSON. I am going to call anybody else. I will get right to you in just one second, Mr. Campman. Would this be a true statement or an accurate statement? In the Sago scenario, had there been beacons, and had they worn the device, we could have known the last beacon they passed that was still functioning, which would have given you a general location? And although they could not have communicated to the surface, you could text page to them?

So if they were in that area at the end of the mine that they shielded off and had their 1-hour devices operating, which they did—we know that was the case—we probably would have known at least generally that they were that far, at least that far in the mine, and would have been able to tell them if you can get to point X, wherever the other team told them, there is good air? Would that be correct?

Mr. ZAMEL. Yes.

Senator ISAKSON. We would not know that they got the message, but we would know we could send it to them?

Mr. ZAMEL. That is correct. I mean based on our experience, your statement is correct, and the beauty of this system and the way in which we have designed it is that reliability is confirmed by its day-to-day use, so that period that Dr. Nutter talks about at the time of the event, pre that time of the event, this is a system that is used day after day after day. So miners get comfortable with the fact that they have a means of communication because on a daily basis, it is used as a management system.

So at the time of an event, an emergency, it is known that the system is functioning and reliable, and we have always felt that is a very fundamental advantage of this type of technology, that it is, apart from at the time of the event, by having the transmission system outside of the mine, you know the system is still functioning.

Senator ISAKSON. Mr. Campman.

Mr. CAMPMAN. Yes. If I may, I would like to elaborate a little bit more on Mr. Zamel's description for locating system. The technology for locating based on the type of system described does require an infrastructure in the mine, if I am correct in that.

Some of the newer technologies, in particular one that we have already developed not only for the fire service but for security applications, allows any facility, whether it be a mine or a building, to be retrofitted with very low cost, battery powered—I am talking very long-life battery powered devices that will power it to 6 months to a year, that allows personnel to be tracked through these tunneling system.

OK. One thing with our radio telemetry system, we have the ability to successfully communicate and signal in mining tunnels. From an engineering perspective, I am sure some of our other members here as well would agree that radio signaling in tunnel environments is very difficult, and there are special things that you can do to ensure that your signal propagates out.

Senator ISAKSON. Is it the line of sight problem?

Mr. CAMPMAN. Not necessarily. It has do with multipathing and signal cancellation. OK. The actual tunnels act as a wave guide if you will, and can actually cancel out a signal at any particular point in time.

We have overcome that with our technology and one of the ways we have done that is either through—we use a very, not sophisticated, but a very clever frequency hopping method which we use, if you can envision a shotgun of frequencies. One frequency makes it a certain point and then fades out. Another frequency will pick up and ensure that signal gets propagated out.

The point being though our system, it will allow you to locate miners in real time, hundreds at one time as well. We have that capability now to do that with a low-cost infrastructure in the mine. Keep in mind this is radio so we cannot propagate through the earth. However, knowing before a collapse or cave-in incident, knowing where those miners are at in real time is very important.

I think what really should be thought about here is a hybrid technology where the through the earth type communications coupled with another matured technology such as ours could really pay significant benefit to the miners. Now, keep in mind a lot of this technology that we have was developed specifically for the firefighter service as well, so we are very familiar with very rough environments that the miners would see.

Senator ISAKSON. So is it fair for me—I am going to get to everybody—is it fair for me to say yours is through the earth, yours is through the tunnel?

Mr. CAMPMAN. That is correct. Now, keep in mind, though, with our system, any point within a building or a mine where there might be a cave-in or a collapse, where that sight, line of sight has been eliminated, our system has the intelligence to tell where that cave-in or collapse would be, and that takes place through our micro-repeater devices that are stationed in the mine.

And again, these devices would have to be powered, but they also have a battery back-up which allows them to operate in the event of a disaster incident where power would go down.

Senator ISAKSON. Is the information digital information or voice information?

Mr. CAMPMAN. This is all digital signaling information at this time and with our system you have personnel accountability.

You can tell what people are in the mine, where they are located, when they have exited the mine, and if they ever hit their panic button, and again this can be—I did not bring it with me, but we have a command base unit which displays and monitors up to 3,000 individuals at one time. This same device, also we have a computer platform where you can see on a PC screen where these people would be located.

Senator ISAKSON. And your technology is in use in today's mines?

Mr. CAMPMAN. Yes, it is. Not in the mine, it is not, no. It is in use in security and fire.

Senator ISAKSON. OK. Dr. Nutter or who was next? I am sorry. Dr. Walker.

Mr. WALKER. Just a few comments. What I think you are hearing here is that you would have the opportunity to have I will call it a hybrid system between the two that this secure data highway is possible. This is not dissimilar to what we do in the military in terms of what is defined as military operations in urban terrain, where we have to know what operations, where people are, but also you can superimpose on this secure data highway with the advanced signal processing, to know, geo-locate people very precisely, but also to imbed biometrical information which lets you know something about the health of the people.

And we are looking at individual sensors for people, for the soldiers, warfighters, that, in fact, are fairly inexpensive, where every individual is, in effect, a sensor themselves. So to the future, this sort of data highway that is secure, that can withstand extreme environments of explosions and fires, which is what we do as the Navy all the time in our ships and our submarines, this is very doable.

Senator ISAKSON. Who is next? Dr. Grayson.

Mr. GRAYSON. Actually I think Dr. Nutter was before me.

Senator ISAKSON. Dr. Nutter.

Mr. NUTTER. Thank you.

Senator ISAKSON. I recognize all the doctors.

Mr. NUTTER. I hope it is not that bad.

Senator ISAKSON. Oh, no, not bad at all, very good testimony.

Mr. NUTTER. I wanted to comment about a couple of things. One is your comment, Senator, about Sago, where communications, if they had known that there was good air further out, one of the things that already exists are computerized mine monitoring systems. Some mines have them and some mines do not. I would say probably most mines do not, but some mines do.

And so that is a pre-incident system with sort of a leftover that may exist after an explosion, but if the leftovers are still in existence, they can tell above ground where there is good air and where there is bad air. It is monitoring the ventilation system. So they can tell air is moving, air is not moving, how fast it is moving, whether it is contaminated with CO or methane, live real time. That information to a pager makes a great deal of sense. OK. But that, as I said, is not a requirement for mining.

Senator ISAKSON. Right.

Mr. NUTTER. The second thing I want to note is that biodirectional communications, we tend to think of as voice, but after an explosion, voice may not be usable. The pressure of the explosion may have destroyed eardrums, so being able to communicate by just simply throwing a switch or sending a text message, if we can do that, I kind of think that may be difficult at that situation, too. But a switch or set of switches where they can communicate digitally out, I think, is helpful. OK.

The third thing is tracking. The cavers have been communicating with voice above and below ground and tracking for over 20 years. That equipment exists. It is not commercial. It is amateurs, amateur radio operators have built this stuff. I am an amateur but I do not build cave equipment, but I do know people who do, and they can track from outside where their cavers are.

In fact, they monitor and map their caves. This is a picture taken last Saturday outside of Riverton, West Virginia of some cavers above ground tracking the cavers underground, and they were about 300 feet underground at that point. They monitor the caves with this stuff.

Senator MURRAY. What is that doing above ground?

Mr. NUTTER. They have an antenna on the ground and they have a radio. The cavers underground have a very small transmitter and a very large, maybe meter in diameter, loop antenna, which they then turn on. These guys can then take angles and plot the position of that transmitter.

Senator MURRAY. So they know exactly where they are underground?

Mr. NUTTER. They know within a few meters of where they are, yes.

Senator ISAKSON. Excuse me for interrupting. But is that, that slow frequency, is that similar to your technology?

Mr. ZAMEL. Quite some years ago, we looked at what the cavers were doing and we did not see that it had the potential to achieve total mine coverage at mines with considerable depth, and when we design our technology, 200 meters really does not meet a large part of where the market is, so 2,000 meters, as I am saying, is more in line.

So we have to design or we wish to design technology that really could meet a much broader sector of the marketplace. I think if I could make the comment, we welcome this dialogue and we, as a company, are very interested in joint hybrid developments.

We realize that there is a certain amount of expertise that our team holds and others have other levels of skill, and this is too important a subject for us to ignore or disregard the capabilities of other organizations including the Navy and private organizations. So we welcome this opportunity to work further with your industry and with other sectors.

Senator ISAKSON. Excuse me for interrupting, Dr. Nutter. Go ahead.

Mr. NUTTER. No, that is fine. The only other thing I want to say is keep in mind that this is not commercial gear, that this is homebuilt gear. You are looking at probably at least a year of development and this is postincident. This is not very useable in its cur-

rent situation as pre-incident. I think it could be with development, but as we were talking about, there is money that has to be put in those piles in order to get that development done. The market is small. There may be 60 to 80 cavers worldwide who do this kind of thing. The market in mining is small. So development either takes a lot of time or a large effort at once.

Senator ISAKSON. Dr. Grayson.

Mr. GRAYSON. Just one elaboration. Mr. Zamel was correct on the installations of his experience. With antenna loops specifically on the surface, generally speaking, communication to the ground is fairly reliable. Unfortunately, in our instance, here in the United States, all but one are underground installations of the antenna loop which could be compromised because of the explosion as well. So I think properly installed, properly maintained, and then it would increase the reliability quite a bit.

Senator ISAKSON. Anybody else? Mr. O'Dell.

Mr. O'DELL. If I may, I would like to share something with you. What I have here is a report. It is an electromagnetic system for detecting and locating trapped miners. What is interesting about this report, this report was put together by a gentleman named James Powell, who worked for Pittsburgh Mining and Safety Research Center, Pittsburgh, Pennsylvania.

If I may, I would like to just share this with you. In 1968, when the Farmington mine disaster resulted, the National Academy of Engineering recommended that a postdisaster location system be developed, and the then Bureau of Mines, which no longer exists, at the time actually developed an electromagnetic system for detecting and locating trapped miners. It has been in existence since 1970.

It is a full report. You will see in here that it has been tested, it has been proven to work, it passed—as a matter of fact, I can read the summary and conclusions. An EM system has been built and tested that permits the detection and location of trapped miners. The hardware required is compact, sturdy, in general practical for use in mines. Successful field tests of the system have been conducted at a wide variety of mines. So it is not something that was put together haphazardly, but we have had this since the 1970s.

Senator ISAKSON. Whose technology was that?

Mr. O'DELL. This was actually the Government, the then Bureau of Mines did this. NIOSH, I guess, is the——

Senator ISAKSON. If you are in this business, you would like to comment on that?

Mr. CAMPMAN. If I may, the technology you are referring to, which I believe is very similar to Mr. Zamel's technology, was actually developed in the 1980s and 1990s by Los Alamos Laboratories. There is another company who we have recently been in discussion with called Vital Alert Communications, and they have a low frequency system very similar to Mr. Zamel's. However, back in the mid-1990s when they had that technology developed, which this is a prototype unit of that device, there was no driving means for any mines to put this type of equipment in, and that really brings everything full circle.

Our business started out as a niche business in the firefighter protection device market because those devices were mandated by

law that every firefighter must wear a PASS device. Similar legislation going into the mines is not only going to spur development, but I think it is certainly going to open the eyes of a lot of private industry people to put some resources into that because there is enough of a market there, especially for companies our size, to go after.

Senator MURRAY. Mr. Chairman, could I——

Senator ISAKSON. Senator Murray.

Senator MURRAY. And I know Senator Clinton is here. So——

Senator ISAKSON. By the way, I want to apologize. This end of the table has been greatly improved from Senator Kennedy leaving in looks and Senator Clinton getting in.

[Laughter.]

I am sorry I did not recognize you sooner. So go right ahead.

Senator CLINTON. No problem.

Senator MURRAY. You know this is fascinating. And there is so much new technology and it just begs the question: why was this not in the Sago mine? Why is it not there today? Is it a matter of we have to have a regulation to require it? Is that what it is going to take?

And secondarily, the cost of it, how are we going to make that happen? Is it because we have not said you have to have this? Because it appears to me that we had plenty of technology out there that could have made a difference.

Mr. CAMPMAN. I think that is part of it. And again, getting back to——

Senator ISAKSON. What is the other part?

Mr. CAMPMAN. Well, the other part is there has to be a big enough market there for companies to put their R&D resources in. Also, I might add that funding for the product development has to be there. If the company can justify it internally because they can get enough market share, they are going to do that.

However, I believe Senator Kennedy mentioned the SBIR program, and other grant programs, if money is made available, I am sure it will spur development for these types of products.

Senator MURRAY. Dr. Walker.

Mr. WALKER. Just to amplify that, it has been our experience for the Office of Naval Research, we find the most creativity is when we get a cross-section of academia, small business, and industry together. I mean that is really how we have been able to make advancements in discoveries from the phenomenology, but then make things real for our sailors and marines.

So I think you will find that that is really a very fertile area for discovery, but again I do not see any technology challenge that would allow this not to improve mine safety, everything you have heard today.

Senator MURRAY. Mr. O'Dell.

Mr. O'DELL. Yes, in regard to your question about whether it has to be regulated to make it happen, I serve on West Virginia—I had a diesel committee for the use of underground diesel equipment in the mines. And we sat down and we developed regulations that are probably the most stringent regulations for the use of underground diesel equipment in the world, more so than what the Federal Government requires, more so than any—Pennsylvania may equal

what our regulations were, what we came up with in West Virginia.

And people kept saying there is no way; you cannot do that. You cannot force operators to put these type of filters on these diesel equipments; it is too costly; it cannot be done. There is not enough interest out there, but guess what? We made a regulation. The regulation was passed, and after that was done, there were people that came and now we have the use of that type of equipment with the regulations we set forth.

So, yeah, I think it has to be regulated to force people to come to the table to be able to comply with what needs to be done in the industry.

Senator MURRAY. Dr. Grayson, you had a comment?

Mr. GRAYSON. Yes, just an elaboration. Market share and size is certainly part of the answer, but compliance with existing regulations does tend to dominate. I mean that is just a fact of life. You will see the larger leading companies who do in mine-wide monitoring systems. They do put in PED systems and things of this nature, leaky feeder systems. But they are truly leading and everyone else is behind.

And I think the last part is that we probably had lulled ourselves into a state of—I will not call it euphoria—but at least a state of accomplishment over the last 20 years with the record and everyone was seeing the tremendous gains on both the injury side as well as the fatality side. And it is not an excuse; it is just that we probably were lulled a little bit and did not pursue as hard as we needed to make the technology.

Senator ISAKSON. Senator Clinton.

Senator CLINTON. Thank you so much. And I thank all of the witnesses for being here, and I especially thank Senators Isakson and Murray for holding this, and I really appreciate the very straightforward discussion of these issues. Obviously, I was in another hearing and could not get here until just recently, but my staff has informed me that it has been a very open and candid discussion.

It is troubling to me that we have technology and we are not utilizing it as effectively as possible, and I appreciate the nods when Senator Murray asked about what is the problem; do we need to try to mandate it, regulate it? And my understanding—maybe, Mr. Zamel, you could respond to this—is that, you know, Australia's mine safety provisions are more advanced than American safety or at least they appear to be, and is that because it is regulated and mandated?

Mr. ZAMEL. It is really, the Australian industry has to be at the forefront of coal mining from a productivity and a safety point of view because we operate in the export markets and we suffer the vagaries of the cycles of the industry. So productivity and safety go hand in hand. A safer mine is a more productive mine and vice versa.

We operate under a duty of care responsibility, so mine operators, mine owners, mine equipment suppliers are required to provide technology and operate that technology at a standard that is state-of-the-art to meet occupational health and safety needs.

And I think we have constantly learned from the global industry and very much from the United States many aspects of mining,

and we think that Australia is doing some very good work in this area, but we do not sit on our laurels. We continue to put effort into this, and we also will sit back and investigate the Sago incident and see what we can be learning in that industry.

Senator CLINTON. I appreciate that because I am troubled that in the recent budget, there are no increases for enforcement activities at OSHA or MSHA, not even in coal mining in response to the recent disasters. There is not any money for more inspectors to oversee mines and other workplaces, to even ensure that the existing regulations are being enforced, and, in fact, as for NIOSH, the Bush budget would cut funding to 250 million, which is 36 million less than it even requested last year, and this is one of these areas where I think it is highly unlikely that new safety technology can be implemented in the absence of some Federal drivers, both funding and regulatory.

And the additional research, the best practices, the kinds of lessons learned that Mr. Zamel is talking about, will not do us any good if they say in reports, as Mr. O'Dell pointed out, that are 40 years old. You know that is not progress. So I would hope that we can figure out a way to marry the private sector's interest in these new technologies, the work that is done in the Defense Department, NASA and other places on relevant technologies, and try to figure out a more effective response that I am sure is going to include some Federal dollars and regulation.

Otherwise, I am afraid we will be back here in 5 or 10 years, and we will be saying, gee, you know, we have not done it yet, and there are lots of reports that are out there. So I am hoping that, Mr. Chairman, we can pursue this and see what kind of sensible practical solutions we can come up with.

Senator ISAKSON. I appreciate the comment. Let me inject something. I would really like for any of you experts, because I am not, to comment on this. But one thing I want us to all be very aware of, I scuba dive. Most of the things developed for scuba diving were developed a lot later than back in the 1970s and are still very similar. Now not the 93 meter stuff. I am not into that stuff at all. I am a 60 foot and up guy myself but, nonetheless, you have got atmospheres and the consumption of oxygen increases dramatically at every 33 feet in depth that you go because of the compression.

The same thing does not happen per se in mines, but there is a physiological effect on the human being. There is just so much that you can do.

Second, there is a weight problem. What your miner can carry and what, how long it will last, function together. I mean you would like to have a miner be able to carry 32 hours of oxygen, but the fact of the matter is the 1 hour weight is what—31 pounds; is that right? What is the 1-hour weight?

Mr. KENNEWEG. The self-rescuer?

Senator ISAKSON. Yeah.

Mr. KENNEWEG. Six to eight pounds.

Senator ISAKSON. Well, 31 pounds must have been the total weight that miners might carry with all their other stuff, but you end up being—so we have some limitations, you know, of physiology.

Second, and it has been referred to by Mr. Shearer and by some others indirectly, mandating it does not necessarily make, on itself, make it happen. You have got to have the ability to realistically form the capital to make the investment, to do the research and development, to develop the product, as well as it has to be, reasonably be something that can be purchased given the industry that you are talking about by what it generates after it is over.

I do not say that in the least bit to tamper with the idea of requiring anything that will make it more safe. But we have to require that there are some practical issues of human physiology and human strength and things like that, and the laws of physics that affect some of this stuff. So I just wanted to be sure I threw that in there.

Yes.

Mr. GRAYSON. Just a follow-up point because it sort of touches on what you are discussing. But there is sort of a tradeoff between the requirement of certain technologies and how much of it we might require and with other technologies that could be used, and, for instance, for my background, I came back from a multiple shaft mine, and we would——

Senator ISAKSON. Is your mike on?

Mr. GRAYSON. I think so.

Senator ISAKSON. Move it a little closer then please.

Mr. GRAYSON. OK. I came from a multiple shaft mine, so in other words, a vertical shaft going down in, rather than a shaft horizontal type that we are seeing in the news. But we had four shafts, two of them were equipped with elevators, and the other two had escape hoists. So that an SCSR, a single one, that was person wearable, all of a sudden became, you know, very practical because it would be less than an hour to get to the one shaft, and we did not have to go 3 hours or 3 miles in order to get our way out.

So by having two separate and distinct escapeways that were actually separated physically by some distance of a couple of miles, then we enhanced our probability of escape with a 1-hour type SCSR. Unfortunately, a lot of our mines do not have that at this point in time. I am not suggesting——

Senator ISAKSON. Do not have additional escape shafts?

Mr. GRAYSON. No, no, they——

Senator MURRAY. Because there is no requirement or?

Mr. GRAYSON. Well, like the Sago mine. You saw the openings came into the mine from an outcrop, and it ran three and a half miles in, and they had two separate distinct escapeways, but they were just maybe a few hundred feet apart. The minimum requirement of the law was 50.

But they came to the same spot. So when they were trapped, they really had nowhere else to go, neither refuge chamber or an escape shaft, which does not have to be a large diameter escape shaft. As long as you can get, you know, one or two or even four people on an escape capsule at one time up a vertical shaft, it can be a smaller diameter one.

So what I am saying is there are some options here that the operators could use a small diameter shaft with escape hoist or refuge stations in case miners get trapped. Then we also have the other option of the SCSRs, placed at a certain distance, but still re-

alizing that if you fill the mine up with SCSRs every 1,500 feet, let us say, and you have got three miles to go, the odds on getting to the next cache may be blocked, go to the third cache or something like that. So there is a tradeoff on what could be feasible choices in order to achieve what we in the end want.

Senator ISAKSON. I think I—tell me if I am wrong. You just made a great point. I think what I hear you saying is depending on the type of mine and the mining operation, a one-size-fits-all does not work.

Mr. GRAYSON. Exactly.

Senator ISAKSON. If I understand, the Canadian mine where they had the escape chamber—not the escape chamber—the panic room they called it, I think, or the escape chamber, that was a potash mine which is a whole lot different than a coal mine.

Mr. GRAYSON. Uh-huh.

Senator ISAKSON. And so although when I first heard that, I said that is the answer, and then all of a sudden I started asking questions, said, well, it might be the answer in a potash mine, but you might do something different in a coal mine. So what you are saying is you might take the approach, there may be a myriad of options from which mines, given their characteristics, type, location, depth, etc., might choose from to enhance safety; is that correct?

Mr. GRAYSON. Yes, sir, that is exactly the point, and as long as they have the option, they can pick whichever one seems to be make most sense for the particular operation. And then if they want to choose refuge chambers, for instance, and do an optimal siting of where people are going to be located, and then pick two or three locations, not all of which will be compromised in the case of a mine fire or an explosion in coal, they still have other places to go to. Same thing with the shafts.

Senator ISAKSON. Very helpful. Senator Murray.

Senator MURRAY. Mr. O'Dell had something.

Senator ISAKSON. Mr. O'Dell.

Mr. O'DELL. I would like to speak today as a coal miner because that is what I am. I told you when I spoke earlier on I spent 20 years underground as a coal miner while I went to school. From a coal miner's perspective, it is really quite simple: give us enough oxygen to get from the deepest point to the outside.

We have units that can be placed in the mines today to make that possible. I pointed out a report to you that was developed in the 1970s, so we now have the technology to locate trapped miners. Chambers, we like the ideas of chambers, but as coal miners, we are always taught that is the last resort. I think it is something that we should have as a backup in case our escape is blocked, but we should first be given the opportunity to try to get out very first chance.

And there are other ways that you can do that, too, and that is look at the mining plans that are approved today. I think emphasis needs to be put on the intake escapeways being better protected than what they are today. A coal miner should never be put in a position where he has to face smoke coming out of the mine or he has to rely on a cable to hold on to because you cannot see or you do not know where you are going.

And this can be done. I mean if you protect and you make the isolated intake escapeways better for the miners, you give them the oxygen you know they need to get from where they are to the outside—I worked at a mine that I could have picked up, not these units, but another unit, there were probably 14 units on the section, and I knew if I had to walk out of the coal mine, I knew I could pick up two every 1,500 feet if I needed to. So it is possible to do that.

I would encourage everybody that is here today to move forward with the technology that we have, but let us not do like we did, you know, sit on a report from 1970 till now. And I really appreciate, you know, everybody putting this together today. I know it means a lot to our miners. It means a lot to us.

Senator ISAKSON. I am going to ask you a tough question, but you just said something that really hit home with me, going back to the Sago situation, and I met with a bunch of miners. In fact, I met with the miners that got out and I met with the families of the miners who did not, and I think you said you give me the way to get out, that is number one. The chambers and everything else are secondary, but first choice always is to get out.

I learned in that Sago situation, there were a lot of people who thought, gosh, if we had had a rescue team there, they could have got them out and everyone would have been safe, but the fact of the matter is that was not true. They could have gotten out easier than a rescue team could have gotten to them because of the carbon monoxide, all the other things in their way, because the miners that tried to get to them said that.

So you are saying that a miner's first preference is give me the way to get myself out rather than having all these redundant systems for somebody to come and get me. Is that right? I mean not saying those are not good things. I believe in the rescue teams, and I know the mine companies and the miners do too, but the first best way is a path out and the oxygen accessibility to get out?

Mr. O'DELL. Yes. Because if we have that, then we have no need for the other stuff.

Senator ISAKSON. OK. That is an interesting point.

Mr. DROPPLEMAN. That is why we call them self-rescuers.

Senator ISAKSON. Yes.

Mr. O'DELL. But it is important to know that the best plans fail sometimes, so we have to have those things in place for backups.

Senator ISAKSON. Redundancy, right.

Mr. O'DELL. Absolutely.

Senator ISAKSON. There was a hand going up. Yes, sir.

Mr. KENNEWEG. Another thing that would help the manufacturers on the respiratory equipment is the approval process at NIOSH could be sped up. We developed products and then we have to go through this approval process which sometimes impedes the development because it takes so long.

Senator ISAKSON. You are not accusing government of being slow, are you?

Mr. KENNEWEG. [Laughter.] Senator Kennedy mentioned the Fire Act moneys, and there is a special group of respiratory equipment being approved for chemical and biological protection, and that approval takes longer. There is a list of products there. So any of

these other products that go in, it tends to slow those down. So more resources there.

Another thing that could be done is to let NIOSH certify third party labs to do some of the testing instead of the testing all being done by the Government, and that could also speed things up.

New test equipment, some of the test equipment, at least we feel, that NIOSH has is somewhat outdated. We have to do presubmittal testing before we submit our products to sort of assure that they are going to get through, and we cannot really duplicate all of the equipment because it is not available anymore. So that would be helpful.

And we should look at some of the regulations in other countries such as Australia and South Africa, Canada, see what they are doing there. This unit here is a 30-minute unit in Australia and South Africa; here we probably get approval for 20 minutes, and that has to do with the test standards. So maybe we need to look at being more flexible on inhalation temperatures and breathing resistance and things like that.

And the duration of the units underground. The law is tied into this 60 minutes. We maybe need to look at, I think Don Mitchell who used to be with the Bureau of Mines and MSHA did some studies on escapes in different coal seam heights, and he showed, I believe the report showed that you do not need 60 minutes all the time. Sometimes you can get by with a smaller unit, but at the same time, you could also give the impetus to the manufacturers to develop longer duration units, maybe 90-minute units or 2 hour units.

Senator ISAKSON. Were you going to say something, Mr. Droppleman?

Mr. DROPPLEMAN. I would like to speak specifically to self-rescuers and to the self-rescuer portion of this discussion.

Senator ISAKSON. Please.

Mr. DROPPLEMAN. The tracking issue is a very complex one, at least to implement for mines. I make firefighting breathing apparatus, and we do tracking and telemetry and the problem there is significantly different than underground, and all of us will admit that. Our communications to a diver is a different issue than dealing with mines or with tunnels or with buildings.

I am a fairly significant customer of Grace with the PASS unit for the firefighting, and we understand the tracking issues. The fundamental problem today that the guys that are underground today is that we do not supply them sufficient oxygen to make an escape, and you recognized that. You saw that at Sago.

And the current regulations do not differentiate between the performance characteristics of 60-minute approved self-rescuers. You have a coal miner sitting over here that told you that he would much prefer to get out of the coal mine. I happen to be a coal miner from West Virginia as well. And we are not ganging up on you because we are from West Virginia, but the performance standards of the 60-minute approved self-rescuers vary significantly.

I will give you one example. There is a 60-minute approved self-rescuer that has 157 liters of available oxygen. If you think of that in terms of the fuel to make an escape, that is 157 liters of fuel. There is another 60-minute approved device that has 80 to 100 li-

ters of available oxygen. You cannot expect one to give you the same duration and distance and performance of the other. One is twice as much fuel as the other.

We need to recognize that in our deployment standards and build escape strategies around the equipment that we use. We can do that today, and a lot of companies do. If you go to a lot of major coal companies in this country, they provide a belt-wearable unit, a 10-minute device or a filter self-rescuer. They provide a 1-hour stored device on the man-trip vehicle. They provide a stored unit on the section and they provide additional units in the returns or in the primary escape ways to get out, and you have heard that explanation earlier today.

We could require that in all mines in this country. But what we want to do is make sure that we do not eliminate a viable option by regulating it away. And the policy of MSHA has been for the last 6 or 7 years to encourage a single device for miners underground. They said you can satisfy the regulation if you put a 60-minute belt-wearable unit on the belt. Here you are, go in the mine, good luck.

And there are other mines that do not recognize that as an acceptable option, so they put additional units on the mine. They should be applauded, and they should be encouraged to—all mines should be encouraged to do that. And the vehicle is there to do it.

Senator ISAKSON. Are you saying there are two different products, both certified as 1-hour devices, but one has the capacity of double the liters of the other?

Mr. DROPPLEMAN. Yes, yeah.

Senator ISAKSON. And there is no differentiation?

Mr. DROPPLEMAN. They are both approved as a 60-minute self-rescuer. They both meet the requirements of 60-minute approval. One manufacturer chose to meet the 60-minute requirement in the—sorry—one manufacturer chose to meet the very minimum requirements to get his 60-minute approval.

The other manufacturer chose to build significant margin.

And I think what we are talking about at Sago, I think what we are talking about in a lot of escape scenarios is that duration and performance is real significant. If you look at the NIOSH field investigation reports of the last 10 years, you will see the performance of all the devices that are available, and they are significantly different.

We conduct escape trials all the time to establish what is the best pattern, what is the strategy for getting a miner to safety, preferably to the outside.

Senator ISAKSON. Senator Murray.

Senator MURRAY. Yes. Mr. Chairman, I have to leave, but I want to thank you so much for this hearing. This has been tremendously helpful. I learned a great deal. I know everyone here did, and I really want to commend Senator Isakson again for his focus on this issue and a commitment to work in a bipartisan way to move us forward in this area, and I look forward to working with you.

Thank you.

Senator ISAKSON. Thank you, Senator Murray. I would take that cue with about 10 minutes before noon to say rather than me asking a question, does anyone here have something to offer that they

came to offer they have not had the chance to offer yet? Or have a comment on what has been offered that they would like to say?

That being the case, let me tell you what my intention as subcommittee chair is to see to it this information obviously gets to the full committee. I know Chairman Enzi, who could not be here today because we are finally getting some movement on the pension conference committee, and that is his primary responsibility, but he has a keen interest.

He went to the Sago mine and met with the families as did I and Senator Rockefeller and Senator Kennedy. This is not a 1-day hearing for the purpose of saying we did it, but hopefully it is the platform for us to make some critical decisions on what is the best thing for us to do, both as a catalyst to spur development of those things that are out there that we believe are doable, as well as look at the standards that we have and the options that we have and make the very best recommendations we can to the Congress in the interest of the safety of coal miners.

I would make a side comment too. The coal industry has exploded for lots of reasons lately, but primarily is the tremendous demand and the price coal is now bringing. And a couple people mentioned, you mentioned physiology, but the average age of the American coal miner is not in the 20s and 30s. It is more like the 40s and 50s.

In fact, when I met with those coal miners, I am not sure that I met with anybody much that was under the age of probably 45. And with the president's remarks on our own energy independence and the importance for us in technologies that are related to coal, whether it be gassification or clean coal technologies or whatever, everything we can do toward safety helps us to attract a new generation of coal miners because you are never going to take the coal miner out of coal mining.

It is just like technology has improved any number of professions, but it has not replaced the human being. It has made him more productive or her more productive. I think the same would be true in coal mining, and in coal mining, I think safety is one of those key components that leads to good productivity.

So that is our desire here is to find out what is in the best interest of the industry and the miner and, in the end, the United States of America. And I thank all of our distinguished panelists for coming from as far away as Australia and other points and appreciate your being here. I hope you will submit any additional information that you think we might need or that might help us in this. I would encourage you to get it to the committee within 5 days, and I stand ready to be of assistance to any of you should you need it.

Thank you very much, and we stand adjourned.

[Additional material folllows.]

ADDITIONAL MATERIAL

LETTER FROM SAGO MINERS TO THE DOMINION POST

February 3, 2006.

MORGANTOWN DOMINION POST,
Dominion Post,
Morgantown, WV.

DEAR SIR: We are the miners of the Sago Coal Mine in West Virginia that suffered the mine explosion on January 2, 2006. We have experienced all the pain of the loss of our brothers, uncles, cousins, and friends. We have watched with disgust as you have reported us as poor, dumb, coal miners that had to work in horrible conditions because we could not find work anywhere else. Well, let us tell you about our mine and the miners who work here.

We work at this mine because we choose to not because we have to. We are proud of our mine and the miners we work with here. These men are well trained and operate million dollar pieces of equipment within the confines of the coal mine as easily as you do your riding mower on your lawn. We are intelligent, skilled and are aware of our surroundings. None of us would ever allow any condition to exist that would injure one of our fellow workers on purpose. Every time that any of us have become aware of any hazard and reported it to any member of the company they have corrected it almost immediately. We feel that we have a safe mine or we would not work here.

The explosion we experienced occurred behind a set of seals in an abandoned area. I don't know of any man alive that could have predicted that such a thing would occur. We have a greater interest than any other group of persons in the world as to what occurred. We will have a guess but are willing to wait until the investigation is complete to know the real answer.

The current management of this company and our mine has been portrayed by the media as uncaring about our personal safety. Nothing could be further from the truth. This company has put a safety program in place that literally puts our safety in our own hands. They have responded to citations issued and try to correct them immediately. They then discuss with us (the employees) the violation and how we can prevent it from happening again. This is done to get our input, not as a disciplinary measure. There is even talk of developing a bonus plan that rewards us for being safe workers. It appears this plan will reward individuals for attendance and safety instead of for production.

You all seem to indicate that we have a dangerous mine because we received over 200 citations from MSHA over the past 2 year period. But again, every time that MSHA issued a citation we corrected it almost immediately. To tell you the truth we did not do some things very well that we should have. MSHA beat us up pretty good about clean up, rock dusting, and maintaining the escapeway. They forced us to raise our standards. What no one realizes is that ICG's standards meet or sometimes exceed those of MSHA or the West Virginia Office of Miners Health Safety and Training (WVOMHST), and the men at Sago soon began to believe that they (ICG) were sincere with regards to our safety. As a result of their (MSHA, WVOMHST, and ICG) efforts, we did raise our standards and that saved 17 miners lives. You see there was not one survivor of the explosion but 17.

The "One Left" crew was in direct line of the explosion within 1,000 feet but none of them were seriously injured by the blast. Why????? Well, we will tell you why. It was because the area of the mine was so well rock dusted and maintained that the explosion did not propagate at all. When it ran out of methane it stopped. Our 17 miners know how close they came to death and thank God, MSHA and WVOMHST for their efforts. We also thank the company (ICG) for their corrective actions that stopped this explosion. Our miners exited the mine safely in the escape way, which had recently been cleaned, roof bolted and screened.

We also want to thank the mine rescue teams that came to our mine to try to rescue our brothers. There were men here from all over the country in a unified effort. A special thanks to the Consol UMWA teams that came to our aid without any concern for union or nonunion. They only considered us miners. Those teams and individual men will always have a special place in our hearts. We know that they took some bad press from some of the family members but we saw their efforts and admire them for it.

We do take offense at the leadership of the UMWA for their statements about our mine and the indications of how unsafe we are. Many of us have worked at UMWA mines and would like to question why the UMWA leadership made a big deal out our 270 citations over a 2-year period. They indicated that if we were UMWA signa-

ture mine we would not have had so many. They stated that many of the conditions were so serious we should not have been allowed to operate.

Our question to the UMWA is why does the UMWA signature mine McElroy in northern WV receive more than 1,830 citations in the same timeframe and still be allowed to operate? Why did Blacksville No. 2 Mine in Morgantown receive 1,400 citations in the timeframe and still be allowed to operate? Why do Shoemaker, Robinson Run No. 95, and many other UMWA mines receive 500 to 1,000 per year and still be allowed to operate? Why, if the UMWA provide such a good safety advantage, do these mines have such horrific violation records? (If you are interested you can check these numbers, as they are public record on MSHA's page on the Internet.)

We recognize that we owe a debt of gratitude to the UMWA as they helped the miner gain a good wage, health benefits and fought for safety. However, we believe that the current leadership has an agenda to advance at our expense rather than try to help us. They have come to our mine and forced their way in because of this agenda. We do not want them to represent us. We have elected our own representatives from within our miners (by a margin of over 90 percent). Why would we want a union to represent us whose members receive 10 to 20 times as many violations as we receive? We are reducing our citations and will succeed. We have cut the number of citations at this mine by almost 50 percent in the past quarter. Their history has been the same for many years, maybe after they demonstrate that they do have safe mines we would be interested. We will welcome any advancement in technology that will help our miners communicate, be located, or extend their supply of oxygen. But those are all devices we never want to have to rely on. We first want to know what happened, where we failed (if we did), and what can be done to prevent any such thing from ever happening again.

We would also ask the UMWA and it's leadership team about it's contribution to the Sago Fund. As it now seems, ICG started the fund with a 2 million dollar donation. Lots of companies and individuals have generously contributed to the fund as well, particularly a $250,000.00 donation from A.T. Massey. To date, we have seen no mention of the UMWA's donation. If they have that much care and concern for us, show it to these families.

We just want to set the record straight. We are intelligent, skilled men that are working here because we want too. We have a brotherhood here that is close and will become closer when we are allowed to return to work. We will take this experience and learn from it and will never allow it to occur again. We all understand the risk we are exposed to but also know that the mine is as safe as we make it.

THE MINERS OF SAGO,
CRAIG NEWSOME,
Buckhannon,
JEREMY TOLER,
Canvas,
CHESTER RUNYON,
French Creek,
BRIAN E. CURTIS,
Buckhannon.

3M WHITE PAPER

3M CARBON MONOXIDE OXIDATION CATALYST

The topic of this paper is an oxidation catalyst for carbon monoxide that is also an adsorbent for organic vapors. Its potential applications might include significant advances for carbon monoxide filtration for miners and chem-bio/smoke escape hoods.

The current oxidation catalysts for carbon monoxide that are available fall into three categories.

- Hopcalite (mixed oxide of Cu and Mn)
  -good catalyst for CO oxidation but deactivated by water vapor
- Pt/Pd on SnO_2/metal oxide
  -tolerates H_2O but high Pt/Pd loadings needed to be effective at high CO levels
- Nanoparticle gold on oxide support
  -very active at high RH
  -expensive due to high consumption of gold

While these CO catalysts are effective, they each have material drawbacks. Hopcalite is an effective catalyst, but it is deactivated by water. Therefore a desiccant bed up-stream of the catalyst is required. The useful life of such a system is determined by the capacity of the desiccant bed. The Pt/Pd catalysts require high precious metal loadings but these are very expensive materials to be used in high loadings. Current technologies for making gold nanoparticle catalysts are difficult to scale up for commercial applications due to their poor reproducibility. In addition, it is difficult to reclaim the unused gold from these solution-based processes.

Recent 3M Developments

3M has developed an innovative gold nanoparticle catalyst that overcomes these issues with available CO catalysts. This new catalyst works well in high humidity, is extremely effective at catalyzing the oxidation of carbon monoxide, is cost effective to produce, is readily scaled up and is also an activated carbon adsorbent. The 3M technology effectively uses all of the gold that is consumed in the process. This greatly reduces the cost of the catalyst compared to existing catalysts.

The intended application for this catalyst is for respirators or collective protection filters where carbon monoxide is a potential concern. 3M OH&ESD is currently having discussions with NIOSH and MSHA on the potential application of this technology into mining escape respirators. We are also currently in discussions with the US Military labs for the evaluation of this technology.

Summary of 3M Catalyst Advantages Over Currently Fielded Systems

- Effective at high humidity—no desiccant required
- Higher activity than Pt/Pd/SnO2 catalysts
  -Lower precious metal loading
  -More efficient use of precious metal
  -Lower cost
- Readily scaled-up
  -Necessary equipment resides in 3M manufacturing facilities
- Excellent reproducibility
- Capable of dual function (adsorbent and catalyst)

For more information contact Bob Holler @ 651–736–7865, reholler@mmm.com.

INNERSPACE SYSTEMS CORPORATION

PROPOSAL FOR EXTREME DURATION SELF-RESCUE MINER BREATHING APPARATUS

EXTREME DURATION SELF-RESCUE MINER BREATHING APPARATUS

In response to the Sago Mine accident in West Virginia on January 2, 2006, InnerSpace Systems Corporation of Centralia WA. (ISC) would like to submit the following proposal in an effort to fulfill Miner safety and need for a Category of lightweight, extreme long duration Closed Circuit rebreathing apparatus for a meaningful miner self rescue capability.

1.0 Introduction

Company Background

InnerSpace Systems Corp. is a United States based small business known internationally as a top competitor in the manufacturing and development of highly innovative customized closed circuit rebreathing systems to support the exploration of deep/overhead sub sea environments, by direct manned intervention. ISC's manufacturing and engineering headquarters is located in Centralia, Washington. In the County of Lewis (HUB Zone). As a small company of dedicated experienced engineering and support personnel, focused solely on continuing product improvement, new product development, and customer service, ISC is able to conduct rapid engineering and prototyping that can be quickly turned into a final product. ISC is owned by two US military disabled veterans and is an ISO 9001:2000 registered company.

1.1 Intended Use

The closed circuit Miner Breathing Apparatus (MBA) is designed to support mining operations in environments considered too diverse for current breathing systems. The MBA may be deployed in miner self rescue operations and miner rescuer operations that are considered outside the capability of current systems. The MBA diversity is due to a modular engineering approach. The MBA may be fitted with components to increase miner breathing duration or tie into other sources of breathing gases to include being tailored to mission specific requirements such as operating in water.

The MBA may be fitted with components that support working in environments of extreme enclosed spaces, and areas that expose the miner and rescuer to toxic gases, explosive atmospheres, oxygen deficiency and smoke inhalation. This capability provides the miner a greater operational zone of safety.

1.2 Unit Description

The ISC MBA is a lung demand driven closed circuit breathing apparatus (BA) that uses oxygen as its primary life support gas. The MBA has been designed for intensive use in hostile environments yet it is simple in design and construction, robustly built and provides high performance with ease of maintenance.

The MBA is worn as a vest assembly that is easy to don and doff in enclosed and limited visibility environments. The harness assembly allows for ancillary gear that supports and facilitates self rescue and rescue of fellow miners. First aid kit, water, and communications equipment for each miner is provided. The harness assembly will also have reflective capability for light exposure and to include chemical lights, and white light capability. MBA may also be equipped with an activated miner locating system.

The MBA is compact and low in profile minimizing entanglements and snags through enclosed spaces. The miner may even be dragged by another miner to safety with the harness assembly on. The breathing loop assembly has two over the shoulder counterlungs optimizing breathing performance and indicating the miner is breathing and easy ambidextrous capability for ease of reach of any of the control systems. This also includes the ability of a fellow miner to add life saving gas and insure the unconscious miner is breathing.

The Carbon Dioxide scrubber absorbent system and oxygen cylinder are mounted on the harness assembly. The oxygen cylinder and the CO2 scrubber canister are covered by a padded cover adding to aesthetics of the UBA or may be fitted with a hard cover for added protection. The MBA is constructed of black anodized aluminum, and space age state of the art high impact plastics.

The breathing cycle is explained as follows; the Miner exhales into the mouth breathing valve (MBV) that contains the one-way check valve system. The MBV is connected to two flexible breathing hoses, the other ends of which are connected to the counterlungs and CO2 scrubber assembly. The Miner's exhalation breath is circulated into the exhaust side counter lung, through an assortment of water traps, then into the CO2 scrubber canister assembly. All of the exhaled CO2 rich breathing media is absorbed by a bed of carbon dioxide absorbent. The freshly scrubbed gas continues on through the inhalation counterlung and into the mouth breathing valve.

The oxygen consumed by the Miner is replenished by a lung demand valve activated by the result of the reduction of the volume of the oxygen circulating within the closed breathing loop, thus oxygen consumption is dependent on the metabolic demands of the Miner. The MBA is fitted with a cylinder pressure gauge to monitor the oxygen pressure.

1.3 Design Parameters

The modular approach design of the MBA gives the user options. The options may be utilized for the mission specific requirements dictated to the Miner or rescuer. The MBA may be configured with a variety of scrubber systems, oxygen cylinder sizes, and may also be configured to do fire fighting roles if the operational needs are deemed necessary or probable.

1.4 Duration

The duration of the MBA can be up to, but not limited to, 6 hours or longer, depending on the level of effort the miner is doing that may consist of high heart rate from work required for escape, such as walking up inclines, crawling, climbing a ladder, or helping another miner buried in wreckage. Duration is increased by adding more oxygen from a supplementary outside source or a replacement oxygen cylinder, and installing another carbon dioxide absorbent canister if necessary.

1.5 Weight

Weight of the MBA is contingent on the mission criteria dictating duration from environmental considerations. The unplanned contingencies, distance to travel, or miners needing medical aid and requiring physical help for extraction from the mine or the hazardous environment will require increased duration, thus requires the option of a greater CO2 scrubber size and oxygen supply. The estimated weight for such an extended range system may be 35 lbs or more. The MBA may be set up for non extended range duration of 120 minutes and weight may be lighter than 251bs and, of course, be capable in the field of adding an extended range package or changing out oxygen cylinders and CO2 scrubbers systems under duress in an

enclosed space. Size and compactness is another consideration as rescuers should be able to take additional systems down into the mine for entrapped miners. Current technology being used does not allow for compactness unless it lasts only 60 minutes and weighs 6 lbs which has proven to be inadequate for miner survivability, current systems to date with the exception of this proposed MBA is too large and still has a limited duration. The larger breathing systems are not issued to the working miner but only to rescue crews providing them with a limited breathing supply that cannot be shared, or extra sets carried for entrapped miners.

1.6 Maintenance

The MBA is simple in design, built on state-of-the-art innovative construction without the unnecessary engineering and complexity based on out of date technology of other current technology. Currently, other systems require special tools, parts and excessive maintenance to maintain the aging or out of date technology that induces high cost to the end user. The MBA is designed to use off the shelf components when possible and utilize the best in design principles to minimize excessive component parts thus reducing overall operational expenses.

The MBA requires only the common tools and work environment that a modern scuba diving shop facility has and no more. The MBA may be field repaired easily if necessary, with minimal tools that the Miner may have on hand.

Scheduled maintenance of the MBA is considerably less than the current systems. The MBA requires minimal time to replace or repair unit components giving the repair technician and Miner less over all man hours dedicated to the service of the MBA thus allocating more time for training or other operational commitments.

1.7 Prototyping and Cost Estimate

Several prototype versions are being constructed including a unit employing a water tolerant/fire fighting MBA configuration for multi-mission use and marketing purposes. Other markets that will be explored are the civilian and commercial markets.

Based on our current knowledge, we can produce prototype units suitable for testing by July/August 2006. These units will include the necessary components, and options. It is estimated that final production units could be available by December 2006 with aggressive testing, pending that the MBA fits into the mining community's needs.

Final production cost of the MBA will be pending after the formal testing and recommendations from the testing authority. Every effort will be made to minimize cost to the customer and meet customer expectation.

InnerSpace Systems Corp. will conduct the necessary training for end users and a consolidated trainer training camp. All MBA's will have the necessary operator's manual for the final production unit in a water proof format.

Summary

InnerSpace Systems Corp. looks forward to working with the authorities involved in developing a useful and cost effective system for the Miner MBA program. All questions concerning this endeavor should be addressed to Leon Scamahorn CEO Innerspace Systems Corp.

RESPONSE TO QUESTIONS OF THE SUBCOMMITTEE ON EMPLOYMENT AND WORKPLACE SAFETY BY WES KENNEWEG, DRAEGER SAFETY, INC.

Question 1. What devices currently on the market provide the best chance for miners to escape in the event of an underground emergency?

Answer 1. Oxygen Self-Rescuers provide the best chance of escape. The combined technology of a small belt-worn oxygen device in combination with larger stored devices located in strategic locations in the mine would enhance escape and rescue.

Question 2. What are the current technical capabilities of oxygen supply devices in use in underground coal mines today, and what new developments are on the immediate horizon?

Answer 2. There are 2 types of oxygen sources that can be used for oxygen self-rescuers. One is Compressed Oxygen, which requires a scrubber chemical to remove exhaled CO_2 (Carbon Dioxide). The other is Chemical Oxygen, which makes use of one or more chemical oxygen sources. The primary chemical oxygen source is KO_2 (Potassium Super oxide), which reacts chemically with moisture and CO_2 in the exhaled air of the user to absorb the CO_2 and generate oxygen.

Another source of chemical oxygen is Sodium Chlorate which is used on some passenger aircrafts to generate oxygen. This is generally used as a "starter" in the Self-Rescuer lasting for only several minutes after which time the primary chemical,

KO_2, performs the O_2 generating function. KO_2 also has the unique feature of being demand responsive, which means it will provide automatically more or less oxygen to the user depending on his or her breathing rate. Thus Oxygen Self-Rescuers, with NIOSH/MSHA approval for 60 minutes, can last 3 hours if the person is in a rest position, waiting for rescue.

In Australia (New South Wales and Queensland), they make use of Quick-Fill Stations underground. These are banks of compressed air cylinders stored in a metal box at strategic locations underground. At each station are 60-minute SCBA's (Self-Contained Breathing Apparatus) that the miners can don to make their escape or wait for rescue. The cylinder banks allow the miners to quickly refill the cylinders on their breathing apparatus without doffing the breathing apparatus as they make their escape. The stations are located every 500 meters or 1,000 meters. Air is considered by some to be more stable than oxygen in event of a fire or explosion.

Question 3. Is the MSHA approval process helpful or hurtful in ensuring that miners have the latest oxygen supply technology?

Answer 3. The NIOSH/MSHA approval process follows the current regulations in effect, 42 CFR for testing procedures and 30 CFR for underground requirements. This requires that every coal miner be supplied or have readily available within 25 feet, a 60-minute SCSR (Self-Contained Self Rescuer). The aim has always been to make the devices as small as possible so they are belt-wearable. Prior to the oxygen SCSR regulations, the miners were required to wear a Filter Self-Rescuer (FSR) which filters CO (Carbon Monoxide). CO is very toxic and present after fires and explosions. With this device, one must have oxygen present, $\geq$ 17 percent normally, although U.S. law states 19.5 percent. These FSR's are still used in the U.S. metal and non-metal mines and can be used in Coal Mines to get to the stored oxygen Self-Rescuers if the units are more than 25 feet away. Special dispensation must be granted by MSHA to permit this option.

To improve the approval process, several things could be done:

(1) Testing House: NIOSH/MSHA could certify third party labs to conduct the approval testing. At present approval times for certain respiratory protection products can run up to 1 year. This is in part due to the Homeland Security approval testing for CBRN (Chemical, Biological, Radiological and Nuclear) protection. Longer approval times discourage new developments in some instances.

(2) Test Standards: NIOSH/MSHA could look at changing or harmonizing some of the test standards to match those of other countries, such as the European standards. This could, in some cases, allow smaller and lighter self-rescuers to be approved.

(3) Test Equipment: Some of the test equipment at NIOSH/MSHA could be updated. One example is the breathing machines used to simulate human breathing. In order for the manufacturers to develop products that will meet the test standards, we must do pre-submittal testing. In some cases, this cannot be done precisely as the test equipment being used by NIOSH cannot be duplicated.

(4) Less than 60-minutes: If the regulations could be changed to allow a "primary" device that can be approved for 30-minutes, it would give the manufacturers opportunities to put more development time into smaller, lighter devices that could be easily worn by each miner. At present only 60-minute devices are permitted to meet the current standard. Studies were done in the past which demonstrated that 60-minute devices are not necessary for all coal mines. Shorter duration devices could also provide the needed protection in certain mines.

Question 4. How can Congress be a catalyst for new innovation in this area?

Answer 4. Congress could provide funding to the Federal test labs for human resources and modern test equipment. Other funding could be directed to Research and Development projects at MSHA in conjunction with the manufacturers.

Question 5. If you could design the idea postunderground emergency oxygen supply device, what would be some of the things you would consider?

Answer 5. Prime considerations are the weight and size. At present, KO_2 is manufactured in only a few countries. More research could be done to optimize the oxygen efficiency and breathing comfort of KO_2. If one wants to incorporate communications into the oxygen device, one would have to consider going away from the bite-type mouthpiece with nose clip as this prevents talking which could allow toxic gases to enter the breathing system. An alternate method would be a collapsible full face mask that could be incorporated into the SCSR.

Question 6. Realizing that perfection is always a challenging goal, can immediate technological improvements be made to the devices that supply oxygen to miners to improve their chances for survival in an accident?

Answer 6. The devices can be made smaller and lighter if the testing regulations are changed. Larger devices, greater than 60 minutes, could also be developed for storage in strategic locations; but there must be some impetus for the manufacturers to invest R&D dollars into such products. Part of the issue is that while the product is important, the total quantity in use and sold each year is small compared to other products sold in mining and other industries.

[Whereupon, at 11:53 a.m., the subcommittee was adjourned.]

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