Prepared Statement of Kris Merkel
President, S2 Corporation
Bozeman, MT
July 2, 2008

Mr. Chairman, members of the Committee, I want to thank you for coming to Montana, in this remote location of Havre, to discuss issues in regard to Homeland Security. My name is Kris Merkel, and I am the President and CEO of S2 Corporation (S2). S2 is a small company with approximately 15 employees in Bozeman, Montana. S2 was created with the sole aim to develop and commercialize an exciting new technology that we also abbreviate as S2 -- shorthand for spatial spectral holography -- that was developed primarily at Montana State University over the past two decades. The applications for S2 are mainly in ultra-wideband radio frequency (RF) signal processing and surveillance, for goals of radar imaging, signal intelligence and communications. The S2 technology is disruptive technology, representing a new way of achieving a better result which is of high importance to national homeland and defense security. To date, the technology development efforts have been primarily funded by the Department of Defense Science and Technology accounts. This has included participation by the United States Army, Navy, Air Force and the Missile Defense Agency.

Over the past two years due to our engineering efforts at S2 Corporation, the S2 technology has transitioned from being a laboratory curiosity to a rugged general purpose prototype device, which in January of this year, 2008, was shipped overseas and tested on operational radars at the direction of the U. S. Army, and is listed a critical technology within that branch of the military.

The implications of using the technology are immediate access and domination of the full RF and microwave spectrum. This capability includes being able to simultaneously achieve total spectral awareness, and to be able to rapidly configure our use of the RF spectrum for adaptive radar and communications. One of the greatest challenges facing our military operating around the World is the explosion in radio signals operating throughout the entire radio spectrum. This technology would allow our defense agencies to enter a new area and continuously identify all of the operating signals and then find a band width where they could securely operate. Other technology applications include the capability to view the entire radar signal in real-time, or to visualize things such as improvised explosive devices (IEDs) underground and be able to interpret the data in real-time. This is a truly disruptive technology. At the heart of so called S2 technology is a crystal, cooled to cryogenic temperatures, which absorbs light to achieve signal processing. This is a home-grown technology in that the crystals themselves have been grown and characterized in Bozeman, and the system has been conceived, designed, developed and built in Bozeman by the scientists and engineers at S2.

The S2 technology is poised to achieve unique performance improvements and cost savings for a host of critically needed security applications. While the technology offers opportunities to advance both security and defense, there are two unique capabilities of

S2 Corporation testimony to U.S. Senate Committee on Homeland Security and Governmental Affairs   1
on Wednesday, July 2, 2008, at 10 a.m. in Havre, Montana,
titled "Securing the Northern Border: Views From the Front Lines."

immediate applicability to the Department of Homeland Security (DHS). DHS has a need to monitor vast borders and to assure the safety of vast amounts off trade related goods passing into the country entering the United States everyday. In addition to securing the safety of our citizens, this task needs to be accomplished in as unobtrusively a manner as possible to respect our constitutional rights. Our ultra-wideband, bi-static radar processing offers a direct achievable way to remotely patrol our borders both visually and radio communications. The second and just as important application is being able to quickly and discretely investigate cargo containers as they pass through our ports through the penetrating nature of the technology. I will explain further if the committee has questions the specifics of the technology but for now I will leave it as simply being clearly a disruptive breakthrough with significant potential benefit to our national security.

Attempting to do business with the Department of Homeland Security -- as a small business with a new innovative approach -- is frustrating. I have seen little incentive for a new technology to move to deployment in DHS. It seems that between the reaction to disasters which is a critical function and poorly executed programs, DHS is somewhat unable to plan for the future. Simple quick fixes such as building a fence along the entire Mexican border is likely to fail and entail such huge costs as to be unimaginable from the perspective of a small business such as S2. The container cargo issue seems to come up in Congress only to be opposed as too costly while little or no technology discussion. For S2, who has a technology to address both problems, we find it hard to find or maintain the appropriate contacts. Positive leads are pursued only to be followed by silence. When we have approached new leads, there hasn't been a targeted approach to addressing these problems, so discussions have gone around – from government to contractor to contractor and back, and have gone no where.

We want to be part of the solution. We have a technology that has proven success at each step along its development path. I want to thank the committee for holding this hearing and Senator Tester in particular for providing me with the opportunity to present our case. I will stop here with my oral testimony. I would be happy to respond to any questions. I would like to request that the remainder of my testimony be entered into the record.

Remainder of Testimony

Over the past two years due to our engineering efforts at S2 Corporation, the S2 technology has transitioned from being a laboratory curiosity to a rugged general purpose prototype device, which in January of this year, 2008, was shipped overseas and tested on operational radars. Specifically, working under contract for the U. S. Army Space and Missile Defense Command, we tested the S2 radar signal processor at the Ronald Reagan Ballistic Missile Radar Test Site located on the island of Roi Namur, Kwajalein, Republic of the Marshall Islands, on two operational radars, so called ALCOR and MMW. We used the S2RSP technology to process radar returns from both test targets and targets of opportunity. I would like to enter into the record a memo from one individual who worked with us at the test site as an endorsement of our efforts. The tests were highly

S2 Corporation testimony to U.S. Senate Committee on Homeland Security and Governmental Affairs   2
on Wednesday, July 2, 2008, at 10 a.m. in Havre, Montana,
titled "Securing the Northern Border: Views From the Front Lines."

successful. In summary, our technology worked. We are experienced, and ready for the next step towards technology transition and commercialization. Within two years, with adequate support, we could be testing this technology under real-time security conditions. As one homeland security example, we could be looking at every cargo container as it enters our ports with little or no disruption in commerce trade.

This technology could provide a new level of protection from long-range missiles. It could also see all of the activity along vast stretches of our borders unobtrusively keeping watch with little or no disruption of people going about their legal near-border activities. One of the greatest challenges facing our military operating around the World is the explosion in radio signals operating throughout the entire radio spectrum. This technology would allow our defense agencies to enter a new area and continuously identify all of the operating signals and then find a band width where they could securely operate. This same technology could be used to monitor our borders for illegal activity. I briefly mentioned the ability of the technology through its use of the full radar bandwidth to see into the ground to identify an IED or look into a closed cargo container to view its contents. The security applications are both critically needed and addressable by this technology.

Despite our technical success in demonstrating the systems capability, our company is facing a critical juncture. We face a very real lapse in near-term funding just as we approach the so-called "valley of death". This is the period when so many small technology start-up companies fail. It is the point where the technology could significantly assist in meeting our defense and security needs. Typically new technology gets to the point where it is proven and for a whole host of reason, funding either lags or it is simply not available from the next level of agency contract managers and we see our highly trained staff simply drain away. Simply stated, we lack the capital necessary to ride the chasm out. This is a major problem for security high technology start ups when facing technology transition.

A small business, particularly one operating in the security marketplace needs support throughout the entire path through development to commercialization. It is extremely difficult for a small business with scarce resources to target commercial development. The chasm is as big as problem for obtaining outside investment as it is directly for us. A lack of focused mission or direction among our defense and security agencies and inconsistent administration support continues to leave research and development seriously underfunded.

I want to point out, not just as the president of S2 but as a private citizen, we face a huge challenge as a nation to develop new the innovations necessary to maintaining our competitive edge and technological superiority. This need is a basic security and defense need. I am a strong supporter of the value of the small business innovative research (SBIR) program, but it isn't enough. The SBIR program needs to be expanded. Additionally, the execution of SBIR programs needs to be expedited, especially in the critical stage between Phase I and Phase II. There is a critical need for support that can nurture and directly support new technologies through the "valley of death". New

S2 Corporation testimony to U.S. Senate Committee on Homeland Security and Governmental Affairs   3
on Wednesday, July 2, 2008, at 10 a.m. in Havre, Montana,
titled "Securing the Northern Border: Views From the Front Lines."

technologies come primarily from small businesses. However, the infrastructure to assist a successful technology development from demonstration to commercialization, especially for security applications simply is not in place. We can not do it by ourselves. We lack the capital to educate, develop an advocate, demonstrate and bring the technology to commercialization.

The S2 technology is poised to achieve unique performance improvements and cost savings for a host of critically needed security and defense applications, including
       1. Dynamic spectral access for ad-hoc communications networks and radars, especially in situations encountered by our Army troops on the ground and Navy ships in foreign ports, where the spectrum is contended
       2. Full RF bandwidth spread spectrum RF communication
       3. Signal processing for improved radars, including ultra-wideband, bi-static, ground penetrating and high carrier frequency,
              Such as for the detection of improvised explosive devices (IEDs) in the ground and attached to a human body
              The use of radar imaging to remotely examine objects such as cargo containers
       4. Remote border patrol capability, in being able to deploy small ultra-wideband antennas with fiber optic connectors to monitor the entire radio spectrum for illegal communications around border areas,

These last two capabilities are of unique interest to the Department of Homeland Security, however, the department could benefit from all of the applications for our technology if they were developed and available for widespread application. It is this support that our security agencies fail to provide.

I want to take a moment to elaborate on the problems we face in working with the Department of Homeland Security. As a small business with a new innovative approach to solving a real security problem, frankly, it is frustrating. I have seen little incentive for a new technology to move to deployment in DHS. It seems that between reaction to disasters (a critically important function) and poorly executed programs, DHS is adrift reacting to perceived issues rather than planning for the future. It is hard to find contacts to approach and virtually no program to guide us regarding a path forward. If DHS doesn't want to use the technology or has a better way to address a problem that is one issue, but with articulated needs, such as cargo containers or border surveillance, there should be some way for S2 to get a complete review of the technology. We would then know where our technology really stands. Since our inception, we have used scarce resources in technical marketing at DHS to little avail. Positive leads have been pursued only to see opportunities evaporate. When following positive initial interest, we too often encounter little or no feedback and follow-up.

The problems a small business doing defense R&D are government wide. Frankly, the on-going conflict in the Middle East is putting a strain on all federal research and development, but the impact on a company focused on defense and security can be devastating. Unfortunately much of the federal government small business research

S2 Corporation testimony to U.S. Senate Committee on Homeland Security and Governmental Affairs 4
on Wednesday, July 2, 2008, at 10 a.m. in Havre, Montana,
titled "Securing the Northern Border: Views From the Front Lines."

funding has been in the defense and security areas throughout the Bush presidency, therefore forcing us to focus even more so on security and defense research. Any small business faces an uphill battle in getting a new technology to market and to the end users. The situation has been, in the past, alleviated by an emphasis within the services and agencies on R&D, technology development. Now as we approach the technology transfer stage, support seems to be lessening. When the first application for the technology is for defense or national security, the challenge is compounded. Homeland security and defense applications for a whole host of reasons should be the natural commercialization path for a disruptive technology such as the S2 chip. Our nation is at a time when we critically need stable, reliable security protection. I am confident that if given the needed support, S2's technology is capable of providing this protection. Today, it is at a stage where it can be easily implemented into an existing system with long term lower costs and new enhanced capabilities.

To summarize, I strongly support government funding of R&D. Our nation has a long history of being a shining example of fostering technology based innovation. S2 represents a local success story in bringing a new capability a long ways. However, having achieved so much, there is still the final push to commercialization. The U. S. security and defense industry has the most to gain by bringing this technology forward. They need to provide the critical support necessary to achieve this technology transition. The S2 technology can have a significant impact in assisting to meet the mission of the Department of Homeland Security. Currently, we have been unsuccessful in gaining the critical foothold within the agency or with its primary contractors. We appreciate the opportunity to participate in this hearing so we can plead our case for technology transfer. In closing, I would like to encourage the members of the committee to propose and implement a new means for the Department of Homeland Security to take the lead in using dedicated assistance to S&T (science and technology) programs so they can be transitioned to address critical security needs. Protecting our borders is too important to demand innovation. I want to thank Senator Tester and the committee for focusing attention on our critical national security needs and doing it here in Montana. I appreciate the opportunity to testify. I would like to request that my full testimony be included in the hearing record. I would be happy to work with the committee to find a pathway that allows us to move this technology forward.

S2 Corporation testimony to U.S. Senate Committee on Homeland Security and Governmental Affairs 5
on Wednesday, July 2, 2008, at 10 a.m. in Havre, Montana,
titled "Securing the Northern Border: Views From the Front Lines."