D.1 EDUCATION AND PUBLIC OUTREACH PLAN

D.1.1 Overview and Objectives

"Our Sun is the only star proven to grow vegetables." This comment from the HMI PI underscores the importance of the Sun to human society. SDO's study of our star and its effects on Earth provides a singular opportunity to engage the public in scientific exploration and to work with educators to improve the teaching of science, math, and technology. Using public interest in SDO as a "hook," we intend to improve science literacy and public understanding of the Sun's role in the Earth's environment. Our key E/PO goal is to produce and disseminate solar science related information, materials, and activities to aid educators and the general public in understanding the star we live with. Multiple partnerships and student involvement provide leverage to expand the scope and effectiveness of our products. Our ultimate mission is to improve science literacy by inspiring and engaging people's imagination

In Phase A we will work with other SDO instrument teams and with the LWS E/PO program to develop a coordinated program.

D.1.2 Activities

Drawing upon the resources of our existing partnerships, forging new collaborations and jump-starting a program based on proven activities, our multi-faceted, highly leveraged E/PO program will have national impact. With undergraduates trained in the presentation of science materials, we will extend our reach into schools to field-test and assess developed activities. Similar programs have been piloted at Co-I institutes with great success.

The PI and Co-I institutes already have dynamic E/PO programs. These feature the award-winning Yohkoh Public Outreach Project (YPOP), SOLAR Center and TRACE websites[1]; the SOLAR B exhibition at the Chabot Space and Science Center[2]; teacher training workshops and media; science museum partnerships; and a wide range of popular curricula and educational resources that highlight the superb imagery and findings of previous missions. Co-Is routinely visit local schools to present videos, give talks and observing sessions, and distribute materials. Many participate in the Astronomical Society of the Pacific Project ASTRO, a national astronomy education NSF funded program. We have produced and distributed thousands of posters related to the Sun.

We propose to expand this successful work by partnering with Stanford's Haas Center for Public Service[3] and collaborating with science and education institutes. This will produce a dynamic, coordinated, and leveraged program that addresses our broader goals through three specific means:

- **Student Involvement/Service Learning:**

We will integrate university undergraduate students into our E/PO program. The students will work with scientists to develop, field-test, and assess educational materials. Students will also assist the team in developing information and resources for the press and general public. Some students will be involved with data analysis.

- **K-14 Activities and Involvement:**

With educators, we will develop, test, and assess a unified collection of science educational material. The goal is to quickly begin enhancing science literacy to make an immediate impact on classrooms even before mission data become available. Once students and the public are primed on the Sun, they will be more excited by SDO and eager to learn about its findings. Students and scientists will disseminate the material through teacher workshops, master teacher programs, the NSTA, and partnering institutes. Re-

sources supporting the activities will be submitted to NASA CORE for distribution.

- **Public Outreach and Access:**

After launch, we will focus on communicating the research results of the mission to the press and general public. To share the excitement of discovery, we will provide a direct link to the latest data and key scientists. Using our successful SOLAR Center website as a model, we will feature live solar image feeds, daily "solar weather" reports, weekly solar "nuggets", alerts of solar activity, a panel of solar astronomers to field questions on-line, and chat rooms for the public and educators. Existing relationships with the press and science magazines will be nurtured, as new relationships are established, so that the E/PO team will be an appropriate first source of information about solar activity. With the support of our students, we will prepare background materials to support NASA press releases and provide a reference to the general public. We will collaborate with science museums to distribute these materials.

D.1.3 Partnerships

We have existing or newly arranged partnerships with a variety of science and education institutes. These include Chabot Space and Science Center, Oakland, CA; The Tech Museum of Innovation, San Jose, CA; Morrison Planetarium (California Academy of Sciences), San Francisco, CA; Lawrence Hall of Science, Berkeley, CA: the Institute for Imagination and Innovation in Science Education (IIISE – a community college group), Milpitas, CA; the Haas Center, Stanford, CA. (Participation is summarized in table D-1.)

D.1.4 Collaboration with the AIA Team

Our most precious resource is collaboration with enthusiastic individuals who can supply singular and critical expertise to the program. If the LMSAL AIA is selected we will develop a merged program to include AIA components along with the LMSAL HMI role. Participants in the AIA team who are partnered with LMSAL have significant expertise in developing highly successful E/PO programs and materials. Drawing upon AIA's partnerships with students, science museums, and educational institutes we can pool resources to develop programs and materials; broaden our ability to distribute materials; share coordination and management roles; leverage off existing programs; coordinate student programs; and test our educational products in more diverse environments.

D.1.5 Implementation

We will train our involved students through a series of seminars and weeklong summer sessions. The Haas Center and partner institutes will pair the students with elementary, middle, and high schools in the local area to field-test science related materials, assess their value, and adjust the activities accordingly.

LMSAL, Stanford, Montana State University (MSU), and SAO have programs that involve science and technology students with educational and public service institutes. We propose to directly partner with Stanford's Haas Center to leverage our E/PO programs. The Haas Center supports over 40 programs that connect students with outside educational and public service institutions. Haas is nationally recognized as first[4] amongst this type of organization. Working with its partnering institutes, Haas is able to provide selection, training, support, and management of students to work with the science team. Haas will assist development of corporate donations for our competitively selected undergraduate "Science Fellows" stipends. We will work directly with the Haas Center Director, Nadinne Cruz, to develop this model student program that will be exportable to other institutions.

Haas also has a unique program to integrate service learning into the classroom. Haas works with faculty to generate assignments that benefit community institutes or adapt courses to a particular goal such as "Commu-

nicating Science." UC Berkeley has a similar program about which students remark the course "changed their life." Some have gone on to focus on careers in education as a result of participating in the program.[5]

The Haas Center has success with social science service learning and is eager to extend this program to science and technology. Possible service-learning opportunities include a public-oriented online LWS magazine, multimedia presentations of mission results, and generation of educational materials to support press releases. We expect to work with 20-30 students a year in this service-learning model. We will work with Haas and local faculty to develop an effective model program, exportable to a variety of institutes.

D.1.6 Yearly Focus Model

We will focus on developing one major, coordinated educational curriculum or program each year, for the development phase (B-D) of the mission. Educational materials will support the focus; Science Fellows will test the activities in classrooms; teacher workshops through partnering science museums will train in use of materials; webcasts and videos will present the focus activities; and DVDs will allow for use of the material in distance learning. Example projects include:

- Creating a solar-based interactive planetarium program appropriate for use with the Starlab portable planetariums.[6] The need for sun-related programs for Starlab has been recognized as a gap by SECEF.
- Developing a Great Expectations in Math and Science (GEMS) guide on a topic associated with living with an active star.[7]
- Developing a collection of teacher kits and grade-appropriate curricula to accompany our existing low-cost spectroscope.[8]
- Creating activity sets in tracking and understanding the Sun, suitable for a wide age range, school, and family participation.[9]
- Collaborating on coverage of a celestial event such as the transit of Venus or a solar eclipse.

The material and activities will be hands-on, inquiry based, and appropriately aligned to the National Science Education Standards.[10] We will coordinate our program with the interests of the OSS and LWS programs.[11] The basic concept to teach is that the Sun is an active, variable star that has significant impacts upon the Earth. We will draw upon existing resources and materials, presenting them in new and interesting ways and focusing on gaps as identified by the SECEF.

D.1.7 Webcasts

The solar science team at Stanford has already developed a unique webcast series which addresses solar science through a dialog between scientists and students in elementary through high school. Not only do the students learn scientific principles, they get to know the scientists as people and can participate in the show. Supplemental materials, including lesson plans and suggested activities, are available in advance. Viewers can perform the activities, record their results and submit video, data, or student teams for inclusion in the show. Students participate in the discussion through chat rooms. Thus students contribute substantially to the show. For the past two years, with our partner NASA Quest, this team has also hosted Sun-Earth Day webcasts which have been televised on NASA TV.

D.1.8 Evaluation/Assessment

Assessment provides important feedback to both instructors and students. There is an excellent research base in what constitutes effective educational assessment and evaluation[12]. We will rely heavily on this base to guide the development of assessment aspects for our programs. For the educational materials, and model programs, specific goals will be identified and "best practices"-based assessment techniques applied to evaluate the

extent to which goals are being achieved. Stanford's Haas Center has extensive expertise in evaluation and metrics. We will work collaboratively to prepare professional quality evaluation materials and to assess activities, curricula, and model programs.

D.1.9 Involvement

The PI and Co-Is will be closely involved in all aspects of the E/PO program. Scientists will work with educators to develop materials, train Science Fellows, and collaborate on dissemination of the material through teacher workshops and partnering institutes. Each Co-I not directly on the E/PO team will provide 1-4 days of E/PO each year. These will likely be seminars for Science Fellows, teacher workshops, or work on press releases. Scientists will also present the materials at NSTA, AGU, AAS, and similar conferences to reach a larger audience and to share experiences with other scientists.

D.1.10 Underrepresented Groups

Our partnering institutes and we have experience and interest in involving women and minorities in education and research. The San Francisco Bay Area is one of the most ethnically and culturally diverse communities in the nation. The Haas Center has outreach contacts and active programs with minority-based schools. LMSAL supports programs to encourage women to enter scientific professions. Our partner museums have teacher training and master teacher programs that particularly target minority populations. We will actively recruit minorities and women as Science Fellows, where they can serve as excellent role models in our K-14 classrooms. We will particularly focus on liaisons with educational institutes involving minorities and women. We will work with educators to assure our curricula and activities are culturally appropriate to the diversity in our areas.

D.1.11 Organization and Management

Deborah Scherrer, the developer of the Stanford SOLAR Center, will serve as the E/PO Coordinator. We will establish an Oversight Board to direct E/PO planning and development. The Board will be responsible for overall decision-making, choosing the yearly focus, evaluating various possibilities for activities and materials, and for key creative decisions. Most importantly, to encourage frequent contact with and input from scientists, the Board will maintain a steady stream of communication about the E/PO efforts within the science teams and with NASA.

Table D.1 Partnerships

Institution	*Student Involvement*	*K-14 Curr. Devel.*	*Teacher Workshops*	*Assessment Support*	*Multimedia Devel.*	*Distance Learning Support*	*Distribution of Materials*	*Access to Undeserved*	*Public/ infomal ed.*
Stanford	X	X	X	X	X	X	X	X	X
LMSAL	X	X			X		X	X	X
Stanford-Haas	X			X	X			X	X
MSU*	X	X	X	X	X	X	X	X	X
SAO*	X	X	X	X	X	X	X	X	X
The Tech Museum	X		X				X	X	X
Chabot SSC	X		X				X	X	X
Morrison Planetarium /CA Academy of Sciences	X		X				X		X
Lawrence Hall of Science		X	X	X			X	X	
IIISE		X					X		
NASA-CORE							X		

* If AIA is selected.

HMI E/PO BUDGET NOTES

Our proposal and partnerships with Haas, AIA, and the various science museums and educational groups have potential for generating a dynamic and exciting program. However, our proposal for E/PO activities exceeds NASA's guideline for funding. For all of SDO, the 1-2% guideline would be between $3.5 million and $7 million. HMI's 2% would be about $1.4 million, spread over 11 years. The program outlined above is $4.3 million, plus an additional $1.4 million that is cost-shared by Stanford and Haas. We are therefore requesting additional funding, beyond the normal E/PO scope.

According to the answers to official questions about SDO, such funding might come from additional sources rather than being charged against the proposed instrument. If additional funding is not available we will revert to our Descope Plan, below.

Staffing

A program of this scope requires the following staff:

a. 0.75 FTE E/PO Coordinator, Stanford, will be Deborah Scherrer, who will coordinate both HMI and AIA programs and will coordinate with the overarching LWS E/PO programs.
b. 0.2 FTE mission scientist, Stanford, to work directly with the E/PO program, particularly the webcasts. This will be Dr. John Beck.
c. 1 FTE to provide Hass Center student program development and management (first 4 years only)
d. 0.2 FTE for scientific visualization, programming, and web support
e. 1 FTE student support for distributing materials (not needed should NASA or LWS create a distribution program)

The staff is phased in during the initial year. Because we want to begin the E/PO efforts during Phase A, we have arranged for cost-sharing which immediately takes effect. Of the total $5.7 million program, Stanford is willing to cost-share about $1.4 million. They will:

a) Provide .75 FTE to support a Haas assessment and metrics expert (for first 4 years starting immediately after selection).
b) Provide .25 FTE clerical staff support through the Undergraduate Studies division, to assist with the student programs (for first 4 years, starting immediately after selection).
c) Provide support of 1 FTE for Haas student program management, for the initial 6 months of the program. This will allow us to get a student Science Fellow program in place for the first year.
d) Waive overhead on the HMI supported Haas staff person (4 years).
e) Haas will seek funding for the Science Fellow stipends through various charitable trusts (for the full 10 years of the mission). $5K per year per student (uninflated), with 6-8 students the first year and 10-12 each year afterwards.

In addition, scientist Co-Is who are not directly involved in E/PO will donate 1 to 4 days per year of effort. This is to be subsumed into their salaries and not reflected here.

Other Costs

Other E/PO activities and costs include:

a) A contract with Clockworks to produce our webcasts, 12 broadcasts per year for 9

years. (Funding is not included for NASA-TV broadcasts.)
b) NASA Quest production costs for the webcasts. Again, 12 broadcasts per year for 9 years.
c) Subcontracts with LMSAL scientists to directly participate in curricula design and development ($30K for 5 years, $15K for the remainder);
d) Subcontracts with LMSAL to support multimedia production work ($20K for each of 5 years);
e) $11K to purchase a small-sized StarLab for development phase of solar-based planetarium program and use in classrooms; $21K for full-sized StarLab for use in science museum presentations.
f) $10K per year (uninflated) for slides to support the planetarium show, posters, DVDs, training videos, and production of other materials and activities.
g) $50K to support the development of a PASS or GEMS guide.
h) Travel for scientists and E/PO coordinator to present staff-led workshops at major science conferences or conventions.
i) Travel for 3 Science Fellows per year to Montana to train with MSU team. (Not necessary if AIA team not chosen.)
j) Our Science Fellows will also participate in workshops and HMI team meetings. And scientists from the mission will present seminars and training sessions at the meetings. However, these meetings are held locally so no travel is required.
k) Travel funds to coordinate with the LWS E/PO program.

Strategies

Our strategies include:

a) Developing the classroom modules, drawn primarily from the numerous activities now part of OSS curricula or other programs, and when necessary, creating new materials.
b) Piloting and assessing the modules in local grade K-14 classrooms, working primarily with teachers arranged through Haas' networks.
c) Arranging for the publication of all printed and multimedia materials.
d) Disseminating these materials regionally through existing museum partners, educational group partnerships, NSTA and similar conferences, and regular NASA channels.
e) Collaborating with NASA Forum partners to integrate SDO-related themes into the Forum workshops and educational outreach.

Partnership Model

Our model for teacher and master teacher workshops is that the mission will provide one scientist and one Science Fellow, plus all materials, to present the workshop. The partnering museum/institute will provide the space, arrangements, and the teachers. We expect to develop one new workshop each year, for the first 5 years. These can be given through multiple museums (perhaps slightly adapted to their particular focus), with both old and new workshops available during each successive year. Our goal is to provide a minimum of 1 teacher workshop through each partnership per year.

Time-phased Activities

Overall the plan will start quickly in order to prepare materials and train student fellows and teachers early in the mission so they are in place before the flight phase.

Phase A and Bridge Phase

During Phase A we will work out details of coordinating with LWS and jump-starting our E/PO program to have it effectively running

by phase B. A detailed E/PO plan and budget will be prepared, including timelines, staffing, and implementation details. The yearly foci for the first 2 years will be determined.

Phase B

We will implement the first of the yearly foci. After testing by the Science Fellows, we will organize teacher and master teacher workshops through partnering science museums. We will also develop videos and DVDs for use in training and distance learning. Preliminary work on the public website will be started.

Phase C/D

During Phase C/D we will develop and implement the next four coordinated educational curricula, one for each year. Dissemination packages will be developed, for use at professional conferences such as the National Science Teachers Association or the AGU educational sessions. During this phase, we will also further develop our website.

Phase E

During Phase E, we will focus on communicating the research results of the mission to the press and general public. On our website we will feature live solar image feeds, daily "solar weather" reports, weekly solar "nuggets", predictions of solar activity, and so on. We will also provide background materials to support NASA press releases.

Descope Plan:

Should funds beyond 2% of HMI not be available to support our preferred program, we will scale back activities accordingly. At 2% of the HMI budget, we would have available less than $1.4 million, or $125K per year, including indirect, to cover activities for 11 years. This would be a lower level of funding than the present MDI E/PO program. This would decimate the Haas and most of the museum partnerships as well as our ability to hire a nearly full-time E/PO coordinator. The webcasts would be eliminated. We would continue the maintenance of the existing Solar Center website, and perhaps 1 training video per year. The Stanford Haas cost-sharing would be reduced or eliminated. If this option becomes our only choice, we will develop specific plans in the Phase A study.

The E/PO plan is unchanged with or without the vector magnetic field capability.