

# MINING INSTITUTE AUTHORIZATION

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## HEARING

BEFORE THE

### SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES

OF THE

### COMMITTEE ON RESOURCES HOUSE OF REPRESENTATIVES

ONE HUNDRED FOURTH CONGRESS

SECOND SESSION

ON

### H.R. 3249

**TO AUTHORIZE APPROPRIATIONS FOR A MINING INSTITUTE TO DEVELOP DOMESTIC TECHNOLOGICAL CAPABILITIES FOR THE RECOVERY OF MINERALS FROM THE NATION'S SEABED AND FOR OTHER PURPOSES**

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MAY 9, 1996—WASHINGTON, DC

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# MINING INSTITUTE AUTHORIZATION

TUESDAY, MAY 9, 1996

HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON NATIONAL PARKS, FOREST AND LANDS, COMMITTEE ON RESOURCES,

*Washington, D.C.*

The subcommittee met, pursuant to call, at 2:00 p.m., in room 1324, Longworth House Office Building, Hon. Ken Calvert [chairman of the subcommittee] presiding.

## **STATEMENT OF HON. KEN CALVERT, A U.S. REPRESENTATIVE FROM CALIFORNIA, AND CHAIRMAN OF THE SUBCOMMITTEE ON NATIONAL PARKS, FORESTS AND LANDS**

Mr. CALVERT. The Subcommittee on Energy and Mineral Resources will come to order. The subcommittee's business today is a legislative hearing on H.R. 3249, a bill to authorize appropriations for a mining institute to develop domestic technological capabilities for the recovery of minerals from the Nation's seabed, and for other purposes. The bill was introduced by our ranking member, Mr. Abercrombie of Hawaii, together with Mr. Wicker of Mississippi.

Roger, I would like to thank you for stopping by and saying a few words of introduction on behalf of Dr. Woolsey of the University of Mississippi, who will be testifying on the bill. I also understand you have another hearing at the same time and will be unable to stay with us very long so we will move this right along.

I believe my colleague from Hawaii will want to say a few opening words as well so I will just simply say that with the closure of the U.S. Bureau of Mines mandated by the fiscal year 1996 Appropriations Act, I think Congress would be wise to consider limited funding of academic institutions to continue strategic material research efforts.

With proper oversights, perhaps driven by a non-Federal source matching funds requirement, universities can well perform many science and engineering studies necessary to meet society's future needs for minerals, such as developing techniques to remotely identify sand, gravel, and shell resources of the OCS for the use in coastal beach replenishment projects.

So as we begin to debate on the budget for the coming year for various agencies, it is timely to consider authorization of this Federal-State partnership. And with that, I will turn it over to Mr. Abercrombie.

**STATEMENT OF HON. NEIL ABERCROMBIE, A U.S.  
REPRESENTATIVE FROM HAWAII**

Mr. ABERCROMBIE. Thank you very much, Mr. Chairman. I very much appreciate your scheduling this hearing today on H.R. 3249. This is legislation, as you indicated, that was drafted and introduced in the true spirit of bipartisanship by the gentleman from Mississippi, Mr. Wicker, and myself.

And, as you indicated, this would authorize appropriations for a mining institute to promote environmentally responsible technology development for the recovery of minerals from the Nation's seabed. And this type of technology, I hasten to add, is critical to the future of mining in the United States. And in deference to the problem that Mr. Wicker has with time, I would ask your permission to be able to submit the rest of my statement for the record and defer to Mr. Wicker for his remarks.

Mr. CALVERT. Certainly. Without objection, so ordered.  
[Statement of Hon. Neil Abercrombie follows:]

PREPARED STATEMENT OF HON. NEIL ABERCROMBIE

Mr. Chairman, I appreciate your scheduling this hearing today on H.R. 3249, the Mining and Mineral Resources Institutes Act. This is legislation that was drafted and introduced in the true spirit of bipartisanship by the gentleman from Mississippi [Mr. Wicker] and myself. H.R. 3249 would authorize appropriations for a mining institute to promote environmentally responsible technology development for the recovery of minerals from the Nation's seabed. This type of technology is critical to the future of mining in the United States.

H.R. 3249 is not a new government program. Previously, Administration for Marine Mining has been carried out under the Mineral Institutes Program within the Bureau of Mines. Last year the decision was made to terminate the Bureau of Mines. Yet, worthwhile functions of this agency still deserve and need support. One such example is the Marine Mineral Technology centers (MMTC) of the Mineral Institutes Program. The executive branch recognizing the value of this program transferred the MMTC to the jurisdiction of the Mineral management Service.

The MMTC has offered a unique cooperative program involving leading University research teams dealing with applied problems in marine resources and the marine environment. The program is unique in that for a relatively small input of Federal seed money to State institutions and small research organizations, not only has a prodigious amount of practical research and development been accomplished, but a by-product of quality graduate students has been trained with practical hands-on experience. The Center's program of research, technology development and education is multidisciplinary and international in scope.

Currently, the MMTC program is being carried out by the Continental Shelf Division, located at the University of Mississippi, and the Oceans Basins Division at the University of Hawaii.

The University of Hawaii MMTC has been assisted by matching funds from the State of Hawaii because of its critical input to State cooperative development programs, as well as University research and education. Practical aspects of the program have included major inputs to an Environmental Impact Statement on Cobalt Crusts in the Exclusive Economic Zone (EEZ) of the Hawaiian and Johnston Islands, State programs on sand for the preservation of Hawaii's beaches and coastal environment, and the clean-up of military ordnance from the offshore areas of Kaho'olawe Island, recently returned to the Native Hawaiian people by the Navy.

This program merits continued Federal support. I am hopeful that we can move H.R. 3249 expeditiously through the legislative process.

I look forward to the testimony of the witnesses.

Mr. CALVERT. And, Mr. Wicker, you have the floor.

**STATEMENT OF HON. ROGER F. WICKER, A U.S.  
REPRESENTATIVE FROM MISSISSIPPI**

Mr. WICKER. Thank you, Mr. Chairman, and members of the subcommittee. It is a pleasure for me to be here today to introduce a constituent who I am very proud of. I also want to say that I am delighted to be a co-sponsor with the gentleman from Hawaii, Mr. Abercrombie, of legislation which would reauthorize appropriations for the Marine Mineral Resources Program, a program which will enable the United States to continue pursuing the development of ocean mining technology, an activity which many of our competitor Nations are engaged in very aggressively.

This is a program about developing surveying and sampling systems used in locating minerals in the vast, part of our great Nation that is under the sea and around the coastline. It is a program that is vital in the areas of coastal stabilization and beach replenishment.

It is also a program that has a great deal to do with monitoring pollutants in our rivers and in ocean sediments. It is an example, Mr. Chairman, of a strong partnership between the Federal Government, the academic community, and private industry.

So I am delighted to be here, both on behalf of the legislation, joining my colleague from Hawaii, and also to introduce my constituent, Dr. Robert Woolsey, who will testify on behalf of the reauthorization. Dr. Woolsey is the Director of the Mississippi Mineral Resources Institute at the University of Mississippi and the National Director of the Marine Minerals Technology Center's Continental Shelf Division. Dr. Woolsey has worked with industry, the United Nations, and academia to develop environmentally responsible methods of capturing the valuable minerals deposited offshore.

Over the past 30 years, Dr. Woolsey has worked in offshore dredging operations in areas of Alaska, Brazil, Indonesia, Malaysia, and Russia. He also advises the Government of Belize on environmentally safe methods of opening the Belize River to navigation while preserving its delicate ecosystem. I appreciate the opportunity to be with you today and to say a word of introduction to my friend and constituent, Dr. Robert Woolsey. Thank you.

Mr. CALVERT. Thank you. And we thank you, Mr. Wicker, for taking time out of your busy schedule to be with us, and we will report back to you on the success of this hearing.

Mr. WICKER. Thank you.

Mr. CALVERT. Have a good day. I would first like to introduce our first panel, Dr. Tom Kitsos, Director of the Office of International Activities and Marine Minerals, Minerals Management Service; Dr. Robert Woolsey, Director of the University of Mississippi, Mississippi Mineral Resources Institute; Dr. Michael J. Cruickshank, Director, University of Hawaii, Marine Minerals Technology Center; and Mr. John B. Rigg, Sr., Consultant, Arlington, Virginia. If you will all come up to the dais.

Mr. ABERCROMBIE. Mr. Chairman?

Mr. CALVERT. Yes.

Mr. ABERCROMBIE. May I interrupt just a moment to wish a special welcome to Dr. Kitsos who was counsel to the Merchant Marine Committee and one of my mentors when I first was in the

Congress, going back to the time of the special election back in 1986. And I learned a great deal from him, and I am delighted to see him here today.

Mr. KITSOS. Thank you.

Mr. CALVERT. Welcome, doctor, and you may begin your testimony.

**STATEMENT OF DR. TOM KITSOS, DIRECTOR, OFFICE OF INTERNATIONAL ACTIVITIES AND MARINE MINERALS, MINERALS MANAGEMENT SERVICE**

Mr. KITSOS. Thank you, Mr. Chairman. Thank you, Mr. Abercrombie, for those nice remarks. Those were interesting times back then. Mr. Chairman, thank you for the opportunity to present testimony on H.R. 3249. The Interior Department supports the concepts embodied in the bill and recognizes the importance of the investigations and technological development to be carried out under the bill.

However, because of funding constraints and the likelihood of declining or stagnant budgets, the program continued by the legislation could impact ongoing critical departmental programs and activities absent additional funds to carry out the provisions of H.R. 3249.

The bill essentially reauthorizes the current Marine Minerals Technology Centers that, until quite recently, were administered by the Bureau of Mines. And the primary objective of the MMTC program is to promote the development of technological and engineering systems for the exploration and sustainable development of marine minerals and the environmental assessment in monitoring the United States Exclusive Economic Zone.

H.R. 3249 would authorize up to \$1.2 million per year for each fiscal year after fiscal year '96 to, in effect, continue the MMTC program that is currently being carried out by the Continental Shelf Division, located at the University of Mississippi, and the Ocean Basins Division at the University of Hawaii.

Right now, Mr. Chairman, MMTC is in the process of being phased down under the provisions of Public Law 104-99. In February of this year, the administrative and oversight responsibility for MMTC was transferred from the Bureau of Mines to the Minerals Management Service (MMS).

The transfer was designed to do four things: one, facilitate the orderly phaseout of the MMTC program; two, provide for the necessary oversight of obligated contracts under the MMTC program; three, allow for the close coordination of the work done by this program with related programs of MMS; and, four, ensure that the highest priority problems and issues related to marine minerals are addressed.

The MMTC was transferred to MMS because the Bureau's general responsibility over the nature, extent, recoverability, and valuation of leasable minerals on the Outer Continental Shelf makes its mission compatible with the MMTC. MMS is directed by the OCS Lands Act to require its lessees to use the best available technology and to recover mineral resources in an efficient but environmentally safe manner.



Such technical and environmental responsibilities of the MMS encourage the Bureau to reach out to outstanding research institutions, such as the centers established under the MMTC, for partnerships in the development of technologies in the field of marine mineral development.

Because funds for the centers have been obligated through fiscal year 1997 and because the objectives and research of the MMTCs are compatible with the objectives of MMS's marine minerals program, we will continue to utilize the expertise and research products of the centers, and we will avail ourselves of their relevant research reports and other products until the funds are completely expended in fiscal year 1997.

It is a privilege to be on the same panel with these distinguished members of the Marine Minerals Community. I thank you for the opportunity to testify and would be happy to answer any questions.

[Prepared statement of Dr. Tom Kitsos may be found at the end of hearing.]

Mr. CALVERT. Thank you for your testimony, doctor. Next, Dr. J. Robert Woolsey, Director, The University of Mississippi, Mineral Resources Institute. Doctor?

**STATEMENT OF DR. J. ROBERT WOOLSEY, DIRECTOR, THE UNIVERSITY OF MISSISSIPPI, MISSISSIPPI MINERAL RESOURCES INSTITUTE**

Mr. WOOLSEY. Thank you, Mr. Chairman, and members of the committee. We want to express our sincere gratitude for the opportunity to be with you today and present our testimony. With regard to our written testimony, we have provided it in several parts. There is the basic testimony that refers to our program and then there are two attachments which also, relate to our historical background. Mr. Chairman, there is a section that refer to some of your direct questions with regard to the makeup of the programs. We also added a third attachment which relates to some of our ongoing activities that mainly presents our very interactive program with government agencies, the military, and industry. It is actually an excerpt from our progress report that is due to Mr. Kitsos next week, and addresses those areas of our prime interest. So hopefully this will give the committee some idea and background of the extent of the activities that we are involved in, in a cooperative way, with industry and many of the government agencies, particularly Minerals Management Service.

I hope in going over this testimony the committee will find we have done a good job in the past in pursuing our prime interest, which is the promotion of environmentally sound, sustainable development of marine mineral resources within our Exclusive Economic Zone. I think if I now might share this period of discussion with Dr. Cruickshank, if we will just trade back and forth on this, I feel it will probably provide the committee with the best use of their time. Mike, can you say something about this?

Mr. CALVERT. Doctor, also we will enter your full, written testimony into the record without objection.

**STATEMENT OF DR. MICHAEL J. CRUICKSHANK, DIRECTOR,  
UNIVERSITY OF HAWAII, MARINE MINERALS TECHNOLOGY  
CENTER**

Mr. CRUICKSHANK. Thank you, Mr. Chairman. I am Michael Cruickshank, and I have been with the Marine Minerals program since 1964 with the U.S. Government and followed through on different occasions since that time. And so I have seen a lot of changes over the program.

But one of the biggest changes of all that I have seen is the discovery and realization over this period of time that the potential for finding mineral deposits in the seabeds is as great as the potential for finding mineral deposits on land. So that when you look at the size of the global mineral resources, we have quadrupled the global mineral resources from terrestrial sources by the additional three-quarters of the globe which is under water.

Just with the addition of the Exclusive Economic Zone to the United States; the United States Mineral Resources have actually more than doubled by the addition of the seabeds under the Exclusive Economic Zone. So this is an enormous resource that we are looking at here, and the need to go ahead and develop and find ways of characterizing and understanding the seabeds and mineral resources of the seabeds is extremely important.

And as in the last 10 years or so, our own government efforts have decreased so they have picked up overseas, and we are in the case now of saying, "Wait a minute. We are going to be in the following mode here. We should be leading." We have a tremendous amount of information and skill and equities built up over these years that we are in danger of losing. MMTTC is the last National program in existence which deals specifically with seabed minerals.

And so what we also have between Hawaii and Mississippi is actually two very, very fine natural environmental laboratories within which these minerals exist. The one in Hawaii is in the Pacific Ocean, and this looks at the island environment and the deep seabed environment, particularly the spreading centers off the California and Oregon coasts.

In the Mississippi area, of course, we have the Gulf Coast and the Atlantic so that together the two combined institutes offer a very, very strong base on which to build and continue to build this research effort of ours. Thank you, Mr. Chairman, and I would be very pleased to answer any questions in these areas.

Mr. WOOLSEY. If I might continue on with this—

Mr. CALVERT. You have some additional time there since it is the two of you together so go ahead and take what time you need.

Mr. WOOLSEY. Thank you. There are possibly questions as to why these two programs, Mississippi and Hawaii, are different from many of the other big-name programs that you hear a lot about. And we certainly don't mean in any way to cast disparagingly on these programs. They are really top-notch; for instance, Scripps Institute of Oceanography, Woods Hole Institute of Oceanography, we work with individual of these groups quite closely; They are, however involved primarily in science and the scientific aspects of the sea. Our programs are more nuts and bolts, hands-on technology, and as such, we have endeared ourselves to many of the Interior agencies, industry and the military as well, because

we have been able to identify problems through our close associations. We go to the shop and design and build these systems. You might say, well, what is unique about all of this? A good recent example took place a few weeks ago. We had a call from the Corps of Engineers, New York District, where we were asked about a special drill that we have designed in cooperation with a former MMS-joint Interior project conducted off the Georgia-Carolina coast to evaluate an agricultural-grade phosphate that occurs in abundance there.

Well, this same drilling system is more of a specialized, robotic, remote-operated system that has a capability of taking discrete samples down to about 30 feet below the seabed. This is the only system of its kind in the country, and here we get a call down in Mississippi to go up to New York to put this drill to work.

The Corps knows of our system through their office in Vicksburg with which we have one of our adjunct professors, Dr. Richard Lewis, who is a researcher with the Corps of Engineers, has explained the uniqueness of this system to his associates. So, we are scheduled now, if everything clears with the progress of this project, to go up to New York in July.

As explained to me, they are trying to find areas in the sand and gravel province off of New York Harbor to dig a large borrow pit. The borrow pit then would be the repository for about 100 million cubic yards of muck from New York Harbor; it would then be capped over with clay. And so as I understand it we are to drill the control holes that will help the Corps define the terms of the contract, which they would let to industry to actually perform the work.

So we get calls like this quite of ten, both Hawaii in their realm, and we in our own. We do these jobs with the actual systems that go down and sample. We also have—as one paper attachment refers, cutting-edge technology using acoustics to define the characteristics of these sand bodies and other mineral deposits which the Minerals Management Service and other agencies are interested in. So with that, Mike, Mr. Cruickshank and I will be happy to answer any specific questions that you might have.

[Prepared statement of Dr. J. Robert Woolsey and Dr. Michael J. Cruickshank may be found at the end of hearing.]

Mr. CALVERT. Thank you, doctor. Before we get to that, Mr. John Rigg, Consultant, out of Arlington, Virginia.

**STATEMENT OF JOHN B. RIGG, SR., CONSULTANT, ARLINGTON, VIRGINIA**

Mr. RIGG. Thank you, Mr. Chairman. I have submitted a written statement which I would appreciate you receiving. I just wanted to confirm what basically has been said here at the table today. This is a very unique program, and it is one of the last programs that is addressing the technical and environmental issues in offshore from a viewpoint of see if we can make the thing work with something new and something creative.

I think the biggest concern right now I have is for the sand and gravel that used to be utilized by the Corps of Engineers for replenishment and renourishment of beaches, and they don't do that anymore. They are cutting that all out. And we have got to address

that issue, and Bob has got the equipment and tools. And I think he is going to be needed especially off of California and Florida and the East Coast and the rest of the Gulf. It is a real problem now, and we need to keep addressing it.

And out at Hawaii, I just think that unit is one of the finest little programs going. They have more knowledge of these minerals in the deep ocean than anyplace else that I am familiar with. And this information is going to be priceless to us. And the minute you shut something down, everything gets lost I have found in the past. But I appreciate the opportunity to be here, and I would be happy to answer any questions.

[Prepared statement of Mr. Rigg may be found at the end of hearing.]

Mr. CALVERT. Certainly, and your written record will be submitted for the record without objection.

Mr. RIGG. Thank you.

Mr. CALVERT. Again, I thank all of you, and when Mr. Abercrombie asked me to have this hearing, I always remember this subject when I was a young lad probably a few years ago. When the GLOMAR Explorer was being constructed, and I don't know what ever happened to that ship, but for other purposes supposedly, but I remember they were taking these manganese nodules I guess right off the coast of Hawaii, but actually they were to do other things. But I always remembered that and was always fascinated by the subject. And so I am glad that you are here today to testify and answer a few questions.

Obviously, what we are talking about is applicable technology, and there is a debate here of basic science and applicable technology and dollars and budgets and so forth. Eventually, you must all believe that at some point that it is going to be cost effective in order to go out and get—primarily mining materials I am talking about right now and putting aside beach sand and replenishing coastal areas, which is certainly important also to California—but for minerals.

How soon do you think that this will be a profitable endeavor would be my first question? And, secondly, has some mining companies or private enterprise are looking down the road? Are they assisting you in coming up with some dollars for this applicable technology? Any of you.

Mr. CRUICKSHANK. Mr. Chairman, the present forecast for when these things will be profitable, there is quite a bit. Basically, there are five different areas or types of mineral deposits offshore. There are the manganese oxides which consist of the nodules and the crusts. There are metalliferous sulfides which occur also in deep water in many parts of the ocean—in fact, all over the oceans.

And there are phosphorites for fertilizers which occur on the surface and underneath the seabeds, and there are sands and gravels and construction materials, plus a number of heavy minerals such as gold alluvials, iron and titanium minerals such as that. So individually these things are—when you look at them, some are viable today. Others may take 15–20 years. It looks like in 50 years' time there will be a general active industry, and it may not start here. It may start somewhere else. For example, the Cook Islands are already looking to take some deep water minerals.

But in the United States, there are certainly many continental shelf minerals which are available only with the discovery of the deposits—characterization of the deposits. And the processes involved are ones, of course, which take quite a little time to develop.

The primary trigger may well be the fact that environmentally it may be more benign to go offshore than it is to dig up farmlands and forest areas as we have in many parts of this country here. So I would say that depending on discoveries that it could be anytime from five years to 50 years there will be generally increasing activity in terms of minerals development in this area.

And you asked about companies assisting us. In fact, in Hawaii, we have a contract with the BHP of Australia looking at the tailings from some of the oxide minerals and the uses of them. As these uses of the minerals become more varied and more studied, then it makes the minerals themselves more useful or more economic to look at. And I think that Bob could probably address a lot of the—some of the other things in terms of placers and heavy mineral sands which occur in many places.

Mr. WOOLSEY. Mr. Chairman, if I may add to these very knowledgeable remarks of my colleague, indeed at this very moment, there are requests by several States—New York, Florida, Virginia—I believe that is right, isn't it, Mr. Kitsos?—for sand and gravel in the Outer Continental Shelf. These States are much in need of these sand and gravel resources for the stabilization of their heavily eroded coastlines which have developed over the past few years. So indeed the need is very present and very real, and there are ongoing dredging operations now.

We feel that in another area some of our new concepts and dredge system knowledge can greatly reduce the cost of supplying these sands and gravels to the shore and can do so in a much more environmentally friendly way. Some of our technologies, which we have been working on, reduce turbidity, generated by dredging, more than 50 percent.

In one of the more, well-publicized marine mining activities of recent years, the Bema Operation in Alaska, those offshore Nome gold deposits are world class. They are very good deposits, but it was an application of a wrong system—the wrong system was applied to that operation. And had the right—proper system been put in place it could have been a great success I think Mr. Rigg can also comment on this because he called me in on that project very early in its infancy, and having come from the dredge mining industry in Southeast Asia, I was appalled by the selection of the Bema, and it couldn't even mine tin effectively in Indonesia. So, again, it is the case of the wrong system at the wrong place at the wrong time, and it has given marine mining in Alaska a bad name.

So we need several things. We have the markets in place for sand and gravel. The market was there for gold, but it was the wrong system. I think we will see more and more of these operations going into effect. Phosphate is another area that the Minerals Management Service, the GS, and the Bureau of Mines was very interested in some years ago because we all know that this very valuable Agricultural resource is on a very sharp decline in this country.

We are already beginning to see our imports surpass our exports. And by the next century, we will be totally dependent upon imports when we have a world of phosphates right off the Georgia-Carolina coast that could be mined in a profitable way. And it can also be done in an environmentally sound way.

One of the things that you mentioned, manganese nodules, we have an ongoing program at the University of Mississippi at this time looking at some very novel uses of these. We find that we can use them as a filter material to extract up to 98 percent of sulphur dioxide from coal-fired utilities burning high-sulphur coal. We can then take this filter material made from the nodules with its absorbed sulphur, subject it to hot water, and then take out the strategic mineral commodities—manganese, cobalt, and nickel. We can recover these very efficiently and effectively.

None of these mineral commodities, very vital to our industries, are produced in this country. We import all of them. We could become self-sufficient in manganese, cobalt, and nickel. And then there is also a byproduct, copper, as well.

The acid concentrate that we would take from that, we could treat phosphate rock that occurs in the same vicinity of this manganese material, in which the manganese has replaced—we think these manganese nodules have replaced the preexisting phosphate. We can treat the phosphate with the acid residue and come up with a superphosphate fertilizer. And all this could—fit into an economic framework using barge transportation right into the heartland of our country. So these concepts and technologies are real, and they could be put into practice at almost anytime.

Mr. CALVERT. Thank you, doctor. Mr. Abercrombie.

Mr. ABERCROMBIE. Thank you very much, Mr. Chairman. I want to move to Dr. Kitsos first and then follow up on some of the commentary already given to us. Dr. Kitsos, I am sensitive to your outline with respect to the budgetary constraints and considerations. And, obviously, I am sensitive to it, not only for this agency, but for every agency.

And I want to make it clear on behalf of Mr. Wicker and myself and for the record that we are not supporting taking existing money from MMS's budget to fund the MMTC program. However, the question I then pose to you, would MMS continue to support the MMTC program if Congress included funds in direct support of the MMTC program?

Mr. KITSOS. Mr. Abercrombie, if Congress directed funds for the MMTC program, particularly if they were funds in addition to the MMS budget, clearly I believe the Bureau would support the continuation of the program.

Mr. ABERCROMBIE. So is it a correct statement then, inherently, you see the value of this program? The funding question is not one based on merit, but rather one based on funding priorities and availability of funding?

Mr. KITSOS. That is correct.

Mr. ABERCROMBIE. Thank you.

Mr. KITSOS. There is no question about the merit of the program.

Mr. ABERCROMBIE. And am I correct in stating that this is the scenario that the MMTC program has been operating under since 1988?

Mr. KITSOS. It has been operating through congressionally directed funds since its inception. That is right.

Mr. ABERCROMBIE. So what we are attempting through this bill is not without precedent. Right? This has been the manner in which we have pursued the program. The justification for it, et cetera, has been established in 1988 and repeated by various Congresses?

Mr. KITSOS. That is correct.

Mr. ABERCROMBIE. Thank you. Now, I would like to know what your opinion then is of the quality of the research that the MMTC program produces in terms of efficient use of marine mineral resources and, more particularly, the context established by Dr. Woolsey and Dr. Cruickshank in terms of prospective use?

Mr. KITSOS. Mr. Abercrombie, as you know, the MMTC program is relatively new to MMS, although some staff persons in our office have had a longstanding relationship, being on its advisory council and so on. They have known Mike Cruickshank and Bob Woolsey for many years. In response to the transfer of the Centers to MMS, I have had an opportunity to look into some of the research and some of the projects completed.

In short, I think that the work carried out by both Centers is excellent. They are tough, mission-oriented, applied research institutions. As Bob has indicated, they are not institutions of basic science but more of applied science, of engineering and instrumentation and mineral resource characterization in our EEZ.

If you look at their testimony in great detail, you will see all the projects that are outlined. It is my understanding that in the marine minerals research community, the work of both Centers is highly regarded.

Mr. ABERCROMBIE. Thank you very much. Could I move then to Mr. Rigg. I am interested—could you just for the record of the committee provide a little background in terms of consultancies with which you have been associated or are currently engaged?

Mr. RIGG. Thank you. I just recently retired from Interior last year, and I have done some work in some islands and things since then. But my information on this program goes back not to '64 with Mike Cruickshank next door, but to '68 and '69 when the National Academy came up with a report preparatory for President Johnson to declare the Decade of the Ocean from 1970 to '80, which was also supported by President Nixon. And that was a high hope at that time, and that is when I got interested in it.

And I have ran the offshore program for five years for MMS when we established Dr. Keith to his office, and we also established our relationship on the Hill of the centers over at the Bureau of Mines, I was active in that.

Mr. ABERCROMBIE. Thank you very much. And I wanted to establish that premise although you have, obviously, given Mr. Calvert your background, but I wanted to have that on the record for this question that I wanted to pursue.

In the summary given to us by the committee staff with respect to marine mining research—the institutes—one of the points made, and I wanted you to comment on the validity of this, and I think you have almost already by your previous answer, Congress funded research efforts to maintain the U.S. lead in deep ocean mining

technology after President Reagan ordered establishment of the 200 nautical mile wide Exclusive Economic Zone beyond the traditional territorial boundaries.

Would it be your opinion that the activities underway in Hawaii and Mississippi are in furtherance of that goal of maintaining deep ocean mining technology leadership?

Mr. RIGG. Yes, sir, they are.

Mr. ABERCROMBIE. And so this is something that we can safely say has transcended particular Administrations. Right? Be they Republican or Democratic?

Mr. RIGG. It has transcended. I was pleased to see the picture of Chairman Wayne N. Aspinall on the wall when I came because he was Chairman of the Public Land Law Review Commission in the late '60's and early '70's in which they had a full chapter on the OCS and the hard minerals program and the deep sea mining, and it was a bipartisan effort at that time.

Mr. ABERCROMBIE. Would you say that it is a fair statement that seabed mineral activity, whether it is economic at the present time or not though—that seabed minerals constitute an economic resource not generally acknowledged in terms of public awareness at this time?

Mr. RIGG. That is correct. The only one that is acknowledged that is in production domestically is the world's largest fraash sulphur mine in the Gulf of Mexico, which is in the OCS under the OCS Lands Act leasing.

Mr. ABERCROMBIE. Thank you. Then let me move quickly if you will just give me a moment or two more, Mr. Chairman, to Dr. Woolsey and Dr. Cruickshank.

Dr. Woolsey, in your very valuable series of testimony here, including the attachments, you note after the history of the Marine Minerals Technology Center that in commenting on the Basic Minerals Institute program, that one of the antecedents that forms the foundation for your mission is that under the program established under Title 3 of the Surface Mining Control and Reclamation Act in 1977, one of the intentions there was to reverse a National decline in numbers of students graduating in the fields of mining and minerals engineering.

And, more particularly, I am extracting from this that marine minerals engineering would be part and parcel of that tasking. Would that be correct?

Mr. WOOLSEY. That is correct. That is certainly true.

Mr. ABERCROMBIE. So isn't one of the vital elements of the existing programs in Hawaii and Mississippi to encourage and, in fact, promote graduate student activity leading to engineering and related professional activities and capacities?

Mr. WOOLSEY. That is true, and it has been very successful. We have a professional post-graduate program where we draw in top students from all over the country to partake of some of the practical experience that we offer. And it has been very effective.

Mr. ABERCROMBIE. Would it be a fair statement that the record would sustain, if examined, to say that both the public sector and the private sector have benefited directly from the graduate work study and experience both in Mississippi and Hawaii?



Mr. WOOLSEY. That is certainly true, and certainly one of the strong points of our program is that, particularly with our Federal agencies, we can go out on call at almost a moment's notice; put our equipment and our research vessels in operation. We can do this with very little concern regarding logistics and cost on the part of the agency. And not only do we do this economically, but, as you suggested, we turn out a very fine byproduct of quality students trained in these various skills that our young people are going to need, to pursue these interests in the next century.

Mr. ABERCROMBIE. And the private industry, of course, can take advantage of that activity—excuse me—that experience. Right?

Mr. WOOLSEY. We work hand-in-glove with private industry as you might see in that third attachment, at almost anytime we go out, we will have private industry and/or someone representing a Federal agency and always a graduate student—one or two or three—along. So they get this hands-on experience from all of these different sectors.

Mr. ABERCROMBIE. Then in the context that Chairman Calvert established, and which I have pursued in my commentary and questioning to this point, could both of you say for the record what your perception is today of the ranking of our capacity in the United States to compete on the level of work and the development of technology with the rest of the world?

You cited in your various testimonies, for example, China, Korea, Japan all steadily advancing their commitment to marine minerals research and technology. So I would like to have your evaluation of our ranking today as compared to that which was set before you from 1977 and in '88 on.

Mr. WOOLSEY. I think Dr. Cruickshank can best answer those questions. I know that we have enjoyed a superior position in the past. We are threatened with losing that lead. Dr. Cruickshank has just recently come back from the Far East. He has some very interesting and sometimes disturbing information, and if I might turn the podium over.

Mr. CRUICKSHANK. Thank you. It is obvious to me that we still have the lead position. These countries of Japan, Korea, China come to us for information and for assistance in many of these aspects. But they themselves are—each country is spending tens or hundreds of millions of dollars each year on their own programs. So where we still have a technical lead and a capacity to advance at anytime given the resources, we are in danger of losing it if we stand back and watch this go by.

Mr. ABERCROMBIE. So is it fair to say, and I guess I should ask Mr. Rigg really in this regard as kind of the expert witness here—Mr. Rigg, is it fair to say that the amount of money that we are presently expending is—I don't know any other word to use—minuscule compared to what other Nations are now doing, and that we have been getting in these programs an enormous benefit far in excess of the investment that has been made in terms of the taxpayer dollar?

Mr. RIGG. There is no question about that. In the first place, we are going on the cheap in our research funding, and we also are receiving a great bit of information from these other Nations who are spending tons of money out there, but they do come to us.

On the education thing, the labor ought to be more. Down at the University of Texas in Austin, they had a post-graduate program. All of these post-graduate students were from other countries than the United States, and much of them were from India who were very serious about getting programs going in the deep ocean mining off India.

Mr. ABERCROMBIE. Well, let me go back, if you will just indulge me a moment more, Mr. Chairman. Dr. Cruickshank and/or Dr. Woolsey, what is the status of graduate student application and numbers now in terms of what you think is needed over the next 50 years?

Mr. CRUICKSHANK. The number of graduate students that come specifically to study ocean mining is not great because we don't have the size of program to warrant that. And I think that what we are doing is looking at this multidisciplinary effort to bring students in from other fields and to teach them about ocean mining, and then they go back out and spread the word or do their own thing until the time comes when they can be usefully employed in the U.S. in these areas.

But our students come mostly from ocean engineering. We also have them from mechanical engineering, electrical engineering, and even law and business school so that it is a very broad and varied program that we have at this time.

Mr. ABERCROMBIE. Are you attracting though the numbers that you think will likely be needed given the outlines that you and Dr. Woolsey gave us as to what the activity is liable to be over the next half century?

Mr. CRUICKSHANK. Yes. We have done that, and the numbers are quite substantial provided that the forecasts are true. And these have been up and down over the last couple of decades depending on what is happening in the industry.

Mr. ABERCROMBIE. Dr. Woolsey?

Mr. WOOLSEY. Yes. In our own program, over the last few years, we have trained four—turned out four, top-notch Ph.D. students and about double that number at the Master's level. They are all gainfully employed. One of the highlights I think of our program and strengths of it is, we take young people usually with backgrounds in science or engineering, and we stress the environmental—you might say the environmental technology and its importance in this role. Because all we have to do is look out offshore and see these activities now that are currently in progress where we are providing sand for beach nourishment, shoreline protection, and this sort of thing. And we can point out all the various serious problems that are not being addressed. And so we hope that we are training a vanguard of young people that are environmentally aware, as well as good engineers and technicians.

Mr. ABERCROMBIE. So is the panel all in agreement that the bottom line here is that a record has been well established in terms of efficient use of the dollars allocated by the Congress, and that we can make a case to the Congress to continue this funding?

Mr. WOOLSEY. I would certainly think that, you know, being with this every day it is just extremely obvious to us. I wish it were more obvious to others because it is the very vitality of our industrial-based industries that are at stake in this. We are talking

about jobs, exports, imports. You might say that the wealth of States and Nations relate to these natural resources and their wise use. And as they say down in my part of the country, if you don't grow it or dig it out of the ground or catch it from the sea, it doesn't exist. And I think we have lost sight of these basic truths of basic economic factors here in our endeavor to boost service industries. Well, these service industries can't exist without a basis in resources, and we need to look at the sustenance of this resource-based industry and do so in a wise and environmentally sound way.

Mr. ABERCROMBIE. Thank you very much, doctor. In the absence of any objection from the others on the panel, I will let that stand as a summary of the questioning period that I have engaged in, Mr. Chairman, and I thank you very much.

Mr. CALVERT. I just have a couple of questions. Then I have got to go onto the floor. Dr. Woolsey, I agree with you. If it is not mined or farmed or come from the sea, there isn't really anything around, and that is certainly very important. You described some research advances that were made through the years in the Marine Minerals Technology Center's Continental Shelf Division. If the Federal funds were not available hypothetically, do you believe that sufficient industry or State funds would have been forthcoming to fund what was necessary to make those advances?

Mr. WOOLSEY. No, I don't think so because here we have a very unique situation. This whole concept of offshore mineral resources and mining is extremely new, particularly to our industry. As you know, the mining industry is basically very conservative. They have investments in onshore-type equipment. Even though we have provided them with numbers, demonstrating the advantages of working offshore, particularly for sand and gravel, this means a whole capital outlay for new equipment. They vitally need this input from government—Federal and State—to encourage them and give them some degree of stability, to move off into these other areas. By this, I mean they can't really afford to do the long-term research and development that is needed to move into a totally different realm that they aren't familiar with. And I think that is where we can provide a vital role. I think that is my concept of where government does best, not doing the day-to-day mission-oriented programs, but the long-term mission-oriented-type work that government does best, looking down the road, 20, 30, 40, 50 years. And with that type of support, I think we can show our industries that this is the way of the future, and at the same time we can do this and instill in them the need to pursue this in an environmentally sound way as well.

Mr. CALVERT. Thank you. Mr. Rigg, obviously, from your resume you have been in the private sector and the public sector, now retired from the government. And as your current role as a consultant, do you see realistically that the mining industry and materials industry supporting the goals of this institute and demonstrating that with some kind of matching grants or supports or contracts?

Mr. RIGG. Well, now, Mike gave the example of BHP supporting his program out there. I don't know that the mining companies have—this is a top, high priority for their research dollars or for

their foundation funds at this time. But, then again, I don't know that they have been asked for their support.

Mr. CALVERT. OK. My last question is for Director Kitsos. Within the royalty in offshore minerals management budget of MMS is the environmental studies program line item amounting to just less than approximately 13 million this year, and the Administration is asking for a level of funding, as you know, in fiscal year '97.

I understand these studies are preparatory to leasing for oil, gas, and mineral resources. Can you tell us whether or not, in your opinion, there is room in this budget for a cooperative research effort such as this institute represents? In other words, can we get the money out of that?

Mr. KITSOS. I think the short answer, Mr. Chairman, is there is probably no room in the environmental studies budget. That budget, a few years ago, was at \$30-\$33 million. It is now down to \$13 million. The leasing program has contracted but so has the environmental studies program. Many of the projects funded are multiyear projects so that they are in the second or third year of funding.

Very few new studies are being funded under it because of limited resources, and a lot of that money is being used now on existing platform safety and other types of important production-related activity of the Bureau. I would like to submit more detailed information for the record on the environmental studies program, but I think that it would be very difficult to try to fund this out of that part of the MMS budget.

Mr. CALVERT. I just point that out as a potential pool of money. With that, I have got to go to the floor. Do you have any other questions, Mr. Abercrombie? Thank you very much for your testimony and coming some great distances to be with us here today. We are adjourned. Thank you.

[Whereupon, at 2:56 p.m., the subcommittee was adjourned and the following was submitted for the record.]

104TH CONGRESS  
2D SESSION

# H. R. 3249

To authorize appropriations for a mining institute to develop domestic technological capabilities for the recovery of minerals from the nation's seabed, and for other purposes.

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## IN THE HOUSE OF REPRESENTATIVES

APRIL 16, 1996

Mr. ABERCROMBIE (for himself and Mr. WICKER) introduced the following bill; which was referred to the Committee on Resources

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## A BILL

To authorize appropriations for a mining institute to develop domestic technological capabilities for the recovery of minerals from the nation's seabed, and for other purposes.

1       *Be it enacted by the Senate and House of Representa-*  
2 *tives of the United States of America in Congress assembled,*

3 **SECTION 1. SEABED MINERALS.**

4       (a) **AUTHORIZATION OF APPROPRIATIONS.**—Section  
5 2(a) of Public Law 98–409 (30 U.S.C. 1222(a)) is amend-  
6 ed by adding the following at the end thereof:

7 “There is authorized to be appropriated to the Secretary  
8 not more than \$1,200,000 for each of the fiscal years after

1 fiscal year 1996 to be made available by the Secretary to  
2 an institute experienced in investigating the shallow and  
3 deep seabed as a source for nonfuel minerals to be used  
4 by the institute to assist in developing domestic techno-  
5 logical capabilities required for the location of, and the ef-  
6 ficient and environmentally sound recovery of, minerals  
7 (other than oil and gas) from the nation's shallow and  
8 deep seabed.”.

9 (b) **SHORT TITLE.**—Section 11 of Public Law 98-  
10 409 (30 U.S.C. 1201 note) is amended to read as follows:

11 **“SEC. 11. SHORT TITLE.**

12 This Act may be cited as the “Mining and Mineral  
13 Resources Institutes Act.”.

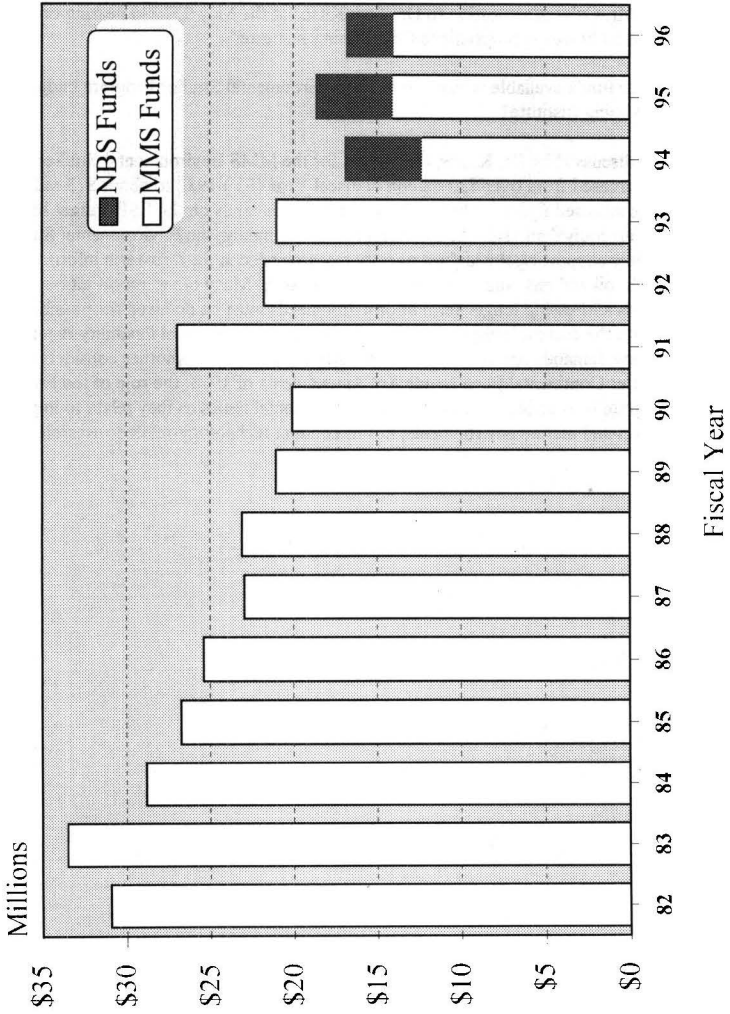
Response to Mr. Calvert's question to Dr. Tom Kitsos at the May 9, 1996 hearing on H.R. 3249, to authorize appropriations for a Mining Institute

**Question:** Are funds available within the MMS Environmental Studies Program budget to support the Mining Institute?

**Answer:** As discussed by Dr. Kitsos, the budget for the MMS Environmental Studies Program (ESP) has decreased from over \$30 million in Fiscal Year (FY) 1982 to about \$13 million in FY 1996 (see attached figure). During this period, the demands on the ESP budget have not decreased at an equivalent rate. At the current level of funding, the Environmental Studies Program is only supporting the highest priority research needed for near-term information needs of the offshore oil and gas, and marine minerals programs. Many other important but lower priority studies addressing longer-term information needs must be deferred for possible future funding. With the current budget, the ESP does not possess the fiscal flexibility required to respond to new demands such as support of the Mining Institute. Another consideration is that under the Outer Continental Shelf Lands Act Amendments of 1978, the role of the Environmental Studies Program is to collect information on environmental issues as they relate to impacts on coastal, human and marine environments, not to conduct technology-related research.

# MMS Environmental Studies Program

Total Spending By Fiscal Year





PREPARED STATEMENT OF DR. J. ROBERT WOOLSEY AND DR. MICHAEL J. CRUICKSHANK

Testimony of  
The Marine Minerals Technology Center  
Dr. J. Robert Woolsey, Director of the  
Continental Shelf Division  
Dr. Michael J. Cruickshank, Director of the  
Ocean Basins Division

Before the  
United States House of Representatives  
Committee on Resources  
Subcommittee on Energy and Mineral Resources  
The Honorable Ken Calvert, Chairman

This statement is respectfully submitted to the Subcommittee on Energy and Mineral Resources in support of House Bill H.R.3249, a bill to authorize appropriations for a marine mining research institute to develop domestic technological capabilities for the exploration, evaluation, and recovery of strategic and economic minerals from the nation's seabed, with due regard for environmental protection.

In the last thirty years, it has become apparent that the mineral resources of the world's oceans and seas represent an extraordinary addition to the global mineral potential. Based on our knowledge of terrestrial deposits and new discoveries offshore, it appears that, area for area, the potential for discovery of marine minerals is generally equivalent to the potential for discovery of minerals on land. Considering that the marine environment covers almost three quarters of the globe, it may be fairly stated that three quarters of the world's mineral resources lie beneath the oceans. At the same time, the Law of the Sea, in force since November 16, 1994, has become a major contributing factor in what is probably the most far reaching redistribution of public lands and their natural resources in human history. The concept of Exclusive Economic Zones (EEZ's), extending at least 200 nautical miles from territorial baselines, has resulted in a peaceful subdivision of jurisdictions which should significantly affect the world's mineral markets and the balance of economic powers for as long as we are dependent on the use of mineral raw materials.

With the addition of the seabeds in the EEZ's, the mineral resources base of the U.S. has been at least doubled, or in terms of public lands, quadrupled. With regard to the development of marine minerals, however, the U.S. Government has done little in the last years to encourage participation of our own industrial partners or demonstrate a strong presence in this field. This abrogation of long term responsibilities for critical minerals supplies has been disruptive of partnerships among the U.S. and other scientific, industrial and academic communities. If continued, it may result in the loss of U.S. industrial leadership in ocean minerals technology, loss of employment, and loss of educational and career opportunities on a significant scale. The U.S. technology lead, gained during the decades of the sixties and seventies with major financial investments and strong industry/government partnerships, is fast disappearing.

H.R.3249 is a farsighted bill and focuses on the continuance and strengthening of a unique and critical program. The Marine Minerals Technology Center (MMTC) was developed during the last decade to perpetuate U.S. leadership in the sustainable development of minerals within the Public Lands of the U.S. seabeds and elsewhere. The MMTC has been supported by the Department of the Interior through the Bureau of Mines' Mineral Institutes Program as a Generic Technology Center for Marine Minerals. Closure of the Bureau has resulted in the total curtailment of funds and the program's transfer to the Minerals Management Service.

The primary purpose of the MMTC is to promote the environmentally sound and sustainable development of mineral resources other than oil and gas of the U.S. Exclusive

Economic Zone (EEZ), an essentially undeveloped region of seabed extending 200 nautical miles offshore and encompassing more territory than the continental U.S. itself. The MMTTC includes the Continental Shelf Division, located at the University of Mississippi, and the Ocean Basins Division at the University of Hawaii, which respectively emphasize shallow and deep water resources. Both divisions have successfully linked academia with industry to develop a strong technological capability that has placed our nation in a leadership role internationally in terms of underwater technology development as well as environmental protection and mitigation. At the same time, quality students have been trained with practical hands-on experience.

The Continental Shelf Division (CSD) has provided technical support as requested to government agencies, academia, and industry. Previous cooperative projects have included the development of a remotely operated drill to reduce sampling costs offshore Alaska, an exploratory and environmental research study offshore Oregon, an earthquake damage prediction study in Richardson Bay, California, a sand resource investigation offshore Hawaii, the development of a seabed remotely operated, core drill for marine mineral and environmental applications. Also, a variety of geophysical and geochemical tools for the rapid detection of seafloor mineral deposits and environmental pollutants, and a specialized towed underwater vehicle for their efficient deployment have been developed. Industry partners have included Western Gold Exploration and Mining Company, Inc., Ingersoll-Rand, Inc., DuPont Senegal, Inc., Westinghouse Corporation, and many others. Government partners have included the U.S. Bureau of Mines, the Minerals Management Service, the U.S. Geological Survey, the U.S. Army Corps of Engineers, the U.S. Department of Energy, and various research arms of the U.S. Navy.

The Continental Shelf Division has funded a number of research affiliate grants each year on a competitive basis. Examples of such projects include a project at Louisiana State University which used MMTTC/CSD technology to investigate aggregate resources in the northern Gulf of Mexico, a similar project at Rice University which utilized new seismic survey methods to locate and map offshore sand bodies as potential sources for shoreline stabilization material, and the development at the University of Georgia of rapid, underwater, towed systems which determine the bottom surface chemistry for environmental characterization and monitoring. Other CSD projects of interest include the successful partnership with Russian scientists resulting in the development and patenting of a unique, low cost, self-cleaning acoustic screen filter (ASF). The ASF has demonstrated applications for the continuous separation of suspended micron sized organic and inorganic particles from host liquids. A wide scope of applications have been noted, ranging from control of dredging induced turbidity to pre- and post-cleanup of industrial process waters. Yet another project involves a novel use of manganese nodules recovered from extensive surficial deposits on the Blake Plateau (offshore Georgia/South Carolina). Studies show that crushed manganese nodules employed as a filter media can successfully scrub sulfur dioxide from utility stack gases burning high sulfur coal. The sulfated nodules can then be economically processed to liberate the strategic metals cobalt, nickel and manganese; 100 percent of U.S. consumption being imported. Copper is also recoverable, with the total process rendering by-product sulfuric acid. An added bonus is the proximity of phosphate rock (which the manganese nodules have replaced) which can be recovered and barged along with the nodules. The phosphate rock can be treated with the by-product acid to produce a form of superphosphate fertilizer for direct field application. This technology may be of particular interest to midwestern, farm belt-industrial states having abundant high sulfur coal and access to inland water transportation.

Through these projects, and others like them, the CSD has provided assistantships and part-time positions for graduate students at the affiliate Universities as well as the University of Mississippi. The CSD also established a post-graduate degree program for qualified professional candidates with M.S. degrees whose research has established them in the field of marine geology. These individuals may enroll in directed studies coursework toward a Ph.D. at the University of Mississippi and utilize approved, professional projects for credit. Since 1988, four students have

graduated from this program, and two others are currently completing their studies. The CSD also maintains an extensive reference library for marine geology and marine mining and presents technological developments at a number of conferences and meetings each year, including the annual Underwater Mining Institute, the premier international meeting in this field, which is partially funded by the MMTC.

The research focus at the Ocean Basins Division (OBD) has been on tools and techniques for characterization of deep seabed metalliferous oxides, metalliferous sulfides and tropical carbonate sands with a long term emphasis on potential minerals development and related environmental aspects. Specific projects supported by the OBD have included the development of a free-fall seafloor hard substrate corer, a study of the roughness of cobalt rich crusts, which has aided in the design of other seabed systems, the design of support cables for remotely operated submarine vehicles used for seabed characterization, the characterization of tropical, reef-derived sands for beach replenishment and coastal protection, the characterization of cobalt-rich crust deposits in the Johnson Island EEZ, and the location and mapping of unexploded ordnance in offshore ranges scheduled for decommissioning. Industry and government partners have included Ocean Minerals Company, Edward K. Noda and Associates, Marine Development Associates, Inc., the U.S. Geological Survey, the U.S. Army Corps of Engineers, and various research arms of the U.S. Navy. The OBD has a strong international linkage with other researchers, particularly in Asia and the Pacific.

The projects conducted by the OBD have supported graduate research on all facets of marine resources development. OBD researchers, serving on the faculty of the School of Ocean and Earth Science and Technology of the University of Hawaii, have taught or participated in courses in geology, oceanography, and environmental science. Since 1988, five Ph.D. students and nine M.Sc. students have graduated and the OBD has offered courses and workshops through the United Nations and to several foreign governments and industrial organizations on request. Since 1991, the OBD has assumed full responsibility for the administration and technical programming of the Underwater Mining Institute, which provides the opportunity for leaders in government, industry and academia to meet each year and discuss prospects for sustainable marine minerals development.

The library and resource center at the OBD houses one of the most complete multi-media collections in the U.S. on marine mineral resources and associated technology. In addition, nearly 10,000 cataloged samples of marine biota and minerals are available for study as well as thousands of line kilometers of geophysical data. The resource center is available to students affiliated with the OBD, and others including researchers in government, industry, and academia.

The Continental Shelf and Ocean Basins Divisions each receive matching financial support from their respective states of Mississippi and Hawaii. Through the Mississippi Mineral Resources Institute, facilities are provided as well as salaries, either wholly or in part for the CSD Director, Associate Director and all CSD employees. The state of Hawaii has provided research facilities, two full time positions, and funding for other research and support personnel. Continuance of States support, however, is contingent on the continuance of federal funding.

Minerals conservation and protection of the environment are global matters of concern to all citizens. U.S. leadership in these fields is readily apparent to anyone involved with the international minerals industry and it is encouraging to see the lessons learned here in the U.S., sometimes at great cost, being applied all over the world. S.1194 and H.R.3249 provide, at little cost, the opportunity for U.S. institutions to retain this leadership in marine minerals development and to realize a significant return on the invested capital in both economic and environmental terms. Mr. Chairman, we strongly urge you to support H.R.3249, which nurtures the seedling from which a strong U.S. leadership in this critical field will prevail.

## Attachment 1

History of the  
Marine Minerals Technology Center

Technology development for minerals in the deep and coastal oceans was initiated in 1964 by the U.S. Bureau of Mines at the Marine Minerals Technology Center at Tiburon, a new facility within the Bureau's Research Division. The MMTC was directed to encourage and assist in the development of a viable marine mining industry, privately owned and operated for profit. Research at Tiburon focused on environmental disturbance prediction, fundamental technology, and advisory services, in consort with members of U.S. industry, the academic community and other government agencies. On the formation of NOAA in 1969, the MMTC was transferred to the Environmental Research Laboratory division of that agency and in 1973 as a political expedient the Center was closed on 30 day's notice.

During the hiatus which followed, government marine minerals interests were pursued as a number of discrete programs. They were located in NOAA, the Office of the Secretary of the Interior, the Conservation Division of the USGS, the Bureau of Land Management, subsequently the Minerals Management Service, Office of International and Marine Minerals (INTERMAR), the U.S. Army Corps of Engineers, the Bureau of Mines and the Department of State. These efforts were largely uncoordinated and largely managerial, but some research efforts were sustained, particularly by USGS for marine geology, Corps of Engineers for environmental effects of coastal dredging, NOAA for environmental effects of deep seabed mining, and the Bureau of Mines for the processing of marine minerals.

Industry meantime pursued their interests in deep seabed mining through the seventies when most of the development was put on hold due to a mix of metal downturn and political risk. Changing government priorities led federal marine programs to be neglected in the U.S. over the next decade while a gradual increase of interest by other nations led to significant marine minerals programs in Japan, Korea, China, India, Europe, southern Africa, and the Pacific.

A combination of academic and congressional insight finally resulted in 1988 in the funding of a small but revitalized MMTC, managed by the Bureau of Mines through their Mineral Institutes Program as a national Generic Mineral Technology Center. The Universities of both Mississippi and Hawaii were involved in developing the program and strong international linkages were established between the MMTC and advanced research partners in Russia, United Kingdom, France, Canada, countries of the Pacific Basin and Rim, Japan, China, Korea, and India. These established linkages represent a significant opportunity to re-establish leadership by the U.S.

The subsequent demise of the MIP and the Bureau led to the present situation while hearings in 1994 on S.1194, which included such speakers as Admiral James Watkins and undersea explorer Robert Ballard, clearly indicated the United States was in danger of losing pre-eminence in marine minerals to these other nations. As Congressman Rahall so succinctly stated in 1988, *"When we speak of international competitiveness, we often fail to emphasize the fundamental importance the education of our young players in this arena. President Kennedy may have set a manned lunar landing as a national priority, but without a body of trained professionals this feat could not have been accomplished. The same applies to our current concerns in the areas of mineral resource competitiveness and dependency."*

## Attachment 2

Comments on the Relative Merits of  
the Marine Minerals Technology Center  
Versus  
the Basic Mineral Institute Program

In response to a specific request by the Subcommittee Chairman, we wish to briefly comment on the merits of reauthorization of the Marine Minerals Technology Center (MMTC) relative to reauthorization of the former Mineral Institute Program (MIP) of the erstwhile Bureau of Mines. As a former National Chairman of the MIP program and a Co-Director the MMTC, I can refer to both of these worthy programs from firsthand experience:

1. The mineral institutes program established by law under Title III of the Surface Mining Control and Reclamation Act of 1977, was intended to reverse a national decline in the numbers of students graduating in the fields of mining and minerals engineering. Some 30 state institutes, eligible for allotment grants to support students, were established at qualified universities.
2. The Generic Centers program was established in 1982 when Congress transferred the program to the Bureau of Mines, urged a reduction of the number of institutes and required submission of a comprehensive plan for institute consolidation. The Bureau responded with the creation of "Centers of Generic Mineral Technology" to focus research funded through the MIP in a specific area of broad applicability across the minerals industry. Each center, which might involve more than one institute, would be headquartered in one mineral institute. Four centers were established in mine systems design and ground control, pyrometallurgy, comminution, and mineral industry waste treatment and recovery. The following year a fifth center was created for respirable dust. The number of institutes was not reduced.
3. The Marine Minerals Technology Center was established independently by Congress in 1988 to encourage the development of mineral resources other than oil and gas in seabeds under U.S. jurisdiction. Funding for the MMTC was independent of the MIP authorization and was equally divided between the Universities of Mississippi and Hawaii. Originally intended to be located with the Minerals Management Service, the placement of the MMTC with the Mineral Institutes Program was done to expedite the administrative functions using existing facilities. The rigid format of the MIP was not conducive to satisfying the research needs of this somewhat complex program, which was multi-disciplinary, cross-organizational, and international in scope.

With the above differences in mind, it should be apparent that the question of marine minerals research versus the mineral institutes is moot. There are separate issues involved which need to be analyzed, each in their own right.

Marine minerals research is substantially directed to a new industry intimately tied to the future of the oceans. Despite their paramount importance to the future of this nation and the future of this planet, the oceans have not recently been given the measure of funding for research that they deserve. The recent attempt to disband the oceanic and atmospheric programs of NOAA is a prime example of the seriousness of this problem, which seems to relate to the lack of understanding, in lay terms, of the value of ongoing scientific and engineering research. Dr. Eaton, Director of the U.S. Geological Survey, has stated in his paper (Eaton, 1996) that *"We must explain the benefits of science in language that all can comprehend, and we must cease our*

*ineffectual habit of talking exclusively to our fellow scientists...the demand for water and minerals and safe places to live expands. The only way to meet this increasing need in the face of our diminishing resources is to reach outward, to develop partnerships with other agencies in federal, state, and local government, with academia, and with industry. If we use our partnerships to leverage our investment of people and money, both our science and our society will reap the ultimate benefit.*" The MMTC program in marine minerals research is just such a partnership and is focused on the future and sustainable development of mineral materials from the ocean environment.

The Mineral Institutes Program as constituted over the last decade was greatly improved by the incorporation of the generic centers by the Bureau of Mines. The program, however, was woefully underfunded, and these limited funds, being disbursed additionally to the 30 odd institutes which were not reduced in number, did not generally allow the development of viable research and development programs. With the continuing budgetary constraints, the program was largely restricted to training support. However, from an educator's point of view, any funds at all available for student support will always be considered positive. Therefore, the program naturally remained popular at the institute level, although held in less regard by industry, the Department of Interior (DOI), and some in Congress, who considered the funding too little, spread too thin with minimal accountability.

Thus, both the marine minerals program and the mineral institutes program have merit in their own right, one as a mission oriented R&D program with direct advisory input from industry and government research agencies, the other as a valuable support program with training as a primary goal and limited project funds for associated research. The two programs do not necessarily overlap, and the question of their funding should be considered independently. The old Bureau approach with its micro-management and cumbersome regulations does not fit the marine program and may no longer be applicable to the MIP. For the MMTC, the Minerals Management Service has similar goals for natural resources development and is an appropriate government agency with which to work. By this same logic, it may be that the educational aspects driving the MIP would be more appropriately served through an agency dealing more directly in matters of education.

## Attachment 3

MARINE MINERALS TECHNOLOGY CENTER  
CONTINENTAL SHELF DIVISIONGEOPHYSICAL SYSTEMS DEVELOPMENT  
Account #2806 (Continuation)  
Dr. J. Robert Woolsey and Mr. Douglas L. LockhartTechnical Progress Report  
For the Period October 1, 1995 - March 31, 1996

## Summary:

Until recently, geophysical systems were developed under the Cooperative Research Program of the Marine Minerals Technology Center/Continental Shelf Division (MMTC/CSD) budget. This arrangement was very appropriate since the requirements for geophysical exploration tools were driven by CSD cooperative researchers and clients. The result was a very effective match between user needs and CSD support. Currently, geophysical systems are developed as a project of their own. The emphasis is still on client needs and technology transfer but now future needs of clients are being addressed in a more controlled environment. Two new paths of development have been identified in the current proposal: amplitude variation with offset (AVO) for the determination of sediment elastic parameters, and integration of high speed (greater than 8 knots) seismic and sonar systems to reduce acquisition time and survey costs.

The oil industry has been using AVO processing for years to identify gas plays, and more recently, map changing fluid saturations in producing reservoirs. The latter activity has helped create a surge in oil field seismics and infill drilling. The success of the AVO technique in the oil field indicates that the process is effective and robust. To make AVO processing useful for surveys requiring high resolution, source and receiver equipment must be scaled down, acquisition gear must be suitable for high repetition rates and high analog to digital (A/D) rates, and navigation must be tightened up to sub-meter in real time. With this technology in hand, AVO processing can be used to determine sediment properties and to distinguish between sands, clays, and muds.

High speed acquisition is a feature often requested by CSD's commercial clients, although it should prove useful for academic and government users as well. The concept is simple. Survey costs are a strong function of ship time. Anything that can be done to reduce ship time will save money. Currently, high resolution surveys are run at about 4 knots. This speed is generally fixed by signal to noise ratios in the seismic data and resolution issues in the side scan data. Generally these problems can be solved by using equipment acquired for the AVO processing along with digital acquisition of the sonar data and deployment considerations.

## Accomplishments:

The CSD has been very active during this reporting period with equipment acquisition and integration, surveys and post processing. Major components of the high resolution system for AVO have been acquired and put into field use. The CSD has been able to supplement geophysical project funds with outside support from the US Navy and private operators to quickly assemble a collection of cutting edge components for use in the high resolution multi-channel system required for the AVO research. First, a power supply for a high resolution sound source was purchased from money donated by a private contractor. Later, the high resolution source, its tow vehicle and cables, along with the multi-channel, 3-D, seismic array, was purchased using funds from the Navy. These outside providers aided CSD's efforts greatly through nearly \$75,000

in support. All these items were received in the Fall of 1995, along with GPS hardware and software for sub-meter navigation and shot point calculation purchased through Geophysical Systems Development. Assembled, these components, along with a high speed, 24 channel acquisition system acquired the previous year, form the core of the acquisition system for the AVO processing and high speed studies.

In addition to equipment purchased by CSD, many items have been loaned to MMTC to increase our productivity. These items include an OYO G112 plotter, on loan from DWS International, an EPC digital plotter, loaned by EPC Labs, Inc., an ORE Track Point II, loaned by DWS, and a Delph-Sonar 4 channel acquisition card for use with an EG&G DF1000 side scan sonar. Additionally, the OBD has loaned CSD their DF1000 for experimentation throughout the reporting period. Modest as they may seem, loaned equipment such as these items go a long way toward filling gaps in our inventory and maintaining links with other research organizations.

Navigation hardware and software purchased under the Cooperative Projects account and the Geophysical Systems Development account were assembled late in 1996. Hardware items consisted of Trimble 4000RS and 4000DS receivers, radio modems, Coast Guard beacon receivers antennas and cabling. The software consisted of Trimble Hydro navigation software. The Trimble 4000 series receivers are currently being used on land as survey grade instruments. Though they aren't typically considered marine products, they function very well offshore as well. Hydro software is essentially a seismic navigation package with added modules for RUV/TUV navigation, rig positioning, and multi vessel survey coordination. Together, these hardware and software components provide CSD with sub-meter positioning and .5 meter shot point intervals required by the higher resolution needed for current project development.

The CSD began the field portion of the reporting period with a trip to St. Petersburg, Florida, to demonstrate the sub-meter navigation system to Drs. Stan Locker and Al Hine of the University of Southern Florida (USF). Trimble representative Wade Jordan also attended to address USF's particular navigation needs. The CSD's navigation system was set up as a bench top experiment and USF personnel were trained to operate it. The system was then mobilized aboard a USF vessel for a week long survey of the Western Coast of Florida. USGS representative, Dana Wiese, was also in attendance. In the past, the CSD has found that demonstrations such as these help build links between the private sector equipment suppliers and the public sector users, while at the same time, advertising CSD's talents and assets. In this case, the demonstration helped promote the CSD as a participant in an upcoming carbonate reef survey proposed by USF and USGS.

Under a contract won by the Ocean Basins Division (OBD) from the Office of Naval Research (ONR), the CSD participated in an exploration technology demonstration for unexploded ordnance (UXO) recovery. CSD's effort in this study was confined to high resolution, 3-D seismic acquisition and post processing for small object detection over a calibrated site at the Pacific Missile Test Range Facility located at Barking Sands, Kauai, Hawaii. Since the arrays for the 3-D survey could not be manufactured by the mobilization date, the survey was run using existing single channel arrays and arrays loaned by Dr. John Anderson at Rice University, Innovative Transducers, Inc. (ITI), and John E. Chance and Associates. Five parallel lines with a 3 meter cross track interval were collected on each path and the data were processed as single channel data on each line. Interpretations were made by looking across multiple lines to distinguish between real events and off plane refractions. The resulting data illuminated the complexity of locating small objects in a noisy environment that the Navy will face during future tests. Results of the test will not be known until the final report is filed at the end of June, 1996.

During December, 1995, the CSD assisted the OBD in a side scan survey of White Island, The Bay of Plenty, New Zealand. The data were acquired using OBD's EG&G DF1000 digital tow fish and CSD's Delph-Sonar recording and processing package. Like the UXO survey earlier in the



year, this exercise highlighted the mutual support and assistance that CSD and OBD offer each other. The CSD assisted in diving, collecting rock, gas, and water samples, and sonar system installation and operation. A sample of a unique bacteria mat was sampled and returned to the University of Mississippi, Pharmacology Department, for screening as a chemical agent against AIDS and cancer. During the early spring, OBD's graduate student, Greg Kurras, was invited to the CSD to post process the data from White Island using CSD's processing software. Results of the processing, contained in Greg Kurras's Master's Thesis, will help date various flows from the volcanic island, while the sample analysis will be used to model gold production at this and other underwater geothermal regions. The CSD's participation in the project helped us gain knowledge in the digital interface between the Delph-Sonar and the DF1000 digital fish. These elements are essential to the high speed survey system currently being studied at the CSD.

In February of 1996, the CSD demonstrated a side scan mosaicing package, Delph-Map, to engineers from the Westinghouse Mine Counter Measures group. While Westinghouse is very interested in sonar data processing and management, the CSD is interested in a very high speed side scan sonar built and operated by Westinghouse for the US Navy. Westinghouse is currently seeking a commercial market for the tow fish and is willing to talk to CSD about various options. Clearly, the high speed fish may be very useful for high speed commercial surveys.

Other equipment demonstrations during this reporting period included a Delph-Sonar/DF1000 and sub-meter navigation demo at the Corps of Engineers hydrographic convention in Mobile Alabama. At the convention, CSD was able to interface with manufacturers and users of high resolution sonar systems from around the US and many from overseas. Interested participants were invited to tour the RV *Kit Jones* and take short trips from the pier to see the equipment in action. This activity allowed CSD to cement relationships with NOAA, the Corps of Engineers, and Westinghouse, among others.

The final activity of this reporting period was the initial field work on a relic oyster shell exploration and recovery model sponsored by the Minerals Management Service. Both the high resolution multi channel seismic was deployed and operated over a known shell reef, followed by a side scan sonar survey. The data collected show an obvious correlation between surface shows of shell on the sea floor and seismic, sub-bottom records at the same point. This correlation will result in a functional exploration model for shell resources. The data are currently being post processed as multi-fold data to gain further insight into reef geometry. Additionally, the seismic data will be processed using AVO methodology in an attempt to classify sediments around the reef and find a quantitative correlation between reef occurrences and seismic amplitudes.

#### Conclusions:

The Geophysical Systems Development program has always responded to the needs of CSD's clients. Although a great deal of research on the AVO processing and high speed survey methods was carried out during the year, needs of the users were still met. CSD is now in a position to collect quality data for AVO processing. More data will be collected this summer for this purpose and 3-D data at high resolutions will be collected for the first time. The multi-channel data being collected will be used for high speed towing tests as well. Actual operation of high speed seismic will begin this summer, sonar will be added later.

Essential ingredients of the new systems are on-line and ready for use by existing or new clients. As with CSD's original experimentation with single channel systems, the multi component, integrated nature of the multi-channel system is paying off in terms of flexibility, mobility, and cost. Surveys and processing streams are being custom designed to meet the needs of a wide range of projects and clients.

PREPARED STATEMENT OF JOHN B. RIGG, SR.,

Statement of John B. Rigg, Sr., Consultant, concerning H.R. 3249 before the Subcommittee on Energy and Mineral Resources, House Committee on Resource, House of Representatives, May 9, 1996.

Mr. Chairman and members of the committee, thank you for the opportunity to offer a few observations and comments concerning H.R. 3249, a bill which basically reauthorizes the established Marine Minerals Technology Centers (MMTC) and their programs. The MMT Centers are located at the University of Mississippi and the University of Hawaii, with funding obligated at \$1.2 million annually through FY 1997.

I appear as a private citizen who has a keen desire to urge you to keep this program going beyond FY 1997, because this is the only program addressing both technology and environmental issues related to minerals in the sea, which involves university students and is operated with minimum funding. The immediate need for beach nourishment is a matter of concern, especially in California, Florida, and the states on the Atlantic and Gulf coasts, because the U.S. Corps of Engineers announced last November they would no longer fund local shoreline protection projects. Whether this situation will prevail or not is still unknown, but what is known is that states will need the University of Mississippi leadership in addressing other opportunities for locating and utilizing material from offshore for beach protection.

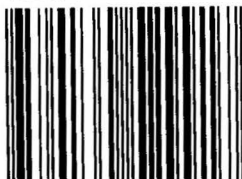
At the University of Hawaii, the knowledge of the location, tenure and environment of deep ocean minerals is more comprehensive than anywhere else that I know of. We need to keep this lantern of knowledge lit, even though we realize that international mining companies do not believe they will address deep ocean mining until after the year 2000. Other nations continue research programs on ocean minerals, and the geologic settings in which they occur far beyond what is funded here. Yet, the Hawaii Center has been able to utilize it's funds by a factor almost of infinity by cooperating with other Nation's research vessels.

We need the information these MMT Centers, their other university, and private colleagues produce about the ocean, the sea floor, the environment and minerals because that information assists this nation's policy-makers in their deliberations as to our future direction.





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