

## FY2010 Appropriations Request Form

Office of Congresswoman Jackie Speier  
211 Cannon House Office Building  
Washington, D.C. 20515  
Phone: 202/225-3531  
Fax: 202/226-4183  
Website: [www.speier.house.gov](http://www.speier.house.gov)

Individuals/Organizations must respond to all questions on the form. Incomplete proposals will not be considered.

All requests will be evaluated before the 12<sup>th</sup> Congressional District's Citizens Oversight Panel. Appointments to appear before the panel must be made through Cookab Hashemi, chief of staff, at 202/225-3531 or [Cookab.Hashemi@mail.house.gov](mailto:Cookab.Hashemi@mail.house.gov). The panel will convene on the following days; Saturday, March 7, Friday, March 13 and Friday, March 20, 2009. All proposals must be submitted by March 2, 2009.

**Date Submitted: February 26, 2009**

**Project Name: Satellite Coherent Optical Receiver (SCORE)**

**Individual/Organization:** *(Is the grantee located in the 12<sup>th</sup> Congressional District?)*

SA Photonics, Yes, 915-D Terminal Way, San Carlos, CA 94070 USA

**Amount Requested** *(if requesting report language, please attach.):* **\$3.0 M**

**Appropriations Bill/Account/Relevant Authorization law/bill/status** *(e.g., "Public Law 107-111"; "FY2008 DOD Authorization", "Currently pursuing authorization through Agriculture Committee", "Safe Drinking Water Act" or "Hatch Act"):* **FY10 DoD Appropriations and Authorization**

**Local Contact** *(Please provide full contact information, including any relevant phone extensions, and indicate if there is a separate D.C. contact.):*

**James Coward, President and Founder**

**Washington Representation: Tom Veltri, Federal Business Group**

**Organization's Main Activities.** *(Please limit your response to 250 words and indicate whether it is a public, private, non-profit or private for-profit entity.)*

SA Photonics has assembled a world-class team of high-speed photonics, optical, electrical and mechanical engineers, who each have over 20 years experience in building complex, ruggedized systems for the military and for commercial industry. We have a long track record of developing

commercial and military products for the aerospace, aeronautical, terrestrial telecom, and semiconductor industries. We have electro-optic systems flying on satellites, cockpit displays in every F/A-18 E/F aircraft and optical switches in commercial telecom networks around the globe.

SA Photonics personnel have designed some of the most advanced laser-based communications systems in the world. Our system designs have been fielded by AT&T and other service providers throughout the world. Our design for a coherent fiber optic communications system could carry 5 Terabits/second of data on a single fiber and was viewed as the most advanced fiber optic communication system in the world.

**Please show main items in the project and total cost in a simplified chart form.** *(Please include the amount of any Federal/State/Local/Private funds, including any in-kind resources.)*

- \$1.5 million to develop the modem hardware and deliver two prototype units
- \$1.5 million to develop the Beam Director optical beam steering hardware and deliver a prototype unit

**Project Description, including a timeline, goals, expected outcomes and specific uses of Federal Funds.** *(Your response must focus on the requested funds rather than the organization's mission and general activities. Please limit your response to 250 – 500 words.)*

The Department of Defense is developing new reconnaissance microsattellites that can be launched very quickly in response to an emerging threat to our nation's interests. Although these microsattellites will gather a large amount of imagery and data, it is currently impossible to get this high-bandwidth reconnaissance data down to the troops in the field, who need it to improve their situational awareness and combat effectiveness. An optical communications system will provide the extremely high data rates necessary for transmitting full-motion, real-time video directly to the warfighter. Existing reconnaissance microsattellites currently gather data at 3 Gbps (Gigabits per second) and will eventually increase to over 100 Gbps. Currently, radio frequency (RF) data links to soldiers are capable of only 1 Mbps (Megabit per second) under most conditions. Even next-generation RF links will only be capable of 10s of Megabits per second. The requirement is to develop an optical receiver that is small, low power and eventually capable of data rates of at least 100 Gbps.

The Satellite Coherent Optical Receiver (SCORE) can meet the data rate requirements of the Air Force Operationally Responsive Space microsattellite program. SCORE will provide linkage not only between microsattellites but also between aircraft, unmanned air vehicles (UAVs), and troops on the ground. SCORE's performance far exceeds that of current optical receivers, which allows it to be smaller, use less power, and transmit at higher data rates. Size and power reduction is critical for integrating high-bandwidth communications into microsattellites, aircraft, UAVs and especially ground troops - where conventional high bandwidth communications systems are too large and consume too much power. SCORE will initially be able to send data at rates of 10 Gigabits per second on a single optical wavelength and can increase to handle data rates greater than 1 Terabit per second by adding additional optical wavelengths (in the same

way that long-haul fiber optic networks add bandwidth and cable TV providers add additional channels to existing cable). This growth potential will assure that SCORE will not only handle the bandwidth required by today's soldiers but also will handle the needs of the next-generation soldier as well.

**How will this earmark serve to expand the capacity of your organization and how will your organization sustain this work beyond the federal funding?** *(Your response must focus on the impact of the requested funds rather than the organization's long-term goals.)*

FY'10 funding will allow SA Photonics to transition SCORE from a research system into a developmental system suitable for inclusion into government programs. This would allow us to grow the capacity of SA Photonics into a manufacturing and assembly company capable of producing SCORE for military and commercial programs. We are already working with prime contractors such as Boeing, Ball Aerospace and BAE systems to integrate SCORE once it is mature. Sales volume of SCORE transceivers could exceed \$40 million per year, which would allow for the sustainment of our efforts to produce SCORE without additional federal funding.

**What is the local significance of this project?**

A production-ready SCORE system will allow for the growth of precision electro-optics manufacturing and assembly jobs in the mid-peninsula. Since there is little of this work currently being done in the 12<sup>th</sup> CD, this would provide not only jobs, but more job diversity within the district.

The underlying technology of SCORE is well suited to the commercial telecom market, which needs extremely high bandwidth to support the newly emerging application of internet based DVD quality video delivery. SA Photonics principals have extensive background in this market segment. A commercial-grade version of SCORE would benefit the district through additional jobs in the area of electro-optics manufacturing and assembly.

**How many residents of the 12<sup>th</sup> CD will benefit from this project?** *(i.e. jobs created, services rendered to, how many people, etc.)*

FY10 funding will create 4-6 new jobs at SA Photonics that will be a mix of senior engineers and recent college graduates from the Bay Area universities. Successful transition into the Responsive Space program will create an additional 30 Bay Area jobs. Migration into aircraft and UAVs will create over 100 jobs. Transition to commercial telecom could lead to an additional 50-100 jobs.

**List any other organizations or state/local elected officials who have expressed support for the project in writing.** *(Please submit copies of support letters along with the proposal.)*

SA Photonics has recently won contracts from AFRL/MDA and DARPA for SCORE related development. The AFRL/MDA contract is to identify key components for a radiation hardened

SCORE system. The DARPA contract is to investigate architectures that maximize power efficiency and bandwidth of the SCORE system.

A key element of the SCORE system is optical beam steering. We are currently under contract with Ball Aerospace to develop a proof of concept system for a very high accuracy optical beam steering system for laser radar systems that will be leveraged into the SCORE system. We have attached a letter of support for our optical beam steering efforts at the end of the form.

Additionally, we have briefed BAE Systems (a large military systems integrator) on the SCORE technology. They have expressed strong interest in our technology, as shown in the attached letter of support.

**Does the organization have any other funding requests for this project?** (*Federal, State, Local or private pending?*) No

**Has the organization previously received Federal funds for this project?** (*Please list any funds received [by fiscal year] and briefly describe how those funds were spent.*)

Congress added \$2.0 million in FY08 and \$1.75 million in FY09. These funds were used to develop the SCORE concept. FY10 funds will be used to transition SCORE so that it may be picked up by an Air Force program. We do not anticipate needing any more Federal funding after FY10.

**Please attach a list of your organization's staff and board members** (*if any*).

**Board of Directors**

James Coward: Chairman of the Board, Founder

Dr. Steve Yee: Secretary, Founder

**Key Management and Technical Area Leads**

James Coward: President, Chief System Architect

Dr. Steve Yee: Chief Scientist

Dr. Michael Browne: Vice President of Product Development, Optical engineering lead

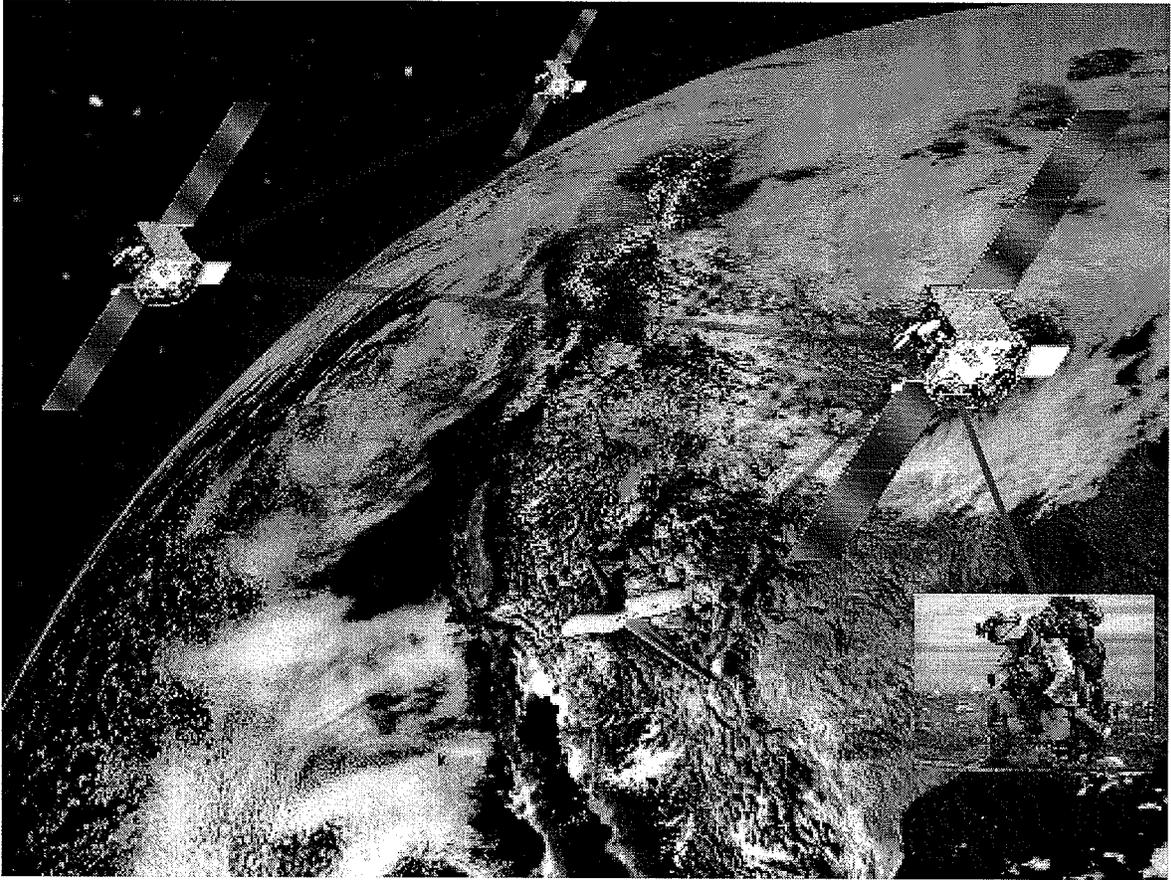
Dr. Ji Li: Analog engineering lead

Dr. William Dickson: Controls System Lead

Roger Bridenstine: Digital electronics lead

Mark Carlson: Opto-mechanical engineering and electronics packaging lead

**Please attach any additional relevant materials.**



**Satellite Coherent Optical Receiver  
(SCORE)**

**Appropriation:** RDT&E, Air Force, PE 0603401F, Line 25 (09), Advanced Spacecraft Technology

Fiscal year 2010 (\$ millions)

Funding Profile	FY09 Funding	FY10 Budget Request	Our Request	HASC	SASC	CONF	HAC	SAC	CONF
SCORE	\$1.75	\$0.0	<b>+\$3.0</b>						

**Issue:** The Department of Defense is developing new reconnaissance microsattellites that can be launched very quickly in response to an emerging threat to our nation's interests. Although these microsattellites will gather a large amount of imagery and data, it is currently impossible to get this high-bandwidth reconnaissance data down to the troops in the field, who need it to improve their situational awareness and combat effectiveness. An optical communications system will provide the extremely high data rates necessary for transmitting full-motion, real-time video directly to the warfighter. Existing reconnaissance microsattellites currently gather data at 3 Gbps (Gigabits per second) and will eventually increase to over 100 Gbps. Currently, radio frequency data links to soldiers are capable of only 1 Mbps (Megabit per second) under most conditions. The requirement is to develop an optical receiver that is small, low power and eventually capable of data rates of at least 100 Gbps.

**Program Description:** The Satellite Coherent Optical Receiver (SCORE) can meet the data rate requirements of the Air Force Operationally Responsive Space microsattellite program. SCORE will provide linkage not only between microsattellites but also between aircraft, unmanned air vehicles (UAVs), and troops on the ground. SCORE's performance far exceeds that of current optical receivers, which allows it to be smaller, use less power, and transmit at higher data rates. Size and power reduction is critical for integrating high-bandwidth communications into microsattellites, aircraft, UAVs and especially ground troops - where conventional high bandwidth communications systems are too large and consume too much power. SCORE will initially be able to send data at rates of 10 Gigabits per second on a single optical wavelength and can increase to handle data rates greater than 1 Terabit per second by adding additional optical wavelengths (in the same way that long-haul fiber optic networks add bandwidth and cable TV providers add additional channels to existing cable). This growth potential will assure that SCORE will not only handle the bandwidth required by today's soldiers, but also the needs of the next-generation soldier as well.

Congress appropriated \$2.0 million in FY08 and \$1.75 million for SCORE in FY09. The Air Force is using these funds to develop the SCORE Laser Modem and Wide Angle BeamDirector Laboratory Units. Additional funding is needed to productize these systems and deliver 2 laser modem prototypes and build one BeamDirector prototype unit to be delivered to the Air Force Research Lab for test and evaluation. Successful testing of these prototypes will allow insertion of SCORE into the Air Force's Responsive Space program.

**Recommendation:** Add \$3.0 million to RDT&E, Air Force, PE 0603401F, Line 25 (09), Advanced Spacecraft Technology, only for the Satellite Coherent Optical Receiver (SCORE) program.



**Ball Aerospace & Technologies Corp.**

10 Longs Peak Dr., Broomfield, CO 80021-2510 (303) 939-4000 FAX (303) 939-5100

Reply to: P.O. Box 5000, Broomfield, CO 80038-5000

9 January 2009

Mr. Kenneth Heeke  
Office of Naval Research, Code 35  
One Liberty Center , 875 North Randolph Street, Suite 1425  
Arlington, VA 22203-1995

**Subject: Letter of Support for SA Photonics SBIR Proposal Topic: N091-087**

Dear Mr. Heeke:

Ball Aerospace & Technologies Corp., acting through its Strategic Business Unit, Systems Engineering Solutions, (Ball) strongly supports SA Photonics proposal to design an advanced fast steering mirror subsystem.

Ball is the pre-eminent supplier of fast steering mirrors (FSMs) for U.S. space and defense applications, having sold more than 500 tactical FSMs on programs supported by every branch of the military as well as the Department of Homeland Security. We have been briefed in detail on SA Photonics photonic sense and control technology. We are very impressed with their capability to achieve micro-radian accuracy on millisecond timescales due to the combination of their photonic angle sensing, digital signal processing, and feed forward control algorithms. We look forward to working in Phase I with SA Photonics to investigate the integration of their sense and control technology with our high performance FSMs for Navy Intelligence, Surveillance, and Reconnaissance (ISR) applications.

Ball recognizes the performance, reliability, and cost benefits of FSMs in defense applications. We are investigating insertion opportunities in tactical programs such as the Army's Future Combat Systems and space based programs such as the Air Force's Transformational Communications Satellite. We view the SA Photonics sense and control technology as a potential enabler for future FSM insertion opportunities.

Based on our meetings with SA Photonics, we believe they adequately understand the challenges of advanced control systems for fast steering mirrors. Their accomplishments demonstrate they have the technical team to execute on this program. If carried to a Phase II effort, Ball anticipates working with SA Photonics in the Phase II and looks forward to testing the resultant prototype in our facilities.

Letter of Support  
9 January 2009  
Page No. 2 of 2

Ball supports the proposed SA Photonics Phase I project. Please contact me if you have any questions of concerns.

Best regards,

Sincerely,

A handwritten signature in black ink, appearing to read "W. Daniel Gibson, Jr.", written in a cursive style.

W. Daniel (Dan) Gibson, Jr.  
Vice President and General Manager  
Systems Engineering Solutions  
Ball Aerospace & Technologies Corp.

BAE Systems  
Electronics & Integrated Solutions  
P.O. Box 868  
Nashua, NH 03061-0868  
Telephone 603-885-7228 Fax 603-885-6833  
Mail Stop NHQ3-2345

**BAE SYSTEMS**

September 22, 2008

Mr. James Coward  
President  
SA Photonics  
650 5th Street, Suite 505  
San Francisco, CA 94107

**Subject: Letter of Support for SA Photonics SBIR Proposal Topic: MDA083-002**

Dear Mr. Coward:

BAE SYSTEMS strongly supports SA Photonics SBIR proposal to develop advanced mirror and pointing systems for missile defense.

BAE SYSTEMS considers your wide field of view fast steering mirror sense and control system to be highly promising for enhancing the performance of EO sensors and payloads for our space and missile defense customers. SA Photonics has already demonstrated outstanding performance on their mirror sense and control system for small FOV mirrors, with better than 20 nanoradians noise equivalent angular resolution and the ability to achieve better than 2 microradian pointing accuracy at 1 ms movement steps, with little mechanical loading of the mirror. We think that demonstrating this mirror system will benefit the Missile Defense Agency's pursuit of fast, accurate tracking systems in support of Ballistic Missile Defense.

Given the eventual successful completion of the SA Photonics effort, BAE SYSTEMS would consider evaluating SA Photonics steering mirror technology using the Advanced Strap Down Seeker Test Bed and evaluating advanced missile defense concepts for terminal, boost and midcourse interceptors.

BAE SYSTEMS strongly supports the funding of this SBIR project.  
Please contact me with questions or concerns.

Best Regards,

Michael D. Evans

Michael D. Evans, DESc  
Program Engineering Manager  
Sensor Systems  
BAE Systems, E&IS

Ph: 603 689-3586  
email: michael1.evans@baesystems.com