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Folder Title:
Strategic Environmental Research and Development Program (SERDP)

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** SENATE ARMED SERVICES COMMITTEE **

Telefax Cover Sheet



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 their program)
 Brad

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Brad, this is the draft text of a speech on SERDP that I put together last spring. If you need more details please call me. 224-4148.

Madelyn

THE STRATEGIC ENVIRONMENTAL RESEARCH AND DEVELOPMENT PROGRAM:
A CORNERSTONE IN ENVIRONMENTAL SECURITY

Not too long ago, survival in this country meant withstanding a daily barage of biological killers. Diseases like tuberculosis, dyptheria, polio, enteric fever and cholera were as common as the flu - only many times more deadly.

But now, thanks to antibiotics, modern sanitation and public hygiene, most of these diseases no longer pose a threat to everyday life. What does pose a threat - a growing threat - to the health of the nation, is pollution: toxic rivers, contaminated drinking water, poisoned soil, and of course, an ozone layer eaten through by flourocarbons. At the same time, we have diseases like cancer in almost every family. We have children who are poisoned before they are born, and wives and mothers who develop breast cancer from completely unknown causes. While we have freed ourselves from so many biological plagues, the threats from a strained environment are widespread, and massively deadly.

Two years ago, the Senate Armed Services Committee set up a structure to deal with these increasing threats as we saw them in our specific area of responsibility - the military services. We knew that lands and waters used for decades as military training areas had been scarred by chemical waste and other damage. We knew that the Department of Defense, the military services, and the Department of Energy had conducted high-quality - if limited - research into environmental clean-up, drawing on a variety of skills, talents, and innovative technologies that could be applied to a spectrum of needs. And we knew that the environmental problems we faced in the U.S. were duplicated by the thousand in countries all over the world.

So we set up the Strategic Environmental Research and

Development Program - or SERDP - to identify the environmental challenges we faced, to garner the resources we already possessed to meet those challenges, and then to face the challenges with our capabilities. We identified three areas of concentration: environmental data gathering and analysis, environmental cleanup technologies, and environmental compliance and advanced energy technologies. We formed a SERDP Council to pull together the resources of the Defense Department, the Energy Department, the Environmental Protection Agency, the military services and the Coast Guard. We charged the Council with the responsibility of reviewing research proposals submitted to it and deciding funding and policy issues. We appointed the SERDP Advisory Board to assist and advise the Council, consisting of a committee of respected scientists including the President's Science Advisor, and the directors of the National Aeronautics and Space Administration and the National Oceanographic and Atmospheric Agency.

Now, you may be wondering what sort of skills or knowledge the Department of Defense could have to protect the environment. Well, the first mission of SERDP - to gather and analyze environmental data - is one area in which we found the defense establishment has a great deal to offer in environmental protection efforts. The military services, through their operational and intelligence activities, collect massive amounts of data. The Navy tracks ocean temperatures, currents, bottom topography and wave patterns. The Air Force gathers information on weather patterns, cloud formations, and atmospheric temperatures and conditions. The Army and the Marine Corps know a great deal about topography and geography - the height and mass of mountains, the shape and size of forests, the location of swamps and bogs.

This data is a powerful tool in environmental research. It enables scientists to track pollution quantities, directions, and effects. It allows them to measure stresses on vegetation and water systems. The environmental data can provide an excellent quantitative basis for analysing landscape structures as well as chemical compositions in the atmosphere. Access to accurate data on environmental trends and changes is the key to understanding whether the earth is warming at an abnormal rate, and why. SERDP matches the data to the needs of the environmental research community by facilitating a dialogue between its member agencies and researchers who can put the data to work.

Two projects illustrate how military efforts in environmental research can benefit both environmental protection efforts and the military itself. In one project, the DOD will study global warming by using sound waves to measure ocean temperature. Because sound travels through water at different rates of speed depending on the temperature of the water, the DOD can take the world's ocean temperature by bouncing sound waves through different regions, and using powerful computers to compile the data. The ultimate goal, should the project achieve

success, is to establish a long-term global acoustic measurement program that could lead to a better understanding of global warming trends and patterns. Changes in ocean temperatures could be an early indicator of climate change. Working with a variety of academic and private research institutions, the DOD can assist in broad scientific efforts while directly benefiting through a greater understanding of the effects of ocean temperatures on sound and submerged objects.

The second project will merge the efforts of the Department of Energy, the Department of Defense, and the National Aeronautics and Space Administration to study atmospheric climate change. For many years DoD has studied the chemistry and dynamics of the upper and middle atmospheres, whose characteristics and conditions have critical effects on defense communication and surveillance systems, including satellites. DoE, on the other hand, has been pursuing studies of atmospheric radiation. Now, with SERDP direction and coordination, a remote sensing project will further develop technologies that are crucial to both of these projects. To do this, SERDP will incorporate the resources of NASA to use space-based atmospheric measurements to study global climate change. Combining and rechanneling resources among the SERDP agencies, the program advances individual agency missions while conserving resources.

SERDP's second goal is coordinating the development of environmental clean-up technologies. In the last two decades we have begun to realize that vast amounts of hazardous and radioactive wastes have accumulated over the years in the soil and water of DoD and DoE facilities. The cost of cleaning up this contamination may rival the cost of the Savings and Loan bailout. DoE has estimated that its cleanup costs are between \$150 and \$200 billion, while DoD estimates it must spend some \$25 billion to restore its contaminated lands to usable condition. As high as those numbers are, they keep rising as the full extent of the problem continues to emerge. Many of the existing cleanup technologies are expensive, not very efficient, and take too long. In some instances, technologies for cleanup and waste treatment simply do not exist.

SERDP's second effort is aimed at developing technologies to meet this massive challenge. One key aspect of the effort - which distinguishes SERDP from traditional DoD and DoE efforts - is aiming from the start to encourage technology transfer to the commercial sector. Most of the problems facing DoE and DoD have duplicates or counterparts in the private sector. Corrosive solvents and degreasers used by the Army and the Marine Corps to washing tanks and armored vehicle engine parts are the same substances used by service stations on automobiles. Gasoline, diesel fuel and aviation fuel leaked into military installation soils pose the same problem as those contaminants found in commercial settings. Even chemicals used to produce special nuclear materials at DoE weapons facilities are the same as those used by private industry in the manufacture of a spectrum of

products. Low-level radioactive waste generated by DoE nuclear facilities is virtually identical to low-level radioactive wastes generated by hospitals. All of these cases pose great problems in clean-up and disposal. But with the efforts of SERDP pushing back the frontiers of applied technology to meet these challenges, better and cheaper methods of clean-up and waste control are emerging.

SERDP is already involved in over 100 projects in this area. They include:

- * efforts to examine the potential of certain micro-organisms to attach themselves to and digest chemicals such as oils, asphalts and pesticides. Micro-organisms could be applied directly to the soil, so that contaminated earth would not need to be moved.

- * efforts to examine biological materials like complex carbohydrates that can absorb heavy metals in partnership with proteins that crystallize metals. This process can filter heavy metals out of contaminated water.

- * efforts to improve the quality of landfill caps in high rainfall areas to prevent the spread of contaminants into groundwater systems.

DoD needs to develop other technologies to restore its military bases to useable condition. Many bases are being sold or converted for other purposes, but they have bombing and ordnance ranges that may contain unexploded weapons. Recently at a military base in New Jersey, a teenager climbed a fence into an ordnance area where he found an unexploded hand grenade. When he picked up the grenade, it exploded and killed him. Obviously, we cannot let this be repeated. The SERDP research plan contains several projects aimed at detecting buried explosives.

Two other SERDP initiatives are designed to address hazardous waste disposal problems. Firefighters often use self-contained breathing devices that must be disposed of as hazardous waste after use. With new technology sponsored by SERDP, the hazardous filtration media could be separated from the non-hazardous parts, so that disposal costs would be reduced 90 percent. In another effort, lithium batteries - like those in cameras - could be treated and disposed of safely so as not to pose a hazard in garbage disposal, as they do now.

The challenges of environmental clean-up in the United States - great as they are - pale in comparison with the problems of hazardous waste and contamination of Eastern Europe and the former Soviet Union. American technologies are already the world's most effective - and they can get better. Encouraging joint research by the military, industry, and universities can speed technology development and push American industry into the

forefront as the world's market leader in this area. It's an opportunity we literally cannot afford to miss.

The last focus of SERDP presents a different kind of opportunity. If it works, it could significantly save on government energy use. The Defense Department consumes more energy than any other government agency. That energy is used to fuel aircraft, tanks and other vehicles, as well as to heat houses, and large facilities. The military needs more energy to conduct exercises and tests of its equipment. In an age of decreasing resources and increasing fuel prices, energy conservation becomes a high priority. One of SERDP's goals is to evaluate possibilities for greater energy efficiency at military bases and facilities. For example, one project will apply Energy Department expertise to examine energy use at a DoD military test site. Combined DoD and DoE researchers will examine base operations in detail and evaluate the potential cost and energy savings of specific energy technologies, including solid-state ballasts for use in lighting systems, passive and active solar heating systems, and geothermal heat pumps.

After energy use, come emissions. The requirements of the new Clean Air Act, the Clean Water Act, and the Solid Waste Disposal Act present special challenges to the defense establishment that necessitate changes in energy use and disposal. The Clean Air Act requires significant reductions of the nitrous oxide and sulphur dioxide contained in the flue gases at the 28 coal fired steam generating systems operated by the military services. There is no technology that can scrub or clean the emissions from high sulphur coal to acceptable levels and maintain the fuel's cost-effectiveness. Without efficient scrubbing systems to reduce the emissions, high sulphur coal from the Appalachian states and the midwest can no longer be burned.

SERDP may provide a solution to the disposal problem. One project underway would adapt technology developed by the Defense Nuclear Agency to scrub flue gases using electron beams. Using electron beams to scrub flue gases is not a new idea, but its high cost has traditionally precluded widespread use. The new technology would provide an economical way to generate the electron beams, which would, in turn, allow coal-burning to remain cost-effective. One more benefit is that, while conventional coal scrubbers produce a hazardous sludge as a by-product, the dry-beam process produces a safe fertilizer.

Clearly, there is tremendous potential to harness the scientific capabilities of different parts of the military establishment to benefit everyone, if we can only build an effective structure to support and channel the resources we have. It was, frankly, difficult to get SERDP coordinated and moving forward, because powerful bureaucracies are difficult to change, and difficult to rearrange. Even when the potential rewards are great. But now, for the first time, those rewards are coming into view. The first \$50 million for the SERDP projects was

released on May 13, 1992. The balance of the FY 1992 funding \$75 million was released in October 1992. In Fiscal Year 1993 the SERDP has available to it \$180 million. The DOD is currently in the process of reviewing the proposals for Fiscal Year 1993.

(Note to Brad: DOD did not include SERDP funding in either the FY 1992 or FY 1993 budgets. I have been told by the program that SERDP will be included in the FY 1994 DOD budget. They were not sure how much. An appropriate level would be somewhere between \$200 and \$250 million. You are certainly in a better position to know what is going on for FY 1994 however.)

Although the challenges to SERDP are not insubstantial, I feel that the hardest work - in terms of erecting a solid organizational structure - has been done. That structure is the cornerstone of an effort to begin cleaning up the environmental problems we face in defense-related government. While those problems are challenging enough themselves, the potential for finding answers to a much broader spectrum of environmental problems is great as well. In spending this modest seed money for SERDP - we may grow a bountiful tree of important solutions for the entire planet. The implications are both environmentally and economically important. The gaps in the stratosphere, the chemically-blackened soils of our industrial areas, and the poisoned waters of our lakes and streams can be brought back to environmental health, but it will not happen by itself. Humanity must confront its damaging handiwork, while there is still time. With the Strategic Environmental Research and Development Program taking the lead to use technology in this effort, we can and will achieve success with greater economy, effectiveness, and speed. Environmental security is, after all, the foundation upon which national security - and all security - is built.

THE STRATEGIC ENVIRONMENTAL RESEARCH AND DEVELOPMENT PROGRAM

In 1990, the Senate Armed Services Committee set up a structure to deal with the increasing environmental threats from the perspective of the military services, the intelligence community and related federal agencies. The primary sponsors of the Program were Senators Nunn and Gore, assisted by Senators Exon, Wirth and Bingaman. The Strategic Environmental Research and Development Program was designed to focus on three areas: environmental data gathering and analysis, environmental cleanup technologies, and environmental compliance and advanced energy technologies.

The Department of Defense, the military services, the intelligence community and the Department of Energy have an array of data and technology that can be utilized to assist research dealing with global environmental problems such as ozone depletion and climate change. DOD also has a broad technology base that should be explored to see if there are technologies that were developed for military purposes that could have non-military, spin-off applications. These other applications might include both energy efficiency, alternative energy production sources, and pollution prevention.

The lands and waters used for decades for military training and other defense purposes have suffered significant environmental damage that must be cleaned up. In many instances the type of contamination at these facilities is identical to the type of contamination confronting the private sector in the U.S. as well as contamination world-wide. In the long run the DOD and the DOE must also look ahead and to identify ways to conduct business in the future in a manner that will not repeat the contamination of the past. This can only be accomplished through an aggressive pollution prevention program, supported by a strong research and development program.

In addition, DOD and DOE have sophisticated laboratories capable of conducting high quality environmental research to identify environmental compliance, cleanup and pollution prevention technologies that could be redirected to assist the DOD and the DOE meet their environmental challenges.

The SERDP program is a research program. SERDP funding was not intended to conduct any cleanup operations. Other funding is available to DOD and DOE to conduct cleanup operations. It was designed to focus much needed attention, through a cooperative multi-agency approach, on environmental technologies. It was not designed to replace the existing environmental research being conducted by the DOD, the military services and the DOE, rather it was to provide an additional source of funding to allow research to provide technology that would respond to needs common to the several departments, to serve as a focal point for ongoing research. In other words, to understand who is doing what so duplication is eliminated.

SERDP also provides funding that would otherwise not be available to allow DOD, in coordination with other federal agencies, such as NASA and NOAA, to assist researchers involved in global environmental research efforts. The program was not intended to fund DOD to conduct global environmental research or to supplant existing ongoing research. It was designed to fund efforts in data collection and data identification and modification of military platforms and technology that could be utilized to assist the global environmental research community.

MANAGEMENT

The program is run by the SERDP Council. The members of the Council are specifically designated in the statutory language, and are drawn primarily from DOD, DOE and EPA. The job of the Council is to pull together the resources of the Defense Department, the Energy Department, the Environmental Protection Agency, the military services and the Coast Guard. Because SERDP is a DOD program the majority of members on the council are from the DOD and the military services. The Council has the responsibility to review research proposals submitted to it and to decide funding and policy issues related to the program.

The SERDP statute also directed that a SERDP Advisory Board be formed. The SERDP Advisory Board is appointed by the Secretaries of Energy and Defense provides scientific and technical assistance and advise to the Council. The Advisory Board is made up of respected scientists from a variety of scientific and technical disciplines, including the President's Science Advisor, and the Directors of the National Aeronautics and Space Administration and the National Oceanographic and Atmospheric Agency. The Advisory Board provides a scientific and technical reality check, and serves as a liaison between the private sector and the academic community.

SERDP FOCUS AREAS

Data collection and identification

The defense establishment has a great deal to offer in environmental protection efforts. The military services, through their operational and intelligence activities, collect massive amounts of data. The Navy tracks ocean temperatures, currents, bottom topography and wave patterns. The Air Force gathers information on weather patterns, cloud formations, and atmospheric temperatures and conditions. The Army and the Marine Corps know a great deal about topography and geography - the height and mass of mountains, the shape and size of forests, the location of swamps and bogs.

This data is a powerful tool in environmental research. It enables scientists to track pollution quantities, directions, and effects. It allows them to measure stresses on vegetation and water systems. This environmental data can provide an excellent quantitative basis for analyzing landscape structures as well as chemical compositions in the atmosphere. Access to accurate data on environmental trends and changes is the key to understanding whether the earth's climate is changing and why. SERDP matches the data to the needs of the environmental research community by facilitating a dialogue between its member agencies and researchers who can put the data to work.

Two projects illustrate how military efforts in environmental research can benefit both environmental protection efforts and the military itself. In one project, the Navy studies the issue of global warming by using sound waves to measure ocean temperature. Because sound travels through water at different rates of speed depending on the temperature of the water, the Navy can take the world's ocean temperature by bouncing sound waves through different regions, and using powerful computers to compile the data. The ultimate goal, should the project achieve success, is to establish a long-term global acoustic measurement program that could lead to a better understanding of global warming trends and patterns. Working with a variety of academic and private research institutions, the Navy can assist in broad scientific efforts while directly benefiting through a greater understanding of the effects of ocean temperatures on sound and submerged objects.

The second project will merge the efforts of the Department of Energy, the Department of Defense, and the National Aeronautics and Space Administration to study atmospheric climate change. For many years DOD has studied the chemistry and dynamics of the upper and middle atmospheres, whose characteristics and conditions have critical effects on defense communication and surveillance systems, including satellites. DOE, on the other hand, has been pursuing studies of atmospheric radiation. Now, with SERDP direction and coordination, a remote sensing project will further develop technologies that are crucial to both of these projects. To do this, SERDP will incorporate the resources of NASA to use space-based atmospheric measurements to study global climate change. Combining and rechanneling resources among the SERDP agencies, the program advances individual agency missions while conserving resources.

Environmental cleanup and compliance technologies

SERDP's second goal is coordinating the development of environmental clean-up and compliance technologies. In the last two decades we have begun to realize that vast amounts of hazardous and radioactive wastes have accumulated over the years

in the soil and water of DOD and DOE facilities. The cost of cleaning up this contamination may rival the cost of the savings and loan bailout. DOE has estimated that its cleanup costs are between \$150 and \$200 billion, while DOD estimates it must spend in excess of \$25 billion to restore its contaminated lands to usable condition. As high as those numbers are, they will continue to rise as the full extent of the problem continues to emerge. The majority of the existing cleanup technologies are expensive, not very efficient, and take too long. In many instances, technologies for cleanup and waste treatment simply do not exist.

SERDP is aimed at developing technologies to meet this massive challenge. One key aspect of the effort - which distinguishes SERDP from traditional DOD and DOE efforts - is aiming from the start to encourage technology transfer to the commercial sector. Most of the problems facing DOE and DOD have duplicates or counterparts in the private sector. Corrosive solvents and degreasers used by the Army and the Marine Corps to wash and maintain military vehicles and engine parts are the same substances used by service stations on automobiles. Gasoline, diesel fuel and aviation fuel that has leaked into military installation soils pose the same problem as those contaminants found in commercial settings. Even chemicals used to produce special nuclear materials at DOE weapons facilities are the same as those used by private industry in the manufacture of a spectrum of products. Low-level radioactive waste generated by DOE nuclear facilities is virtually identical to low-level radioactive wastes generated by hospitals, nuclear power plants and other private applications. All of these cases pose great problems in clean-up and disposal.

SERDP is funding a number of projects in this area. They include:

- * efforts to examine the potential of certain micro-organisms to attach themselves to and digest chemicals such as oils, asphalts and pesticides. Micro-organisms could be applied directly to the soil, so that contaminated earth would not need to be moved.

- * efforts to examine biological materials like complex carbohydrates that can absorb heavy metals in partnership with proteins that crystallize metals. This process can filter heavy metals out of contaminated water.

- * efforts to improve the quality of landfill caps in high rainfall areas to prevent the spread of contaminants into groundwater systems.

Two other SERDP initiatives are designed to address

hazardous waste disposal problems. Firefighters often use self-contained breathing devices that must be disposed of as hazardous waste after use. With new technology sponsored by SERDP, the hazardous filtration media could be separated from the non-hazardous parts, so that disposal costs would be reduced 90 percent. In another effort, lithium batteries - like those in cameras - could be treated and disposed of safely so as not to pose a hazard in garbage disposal, as they do now.

The challenges of environmental clean-up in the United States - great as they are - pale in comparison with the problems of hazardous waste and contamination of Eastern Europe and the former Soviet Union. American technologies are already the world's most effective - and they can get better. Encouraging joint research by the military, industry, and universities can speed technology development and push American industry into the forefront as the world's market leader in this area. It's an opportunity we literally cannot afford to miss.

Energy applications

The last focus of SERDP presents a different kind of opportunity. The Defense Department consumes more energy than any other government agency. That energy is used to fuel aircraft, tanks and other vehicles, as well as to heat houses, and large facilities. In an age of decreasing resources and increasing fuel prices, energy conservation becomes a high priority.

One of SERDP's goals is to evaluate possibilities for greater energy efficiency at military bases and facilities. One project will apply Energy Department expertise to examine energy use at a DOD military test site. DOD and DOE will examine base operations in detail and evaluate the potential cost and energy savings of specific energy technologies, including solid-state ballasts for use in lighting systems, passive and active solar heating systems, and geothermal heat pumps.

The requirements of the Clean Air Act, the Clean Water Act, and the Solid Waste Disposal Act present special challenges to the defense establishment that necessitate changes in energy use and disposal. The Clean Air Act requires significant reductions of the nitrous oxide and sulphur dioxide contained in the flue gases at the 28 coal fired steam generating systems operated by the military services. There is no technology that can scrub or clean the emissions from high sulphur coal to acceptable levels and maintain the fuel's cost-effectiveness. Without efficient scrubbing systems to reduce the emissions, high sulphur coal from the Appalachian states and the midwest can no longer be burned.

SERDP is funding a project that would adapt electron beam

technology developed by the Defense Nuclear Agency to simulate the effect of nuclear weapons on electronic equipment to scrub flue gases. Using electron beams to scrub flue gases is not a new idea, but its high cost has traditionally precluded widespread use. The new technology should provide an economical way to generate the electron beams, which would, in turn, allow coal-burning to remain cost-effective. One more benefit is that, while conventional coal scrubbers produce a hazardous sludge as a by-product, the dry-beam process produces a safe fertilizer.

SERDP FUNDING AND IMPLEMENTATION

It has been very difficult to get SERDP coordinated and moving forward. DOD first sought to redirect the \$200 in SERDP funds appropriated for fiscal year 1991. When this proved only partially successful, DOD sought to change the focus of the program to a one year technology transfer effort. Although DOD eventually dropped this effort, no program funds were spent in fiscal year 1991 for the SERDP program. DOD did redirect \$30 million of SERDP funds to satisfy an unrelated congressional project.

DOD did not request funds for SERDP for fiscal year 1992 because the 1991 funds, now \$170 million, carried over to 1992. After several further attempts to kill the program DOD finally allocated \$50 million for the SERDP projects in May 1992.

In the summer of 1992, Congress rescinded a portion of the fiscal year 1991 funds but these funds were later restored and allocated to the program. \$180 million was authorized and appropriated for fiscal year 1993 DOD has stopped fighting the program and is now actively screening projects for 1993. Dr. Bob Oswald, the Executive Director, has worked diligently to get the program off the ground and to ensure technical excellence. The military Services have also been very supportive of the program. The problems with implementation occurred at the DOD appointee level.

FUTURE ISSUES

Due to the roadblocks thrown up by DOD the SERDP has not been allowed to reach its full potential. The concept behind the SERDP was, in essence, to create a program patterned after the national science foundation to fund creative, environmental projects with DOD and defense related applications, and that also has the potential for spin off to private sector application. SERDP has the potential for finding answers to a broad spectrum of environmental problems. SERDP should be considered as seed money. The implications are both environmentally and economically important.

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SERDP is also intended to be a two way street. Projects may also be proposed from the private sector, and the academic and environmental research community, as well as by the SERDP Advisory Board. To be selected, however, a project must have a defense application or relate to a defense interest.

SERDP needs clear direction and support from DOD and should be included in the 1993 DOD budget request at no less than \$200 million.