Dawn Mission E/PO Planning Guide Phase C/D

FY 04 – FY 06

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Dawn E/PO Planning Guide
Phase C/D

Overview of Principles:

Students and the general public should see this mission as a "time-travel" mission where we travel back in time to view solar system material as it existed before planetary formation. When they participate in discovery and share the existing knowledge available to the science community, they will also share in the expectation and anticipation of Dawn's arrival at Vesta and Ceres.

Students in the 7th grade follow the development of the Dawn mission into early adulthood by utilizing our formal, informal, and independent learning tools and activities. When the initial images and data are returned from Vesta and Ceres, a knowledgeable general public can review them with understanding and pride in NASA's accomplishment.

We are very cognizant of the fact that over the duration of our mission, large numbers of students and the general population may come to our website to learn outside of traditional settings. Therefore, we feel that all deliverables should be accessible to formal, informal, and independent learners. All of our materials include teacher/leader guide materials and also independent learner guides. McREL and the Center for Effective Learning have been researching what is known about independent learner guides. Our work here will have significant impact on web-based learning materials.

Identified Educational Components:

- Asteroid Belt
    - Discovery
    - History
    - Relevance
- Ground-based information about asteroids
    - Telescopic Data
    - Photometry
    - Astrometrics
- Role of Meteorites
    - Return samples
    - Composition
- Role of Cratering
    - Surface age
    - Surface excavation
- Role of Light Curves
    - Albedo
    - Rotational period
    - Object shape
- Space exploration
    - Engineering design

Ion Propulsion
Navigation

- Instrumentation
  - Gravitation
  - Composition
  - Surface Features
  - Magnetic Properties

E/PO Management Team Responsibilities:

The Dawn E/PO Management Team will remain the same for phase C/D. The team of L. McFadden (E/PO director and Dawn team scientist), J. Wise (E/PO manager), and McREL has worked very well. Each brings complementary strengths to the team.

L McFadden: E/PO Director, responsible for Dawn E/PO Program
Provides leadership, motivation and direction to the EPO team,
Provides E/PO experience, and knowledge of NASA programs
Maintains contact with Dawn science team
Maintains contact with Orbital Sciences Corp.
Provides science content and review
East coast E/PO representative

J. Wise: E/PO Manager, responsible day-to-day management
Provides focused direction for the E/PO team and contributors
Serves as coordinator for all Dawn E/PO activities
Combines science with innovative curricular ideas
Provides curricular content and review
West coast E/PO representative

McREL (http://www.mcrel.org)**:** John Ristvey, Jacinta Behne,
Responsible for website, content, pilot and field testing, evaluation, dissemination
Provides NASA E/PO experience
Provides insight and networks gained from 35 years of serving the formal and informal education community
Tasked by the US Department of Education to do research in curricular development
Provides expertise in educational standards and classroom practice
Central Region E/PO representative

Dawn's E/PO team determined that for students and the general public to share in the anticipation and excitement of the mission's arrival at Vesta and Ceres, they would need an understanding of the discovery of Vesta and Ceres and the asteroid belt, light curves, cratering, meteorites, ion propulsion, and mission instrumentation. Phase B laid the groundwork for developing materials in these areas.

Deliverables:

In phase C/D of Dawn's E/PO program we continue to develop tools and materials that allow students and the general public to share, with the scientific community, the anticipation and excitement of Dawn's arrival at Vesta and Ceres and the resulting data return.

Maintained:

1. quarterly updates of web site
2. quarterly e-Newsletter
3. FAQ page

Delivered by Launch:

1. A content module on the History of Asteroid discovery up to the time of the Dawn mission
2. A content module on Ion Propulsion (Done in conjunction with JPL's Next Generation Ion Engine (NGIE) mission, Art Hamon, *note: might be done shortly after launch*)
3. The Telescope in Education (TIE) Suite
    a. Imaging Vesta and Ceres
    b. Light Curves of Vesta and Ceres
    c. Asteroid Search
4. Curricular Materials on Meteorites as returned samples using Find a Meteorite
5. Curricular Materials on Cratering that incorporate
    a. Clickworkers (using Mars and Eros images to educate participants about cratering and our expectations for Vesta and Ceres)
    b. Cratering Activity
6. Mission Video in VHS/DVD format with closed captioning
7. Asteroid themed book cover and poster
8. The Dawn Mission Patch Contest
9. A spacecraft rendering for use as mission identifier
10. Speaker's Kit for Solar System Ambassadors
11. A 10% scale model of the spacecraft and a 4% scale model of the spacecraft for use with press releases, displays and mission partners when speaking to the general public
12. Prepare for Launch Conference and "media blitz"

Plan for Development of Deliverables:

A. Design/development
    - E/PO team collaborates to develop a draft of the deliverable. Initial science review by L. McFadden, Educational review by J. Wise, and McREL internal quality assurance, evaluation plan designed by S. Baird Wilkerson.

B. Core Planning Team (CPT) Review
    - The Dawn E/PO has developed a very inexpensive, effective way of getting teacher feedback on materials that are being developed. By using the existing state teacher conferences, the E/PO team is able to present our materials to a large, representative group of teachers without having to pay for travel and housing. The limitation of this plan is that the timing of our CPT reviews is bound by the dates of the various state conferences.

C. Revision
   - Revision is carried out using feedback from the CPT review.
D. Pilot test and science review
   - The pilot test is done with a limited sampling group of students to anticipate the logistical problems that might occur in the classroom setting.
   - At this stage, we initiate the review process required by NASA/JPL and the Dawn Science Team. By initiating the process at this time, we hope to better meet our release date.
E. Revision
   - Revision is carried out using feedback from pilot teachers/students and NASA/JPL/Science Team.
F. Field test
   - This is a much broader test of our materials. Here we utilize McREL's extensive network of school systems across the country. In this way, we are assured of meeting the needs of a diverse student/teacher population.
G. Revision
   - Revision is done based on the feedback from the Field testing
H. Release
   - With approval from NASA/JPL and the Dawn PI, the material is released for public use. I don't think we need approval from NASA/JPL.

Content Modules:

The Content Modules are designed for delivery in formal, informal, and independent learner environments. The Content Module is key to the effective delivery of the formal and informal educational components of the Dawn E/PO. All of the E/PO components are available as stand-alone modules, but they are most effective when linked to a Content Module via hyperlinks and curricular material. The content module is mapped to national standards and forms the framework for placing E/PO activities and tools into formal and informal educational settings.

During phase C/D, we will host a Calibrated Peer Review (CPR) Training for McREL staff and area teachers. CPR modules will be integrated into the content modules and other materials.

We continue to use the five step learning cycle used by McREL for the Genesis mission (see Dawn Guide Phase B pp 9, 10).

The Dawn Learning Cycle

Briefing – Introduces multi-disciplinary modules emphasizing science and technology content.
   - capture student attention and engagement (texts, questions)
   - introduction (build upon prior knowledge)

Exploration – Introduces students to new ideas through activities, links these ideas to students' current understandings, and stimulates new questions that lead to learning. Activities may include reading, hands-on activities, discussions, manipulation of data, or exploration of resources. –

- Information gathering
- 1-3 student activities
- Online searches/journals/texts/interviews
- ion propulsion
- Students recreate the discovery of Ceres and Vesta from images of the plates
  - auxiliary activity: asteroid discoveries using TIE

Student Mission – Outlines module goals for the student. Expectations must be communicated clearly to the student.

Development – Instructs through experiments, observations, or reading and discussion of text. After data is recorded, interpreted, and conclusions are drawn, a relationship between evidence and decision-making is shown. Technical vocabulary may be introduced here. Students may use mathematics and computer tools in their work.

- begin to develop an idea in a context through asking questions
- move explorations findings forward
  1. Construct meaning around prior knowledge, mix with exploration and develop new context
  2. Result: new questions, e.g., Why Vesta and Ceres?

Interaction and Synthesis – Encourages interactions with peers or appropriate resource persons to accomplish a task. This phase of the cycle may include two types of communication:

- Communication Design – students design methods for communicating observations, results, and conclusions to a target audience.
- Debate – Students deliberate and consider opposing points of view. Discussions center on a given proposition regarding the Dawn mission or related science.

Additionally, it is recommended that students maintain a Laboratory Notebook. This can serve as a medium of communication between teacher and students, as well as an item for assessment.

Assessment – Allows students several options to demonstrate what they've learned. The goal is to determine student achievement relative to standards addressed in the module. Assessment items may be selected or constructed by the teacher.

The rough draft of Content Module 1 was completed in Phase B. It involves the history of asteroids up to the Dawn Mission. This Content Module is scheduled for release January 14, 05.

The topic of the second Content Module is the ion propulsion engine scheduled for release near launch or by September 1, 06. This module is done in collaboration with NASA/JPL's Next Generation Ion Engine (NGIE) project. The E/PO of the NGIE project will deliver an animation of an ion propulsion engine. The Dawn E/PO will develop the curricular materials and map them to national standards.

Future Content Modules are planned for planet formation and mission instruments. We have begun discussion of a content module featuring "discovery" that builds on our previous modules and utilizes returned data from our mission.

Action Items/Assignments	Person	Stated Benefits/Outcomes	Identified Measurables	Delivery Date
Content Module 1 CPT Review	McREL	Assures that materials are in line with teacher requirements	Feedback from CPT reviewers	11/28/03 Colorado Teachers Meeting
Content Module 1 Revision	McREL, JW, LM	Assures quality product	Revised Document	12/31/03
Content Module 1 Pilot Test Science Review	McREL NASA/JPL CR, et. al.	Assures classroom adaptability	Feedback from Pilot Test results	4/30/04
Content Module 1 Revision	McREL, JW, LM	Assures quality product	Revised Document	7/30/04
Content Module 1 Field Test	McREL	Assures adaptability to diverse population	Feedback from Field Test results	11/15/04
Content Module 1 Final Revision	McREL, JW, LM	Assures quality product	Revised Document	12/31/04
Content Module 1 Delivered	McREL dissemination		Final Document	1/14/05
Content Module 2 Planning/Development	McREL, JW, LM	Informs about ion propulsion	1st Draft	11/1/04
Content Module 2 CPT Review	McREL	Assures that materials are in line with teacher requirements	Feedback from CPT reviewers	5/31/05
Content Module 2 Revisions	McREL, JW, LM	Assures quality product	Revised Document	9/14/05
Content Module 2 Pilot Test Science Review	McREL NASA/JPL CR, et. al.	Assures classroom adaptability	Feedback from Pilot Test results	12/16/05
Content Module 2 Revisions	McREL, JW, LM	Assures quality product	Revised Document	2/28/06
Content Module 2 Field Test	McREL	Assures adaptability to diverse population	Feedback from Field Test results	5/15/06
Content Module 2 Revise	McREL, JW, LM	Assures quality product	Revised Document	7/31/06
Content Module 2 Delivered	McREL dissemination		Final Document	9/106
Content Module 3 Planning/Development	McREL, JW, LM	Informs about mission instrumentation	1st Draft	7/29/05

Mission Patch Contest:

The Mission Patch Contest has been designed and planned for in phase B. The timing of the contest is set to maximize press exposure for the Dawn Mission Launch. The contest is presented via our webpage, e-news, and a media release. McREL provides:

1. Text that gives the context of the Dawn Mission
2. Criteria for the contest
3. Procedure for submission
4. Awards selection and notification

Judging is done by the E/PO Management Team and volunteers from the Dawn Science Team.

Action Items/Assignments	Person	Stated Benefits/Outcomes	Identified Measurables	Delivery Date
Patch Contest Implementation	McREL:	The Dawn Mission receives press coverage and general public awareness	Number of students participation and the amount of press coverage	6/15/05
Patch Contest Judging	McREL, JW, LM, et. al.	The Dawn Mission receives press coverage and general public awareness	Number of students participation and the amount of press coverage	10/31/05
Patch Contest Awards	McREL	The Dawn Mission receives press coverage and general public awareness	Number of students participation and the amount of press coverage	12/30/05

Asteroid Book Cover/Poster:

The E/PO Management Team determined that a good asteroid poster is needed by both professional scientists and educators. We have therefore decided to produce that poster and an accompanying book cover for school children.

Action Items/Assignments	Person	Stated Benefits/Outcomes	Identified Measurables	Delivery Date
Asteroid Book Cover	McREL, JW, LM	Reference material, draws to the Dawn web page	Number distributed	3/15/04
Asteroid Poster	McREL, JW, LM	Reference material draws to the Dawn web page	Number distributed	11/30/04

Mission Identifier:

Once the spacecraft design is finalized, we will provide the mission a high resolution spacecraft rendering.

We will also provide a 10% scale and a 4% scale models for the mission to be used, at or near launch, for media and publicity opportunities.

Action Items/Assignments	Person	Stated Benefits/Outcomes	Identified Measurables	Delivery Date
Spacecraft rendering	McREL, LM, Orbital	Serves as mission identifier	Educate audiences about the space craft used for this mission.	10/21/05
Spacecraft Models	McREL, LM, Orbital	Media and museum props for mission discussions	Project team will be able to more effectively communicate about the Dawn mission and science to public audiences.	10/29/05

Solar System Ambassadors:

As we approach launch, Dawn's E/PO makes use of the highly successful Solar System Ambassadors Program.

Action Items/Assignments	Person	Stated Benefits/Outcomes	Identified Measurables	Delivery Date
Speakers Kit Assembly	McREL, JW, LM	Material available to all partners to use in their community outreach efforts.	Completion of the kit to include: mission identifier graphics, business card, fact sheet, evaluation materials, templates for PowerPoint presentation.	8/31/05
Speakers Kit Review Revision	McREL, JW, LM	See above	Reports from mission partners on outreach activities and their use of the Speakers Kit.	9/30/05
Solar System Ambassadors Deployed	JPL	JPL ambassadors communicate the excitement of the Dawn mission to their local communities.	Reports from mission partners on outreach activities and their use of the Speakers Kit.	10/29/05

Website:

We decided early in phase B to establish a website based on a database structure. This decision assures that website utilizes the latest in developing website technology. The actual data for the website is maintained at McREL. The website will be the portal to all of the Dawn E/PO materials, and we anticipate regular quarterly updates.

All of our materials include teacher/leader guide materials and also independent learner guides. We are very cognizant of the fact that over the duration of our mission, large numbers of students and the general population may come to our website to learn outside of traditional settings. McREL and The Center for Effective Learning has been researching what is known about independent learner guides. Our work here will have significant impact on web-based learning materials.

Action Items/Assignments	Person	Stated Benefits/Outcomes	Identified Measurables	Delivery Date
Updates as needed, Quarterly Updates minimum	McREL	Provides access to 1. current mission information, 2. curricular materials, 3. archives of eNewsletter, 4. contact Dawn,	Feedback from reviewers and users at conferences and web based surveys	Quarterly 10/1/03 – 9/29/06

Electronic Newsletter:

During phase C/D, we will publish a quarterly e-Newsletter. Teachers, students, and the general public may sign up to receive the newsletter at our website. The Dawn e-Newsletter will be announced in all e-Newsletters currently distributed by McREL and at all conferences and workshops.

Action Items/Assignments	Person	Stated Benefits/Outcomes	Identified Measurables	Delivery Date
Electronic Newsletter	McREL	1. Provides current information on Mission and Mission E/PO activities 2. Draws to web page	Number of subscribers	Quarterly 10/1/03 – 9/29/06

Find a Meteorite (FAM):

The purpose of the FAM activity is to provide information and insight to participants so that they share, to a degree, a scientist's understanding of Vesta and Ceres that is derived from meteoritic samples. It also introduces the role that meteorites play as returned samples.

The FAM component has expanded over phase B. As we worked to develop the web version of H. Newsom's work, it became apparent to us that more interactive components could be developed. Thus, we identified FAM phase 1 and FAM phase 2. FAM 1 will inform participants about how rock formation gives clues to the formation and hence early histories of the bodies of which they are composed. It includes the curricular materials that introduce the ideas of: 1. observation, 2. classification, and 3. analysis and synthesis as promised in Phase B.

Whereas in FAM 1, schools/museums had to purchase materials to fully participate in the activity, FAM 2 updates FAM 1 and introduces animations to enhance the learning experience. Students will be able to "pick up" samples and rotate them as well as make measurements and other animated observations via the web. This should enable independent learners and schools/museums with limited funds to participate more fully in the FAM activity.

Action Items/Assignments	**Person**	**Stated Benefits/Outcomes**	**Identified Measurables**	**Delivery Date**
FAM 1 CPT Review	McREL	Assures that materials are in line with teacher requirements	Feedback from CPT reviewers	4/25/04 Kansas Association of Teachers of Science (KATS) The Association of Science-Technology Centers Incorporated (ASTC)
FAM 1 Revision	McREL, JW, LM	Assures quality product	Revised Document	10/15/04
FAM 1 Pilot Testing Science Review	McREL	Assures classroom adaptability	Feedback from Pilot Test results	6/30/04
FAM 1 Museum Pilot Test	McREL	Assures informal education adaptability	Feedback from Pilot Test results	11/30/04
FAM 1 Revisions	McREL, JW, LM	Assures quality product	Revised Document	12/31/04
FAM 1 Field Test	McREL	Assures adaptability to diverse population	Feedback from Field Test results	4/30/04
FAM 1 Final Revisions	McREL, JW, LM	Assures quality product	Revised Document	1/14/05
FAM 1 Release	McREL		Final Document	1/14/05

FAM 2 Planning	McREL, JW, LM	More interactive experience	Participants are knowledgeable about the role of meteorites as return samples.	7/30/04
FAM 2 Development of animations etc.	McREL, JW, LM	More interactive experience	Participants are knowledgeable about the role of meteorites as return samples.	3/15/05
FAM 2 CPT Review	McREL	Assures that materials are in line with teacher requirements	Feedback from CPT reviewers	5/2/05
FAM 2 Revisions	McREL, JW, LM	Assures quality product	Revised Document	5/31/05
FAM 2 Pilot Test Science Review	McREL	Assures classroom adaptability	Feedback from Pilot Test results	7/29/05
Revisions	McREL, JW, LM	Assures Quality Product	Revised Document	8/31/05
FAM 2 Field Test	McREL	Assures quality product	Feedback from Field Test results	11/18/05
FAM 2 Final Revisions	McREL, JW, LM	Assures quality product	Revised Document	11/21/05
FAM 2 Release	McREL dissemination		Final Document	11/21/05

Telescopes in Education (TIE):

Students, under the direction of J. Wise, have successfully collected images of Vesta from the TIE Chilean telescope and the TIE Mt. Wilson telescope. They have rendered a GIF animation of Vesta and a light curve based on a four hour observation. This work has paved the way for the TIE Suite of activities. This suite of activities includes: 1. Imaging Vesta and Ceres; 2. Determining a light curve for Vesta and Ceres, and 3. Conducting asteroid searches.

Upon release of the TIE Suite, schools will be encouraged to participate in a cyber-community of students interested in ground based research of Vesta and Ceres and asteroids in general noting the difference between the asteroid belt and other asteroids. This is done by means of a monitored list-server. This list-server is maintained at McREL and monitored by B. Duff under the direction of J. Wise.

Independent learners will also be able to participate on-line with participating schools.

Action Items/Assignments	Person	Stated Benefits/Outcomes	Identified Measurables	Delivery Date
TIE: Finding Vesta and Ceres CPT Review	JW	Assures that materials are in line with teacher requirements	Feedback from CPT reviewers	10/15/04
TIE: Light Curves CPT Review	JW	Assures that materials are in line with teacher requirements	Feedback from CPT reviewers	10/15/04
TIE: Find an Asteroid Planning/Development	McREL, JW, LM	Informs about Asteroid discovery and the difference between asteroids and the asteroid belt	1st Draft	9/29/04
TIE: Find an Asteroid CPT Review	JW, McREL	Assures that materials are in line with teacher requirements	Feedback from CPT reviewers	11/5/04
TIE: Find an Asteroid Revision	JW, McREL	Assures quality product	Revised Document	11/30/04
TIE: Find an Asteroid Pilot Test Science Review	McREL, LM NASA/JPL, CR, et. al.	Assures classroom adaptability	Feedback from Pilot Test results	5/3/05
TIE: Find an Asteroid Revision	JW, McREL	Assures quality product	Revised Document	7/15/05
TIE: Find an Asteroid Delivered	McREL dissemination		Final Document	7/15/05

Video:

A video documentary is planned to include mission development, interviews with scientists and technicians, ion propulsion, instrumentation, and the launch. We plan to involve students whenever feasible. We have a group of students in South Central LA who participate in an award winning after school program that encourages students to write, produce, and direct their own video documentaries. We are currently exploring the opportunity of including some of these exceptional students in the video production.

More science reviews are scheduled for this activity than others. Note that science reviews occur at every major step before committing to video. This is to assure that we do not waste time and material.

Action Items/Assignments	Person		Identified Measurables	Delivery Date
Planning and Storyboard	McREL, JW, LM		Document	12/17/04
Science Review	CR, LM et. al.		Feedback from Science Review	12/31/04
Script Draft	McREL, JW, LM		Document	5/2/05
Video Script Science Review	CR, et. al.		Feedback from Science Review	5/16/05
Video collecting assets animation/interviews	McREL		Video clips	5/2/05
Video mix script w/ assets (Draft Video)	McREL		Video (draft)	9/30/05
Video record narration and music	McREL		Sound track	11/1/05
Video mix Narration/Music/Final Graphics	McREL		Sound track	12/14/0/05
Video Science Review	CR, LM et. al.		Feedback from Science Review	12/30/05
Video Navigation Files and Graphics	McREL			1/31/06
Video closed captioning/compression format for VHS-DVD delivery	McREL		Video product	2/1/06

Clickworkers (CW):

The Clickworkers activity is designed to inform students and the general public about the role that surface features, in particular cratering, plays in gathering information about solar system bodies, e.g. Vesta and Ceres. This activity allows participants to share in the expectation and anticipation of the delivery of the first visual mission images from orbit.

The images of Eros were identified and are ready for inclusion into B. Kanefsky's coding of the Clickworkers software. B. Kanefsky's deliverables will be completed in the first year of phase C/D.

The Clickworkers program gives participants the experience of looking at craters on several solar system bodies. We will adapt and utilize the Deep Impact E/PO cratering activity to provide curricular material about the process of cratering within the context of the Clickworkers program. Students and the general public will understand the importance of cratering in determining surface features of Vesta and Ceres.

Action Items/Assignments	Person	Stated Benefits/Outcomes	Identified Measurables	Delivery Date
CW Science of cratering research	LM	Provides scientific information re: information derived from studying craters	Report	3/1/04
Cratering Activity	JW	Provides activities that inform about crater formation	Draft	4/30/04
CW Eros Data on line	BK, LM, McREL, JW	Provides images of craters on an asteroid for comparison purposes	Clickworkers functions using Eros images and Mars images	6/1/04
CW Draft	McREL, JW, LM	Integrates Clickworkers and the Cratering Activity	Draft	9/30/04
CW CPT review	McREL	Assures that materials are in line with teacher requirements	Feedback from CPT reviewers	11/19/04
CW Revisions	McREL, JW, LM	Assures quality product	Revised Document	12/31
CW Pilot Test Science Review	McREL, NASA/JPL, CR, et. al.	Assures classroom adaptability	Feedback from Pilot Test results	4/22/05
CW Revisions	McREL, JW, LM	Assures quality product	Revised Document	8/31/05
CW Field Test	McREL	Assures adaptability to divers population	Feedback from Field Test results	11/18/05
CW revisions	McREL, JW, LM	Assures quality product	Revised Document	2/28/06
CW Release	McREL dissemination		Final Document	2/28/06

Dawn Guide:

The Dawn Guide serves as a running report of the E/PO activities for the Dawn Mission. It provides the philosophical underpinnings for the decisions that are made on a long term and daily basis.
This guide is reviewed by the E/PO Management Team, the Dawn Mission PI, and NASA/JPL E/PO reviewers. Any changes to the Dawn Guide must be approved by all of the participating reviewers or their representatives.

Action Items/Assignments	Person	Stated Benefits/Outcomes	Identified Measurables	Delivery Date
Dawn Guide, Phase E Draft	JW, McREL, LM	States principles and guidelines for the E/PO mission, gives deliverable dates and responsibilities	Document	09/30/05
Dawn Guide Phase E	JW, McREL, LM	States principles and guidelines for the E/PO mission, gives deliverable dates and responsibilities	Final Document	04/03/06

Core Planning Team (CPT):

The structure of the Core Planning Team (CPT) has changed from our preliminary proposal while the function remains the same. Initially, we had structured the CPT to be selected from middle schools, high schools, media, etc. These people were going to meet with us to review materials to make sure that we were serving the needs of the community. This structure carries some hefty costs in travel, stipends, and room/board. After reviewing several options, we decided to utilize the various professional, state and national conferences to involve both formal and informal educators in reviewing our materials. This plan has worked well in phase B and will be continued for phase C/D.

The Core Planning Team reviews are tentatively scheduled. This schedule is intentionally flexible to allow the maximum possible return on our efforts to obtain feedback from professional educators and media personnel.

Deliverable	Venue	Date	Participants
CM 1	Colorado Science Teachers	10/20/03	McREL
CM 1	Maryland Science Teachers	11/19/03	LM
FAM 1	Kansas Association of Teachers of Science	4/22/04	McREL
FAM 1	Association of Science Technology Centers	11/18/04	McREL
CM 2	Colorado Science Teachers	11/12/04	McREL
TIE	California State Teachers Association	10/15/04	JW

Conferences and Workshops:

Conferences and workshops are carefully planned by the Management Team to correspond to conferences McREL is already attending so that leveraging can occur whenever possible.

Conference	Activity	Date	Participants
National Science Teachers Association, National meeting	Conference/Booth/Workshop/Dawn E/PO Management Team Planning meeting	4/2/04	McREL, LM, JW
Utah State Teachers	Conference/Booth	2/6/04	McREL
National Science Teachers Association, Regional meeting	Booth/Workshop	12/3/04	LM, McREL
National Science Teachers Association, National meeting	Conference/Booth/Workshop/Dawn E/PO Management Team Planning meeting	3/31/05	McREL, LM, JW
National Science Teachers Association, National meeting	Conference/Booth/Workshop/Dawn E/PO Management Team Planning meeting	Spring/06	McREL, LM, JW
Launch Conference	TBD	5/10/06	McREL, LM, JW

Appendix A
National Educational Standards Review

Dawn's E/PO team has delivered on its promise to provide standards-based educational materials. Our Content Module #1 addresses the following standards.

Grades 5-8

Science as Inquiry

Understandings about Scientific Inquiry

- Different kinds of questions suggest different kinds of investigations
- Current scientific knowledge and understanding guides scientific investigations
- Mathematics is important in all aspects of scientific inquiry
- Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations
- Scientific explanation emphasizes evidence
- Science advances through legitimate skepticism
- Scientific investigations sometimes result in new ideas for study

Physical Science

Motions and Forces

- The motion of an object can be described by its position, direction of motion and speed. That motion can be measured and represented on a graph.

Transfer of Energy

- Light interacts with matter by reflection. To see an object, light from that object must enter the eye.

Earth and Space Science

Earth in the Solar System

- The Earth is the third planet from the sun in a system that includes the moon, the sun, eight other planets and their moons, and smaller objects such as asteroids and comets.
- Most objects in the solar system are in regular and predictable motion.

Science and Technology

Understandings about science and technology

- Scientific inquiry and technological design have similarities and differences
- Many different people in different cultures have made and continue to make contributions to science and technology
- Science and technology are reciprocal
- Perfectly designed solutions do not exist
- Technological designs have constraints
- Technological solutions have intended benefits and unintended consequences.

Science in Personal and Social Perspectives

Science and Technology In Society

- Science influences society through its knowledge and world view
- Technology influences society through its products and processes
- Science and technology have advanced through contributions of many different people, in different cultures, at different times in history
- Scientists and engineers work in many different settings…
- Science cannot answer all questions and technology cannot solve all human problems or meet all human needs

History and Nature of Science

Science as a Human Endeavor

- Women and men of various social and ethnic backgrounds…engage in the activities of science, engineering and related fields
- Science requires different abilities, depending on such factors as the field of study and type of inquiry

Nature of Science

- Scientists formulate and test their explanations of nature using observation, experiments, and theoretical and mathematical models.
- In areas where active research is being pursued… it is normal for scientists to differ with one another about the interpretation of the evidence
- It is part of scientific inquiry to evaluate the results of scientific investigations, experiments, observations, theoretical models, and the explanations proposed by other scientists

History of Science

- Many individuals have contributed to the traditions of science
- In historical perspective, science has been practiced by different individuals in different cultures
- Tracing the history of science can show how difficult it was for scientific innovators to break through the accepted ideas of their time to reach the conclusions that we currently take for granted

National Standards Addressed in Dawn Phase B Materials:

From *AAAS Benchmarks for Science Literacy*:

Grades 6-8

The Nature of Science

The Scientific World View

- When similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, and it often takes further studies to decide. Even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as correct.
- Scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way.
- Some scientific knowledge is very old and yet is still applicable today.

Scientific Inquiry

- Scientists differ greatly in what phenomena they study and how they go about their work. Although there is no fixed set of steps that all scientists follow, scientific investigations usually involve the collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected evidence.
- What people expect to observe often affects what they actually do observe. Strong beliefs about what should happen in particular circumstances can prevent them from detecting other results. Scientists know about this danger to objectivity and take steps to try and avoid it when designing investigations and examining data. One safeguard is to have different investigators conduct independent studies of the same questions.
- New ideas in science sometimes spring from unexpected findings, and they usually lead to new investigations.

The Scientific Enterprise

- Important contributions to the advancement of science, mathematics, and technology have been made by different kinds of people, in different cultures, at different times.

- No matter who does science and mathematics or invents things, or when or where the do it, the knowledge and technology that result can eventually become available to everyone in the world.
- Scientists are employed by colleges and universities, business and industry, hospitals, and many government agencies. Their places of work include offices, classrooms, laboratories, farms, factories, and natural field settings ranging from space to the ocean floor.
- Computers have become invaluable in science because they speed up and extend people's ability to collect, store, compile, and analyze data, prepare research reports, and share data and ideas with investigators all over the world
- Accurate record-keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society.

The Nature of Mathematics

Patterns and Relationships

- Usually there is no one right way to solve a mathematical problem; different methods have different advantages and disadvantages.

Mathematics, Science, and Technology

- Mathematics has contributed to progress in science and technology for thousands of years and still continues to do so.
- Mathematics is helpful in almost every kind of human endeavor.
- Mathematics has contributed to progress in science and technology for thousands of years and still continues to do so.

The Nature of Technology

Technology and Science

- Technology is essential to science for such purposes as access to outer space and other remote locations, sample collection and treatment, measurement, data collection and storage, computation, and communication of information.

Issues in Technology

- Throughout history, people have carried out impressive technological feats, some of which would be hard to duplicate today even with modern tools. The purposes served by these achievements have sometimes been practical, sometimes ceremonial.
- Technology has strongly influenced the course of history and continues to do so. It is largely responsible for the great revolutions in agriculture, manufacturing, sanitation and medicine, warfare, transportation, information processing, and communications that have radically changed how people live.
- Societies influence what aspects of technology are developed and how these are used. People control technology (as well as science) and are responsible for its effects.

The Physical Setting

The Universe

Grades 3-5

- Telescopes magnify the appearance of some distance objects in the sky, including the moon and the planets…
- Planets change their position against the background of stars.

Grades 6-8

- Large numbers of chunks of rock orbit the sun.

Grades 9-12

- Increasingly sophisticated technology is used to learn about the universe.

- Motion

Grades 6-8

- Light from the sun is made up of a mixture of many different colors of light. Other things that give off or reflect light have a different mix of colors.
- Something can be "seen when light waves emitted or reflected by it enter the eye.
- Human eyes respond to only a narrow range of wavelengths of electromagnetic radiation.
- The Mathematical World
- Symbolic Relationships
- Graphs can show a variety or possible relationships between two variables.
  Shapes
- The graphic display of numbers may help to shown patterns. Such patterns sometimes can be used to make predictions about the phenomena being graphed.

Historical Perspectives
Displacing the Earth from the Center of the Universe

- In the 16th century, a Polish astronomer named Copernicus suggested that all those same motions (described by Ptolemy) could be explained by imagining that the earth was turning around once a day and orbiting around the sun once a year.
- Johannes Kepler, a German astronomer who lived at about the same time as Galileo, showed mathematically that Copernicus' idea of a sun centered system worked well if uniform circular motion was replaced with uneven (but predictable) motion along off-center ellipses.
- Using the newly invented telescope to study the sky, Galileo made many discoveries that supported the ideas of Copernicus…

National Standards Addressed in Dawn Phase B Materials:

From National Council of Teachers of Mathematics, NCTM's *Principles and Standards for School Mathematics*

Grades 6-8

Algebra

Understands patterns, relations, and functions

- Represent, analyze and generalize a variety of patterns with tables, graphs, words and, when possible, symbolic rules.
- Use mathematical models to represent and understand quantitative relationships
- Model and solve contextualized problems using various representations such as graphs, tables, and equations.

Represent and analyze mathematical situations and structures using algebraic symbols

- Use symbolic algebra to represent situations and to solve problems, especially those that involve linear relationships.

Use mathematical models to represent and understand quantitative relationships

- Model and solve contextualized problems using various representations such as graphs, tables, and equations.

Analyze change in various contexts

- Use graphs to analyze the nature of changes in quantities in linear relationships

National Standards Addressed in Dawn Phase B Materials:

From McREL's *Content Knowledge: A Compendium of Standards for K-12 Education*

Grades 6-8

History

Historical Understanding

Understands and knows how to analyze chronological relationships and patterns.

- Knows how to construct and interpret multiple tier timelines.

Grades 6-8

English Language Arts

Uses grammatical and mechanical conventions in written compositions

- Gathers and uses information for research purposes

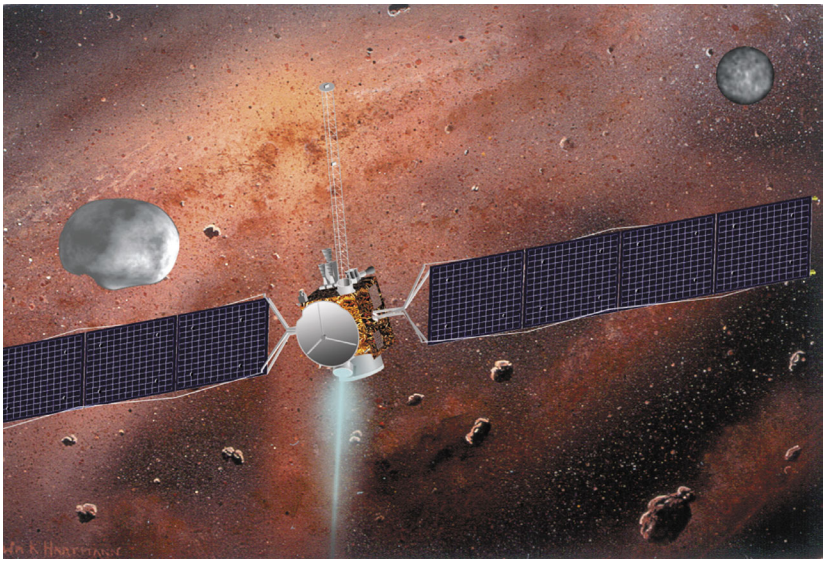
Uses reading skills and strategies to understand and interpret a variety of informational texts

- Summarizes and paraphrases information in texts

Uses listening and speaking strategies for different purposes

- Makes oral presentations to the class

Dawn Mission Education and Public Outreach Evaluation Plan



Submitted to:

Dawn E/PO Team

Submitted by:

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September 17, 2003

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Cover credit: Background painting, "A cocoon nebula, perhaps the primoridal solar nebula" by William K. Hartmann. Courtesy of UCLA.

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INTRODUCTION

As part of its Discovery Program, NASA awarded funding for the Dawn mission in December 2001. Dawn, the first mission to the Main Asteroid Belt, will investigate Ceres and Vesta, two of the largest protoplanets remaining intact since their formations. The mission will address the role of size and water in determining the evolution of the planets by measuring their mass, shape, volume, and spin rate with both imagery, laser altimetry, and gravity. Through this investigation, scientists aim to characterize the conditions and processes of the solar system's earliest epoch.[1] The Dawn mission offers a variety of information and data for the public and educators:

> It [Dawn] brings images of varied landscapes on previously unseen worlds to the public including mountains, canyons, craters, lava flows, polar caps, and, possibly ancient lakebeds, streambeds, and gullies. Students can follow the mission over an entire K-12 experience as the mission is built, cruises to Vesta and Ceres, and returns data.[2]

Dawn begins its trek with a launch in 2006. The craft will travel four years before it reaches Vesta and another three years to reach Ceres with a return targeted for 2015.

The Dawn Education and Public Outreach Initiative

Dawn E/PO consists of a national team of Education and Public Outreach (E/PO) specialists from the University of Maryland, New Roads Schools (CA), and Mid-continent Research for Education and Learning that will develop and disseminate high quality educational resources and materials in support of the Dawn Mission. Dawn E/PO delivers emerging technology and scientific knowledge to the public and to classroom teachers and students. Through the Dawn E/PO Web site, students and the public engage in age-appropriate mission activities, for example, analyzing images for cratering, doing photometry on images to produce light curves, and discussing with mission scientists the importance of Vesta and Ceres to our understanding of solar system origins. Further participation includes searching for meteorites that may contribute to the mission. Dawn E/PO concurrently uses innovative, educational tools to encourage student collaboration, visualization, and peer-review in ways that conform to and further define the national standards in math and science education.[3]

The E/PO effort aims to enhance educator, student and public engagement in space science through the following overarching efforts:

1. Developing products and activities that reflect "best practices" in education (i.e., standards-driven, pedagogically appropriate, and designed to meet the needs of all students, including disadvantaged and underserved).

2. Developing and enhancing practical and technologically efficient systems for reaching, communicating with, and disseminating products and services to educators and the public.

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[1] Dawn: A Journey to the Beginning of the Solar System (2002). The online site for the Dawn mission. Retrieved from the World Wide Web, June 5, 2003, http://www-ssc.igpp.ucla.edu/dawn/.
[2] Dawn Web site: http://www-ssc.igpp.ucla.edu/dawn/
[3] Excerpt from the Dawn Mission E/PO final proposal, July 21, 2000.

3. Leveraging resources and maximizing reach by establishing a broad range of working partnerships between related projects and groups.

Dawn's target audiences include a.) educators (teachers and students, K - Post Secondary); b.) general public members (businesses, parents, politicians, and retired); c.) media journalists (national and local, broadcast, print, trade publications, Internet, instructional TV, radio and public service announcements); d.) informal educators (science museums/centers, arts community, speakers bureaus, youth programs, and service clubs); and e.) disadvantaged and underserved populations.

The Dawn E/PO team employs a strategic outreach approach, developed by Mid-continent Research for Education and Learning (McREL) and proven effective in the Genesis mission outreach, which supports NASA's vision and the Dawn E/PO goals. This approach is based on four components: Delivery, Communication, Education Development, and Evaluation. In conceptualizing its work based on the four components of the outreach model, the E/PO team identified eight, long-term ultimate outcomes, which are supported by 17 intermediate outcomes. Logic models were created to illustrate the activities, intermediate outcomes, data collection methods, and ultimate outcomes for each component (refer to Appendix A). The following lists the eight ultimate outcomes:

Delivery and Communication[4]

1. E/PO efforts reach broad target audiences through high quality products and dissemination mechanisms. Primary contacts share what they learn about the Dawn mission and associated science with their colleagues.

Education Development

2. As a result of the knowledge and skills obtained from Dawn E/PO products and activities, participants have a better understanding of the formation of the solar system.
3. As a result of using Dawn E/PO products and activities, participants are interested in solar-system science.
4. Students will conduct science within a real-life context leading to increased academic achievement.
5. Educators have a better understanding of how to implement inquiry processes leading to improved practices.

Evaluation

6. Dawn E/PO products and services are of high quality and utility because they reflect audience needs.
7. Dawn E/PO can demonstrate the effectiveness of its outreach as evidenced by the impacts of its high quality products and activities.
8. Future mission E/PO efforts will have a blueprint from which to make informed decisions based on extensive documentation of lessons learned from Dawn E/PO.

[4] Although the Delivery and Communication components are separate, they support the same ultimate outcome.

EVALUATION APPROACH

The evaluation emphasizes a collaborative approach to evaluation, which requires the active participation of key stakeholders in the design and implementation of the evaluation work. Throughout the evaluation process the evaluator will consider the multiple perspectives held by various project participants.

Role of Stakeholders

The key stakeholders for this evaluation include Dawn E/PO team members, mission representatives, members of the E/PO Core Planning team[5], and project participants including formal and informal educators. By involving stakeholders in the evaluation process, it is intended that evaluation information will be more relevant and meaningful to them. Stakeholders are expected to contribute to the evaluation by informing the evaluation design, providing access to data sources, maintaining appropriate evaluation records, and participating in data collection and data interpretation.

Role of the Evaluator

A lead McREL evaluator is providing independent evaluation services for the E/PO effort and has the collaborative support of the McREL evaluation team. This evaluator is responsible for developing an evaluation plan, designing data collection instruments, collecting data, managing and analyzing data, and meeting reporting requirements and schedules. Because of the participatory approach to evaluation, the evaluator will engage stakeholders in the evaluation process as appropriate. The evaluator will assess the progress of E/PO efforts; provide relevant, timely and meaningful evaluation information; provide formative feedback to guide project development and implementation; inform project-related decision making as needed; and assess the extent to which activities remain aligned with and work towards realizing project goals. An external evaluator from Inverness Research Associates conducts a quality assurance review of the evaluation plan and design, oversees evaluation implementation, and reviews data interpretation and reporting, as necessary.

METHODS

Quality assurance and evaluation are integral to Dawn E/PO product development and service delivery. Both processes ensure that E/PO products and services are of high quality and utility. External and internal reviewers participate in the quality assurance process and provide critical feedback during both the design and development phases of E/PO work. This process assures that outreach work adheres to high technical and conceptual standards of quality, is designed to meet identified needs, and is appropriate for target audiences.

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[5] The Core Planning Team (CPT) was established in order to review outreach plans, make suggestions for the development of new outreach materials, and provide feedback regarding the perceived utilization of outreach products in a wide range of settings. Team members include representatives from audiences in formal and informal education. Dawn E/PO personnel meet with CPT members during state, regional, and national conferences as well as electronically.

The evaluation design includes both qualitative and quantitative methodologies in order to provide formative and summative information. Formative evaluation information provides feedback to project staff, which is intended to guide project planning and development, and allows for a continuous reflective process throughout project implementation. Summative evaluation information addresses the progress made toward intended outcomes of the outreach effort with a description of how the desired outcomes were realized. Furthermore, logic models are used as a tool for defining and depicting how project activities connect to project intermediate and ultimate outcomes.

Evaluation Matrix

The evaluation matrix displayed in Table 1 delineates the components guiding the evaluation process. There are seven key evaluation questions, which link to E/PO intended project outcomes and are supported by additional evaluation questions, information sources, and data collection methods. For each question, the sources to be used in obtaining information and the data collection methods are identified. The following key evaluation questions focus on impacts of the outreach initiative on the public, teachers, and students, as well as the quality and utility of materials and resources.

1. Do users of the Dawn E/PO materials and resources perceive them to be of high quality and utility?
2. To what extent do teachers and students access and use the Dawn E/PO materials and resources?
3. To what extent do public members access and use the Dawn E/PO materials?
4. Are participating students engaged and interested in the Dawn mission science as a result of using E/PO materials?
5. Do participating students have an increased understanding of the formation of the solar system?
6. To what extent has the Dawn E/PO effort enhanced participating teachers' capacity to teach space science?
7. To what extent has the Dawn E/PO effort affected public interest in and understanding of the Dawn mission?

Information Sources

The evaluator has identified multiple information sources in order to answer the evaluation questions. Data will be collected from on-line users of the Dawn Web site, professional development participants, teachers and students in pilot- and field-test sites, and possibly participants in informal education settings.

Data Collection and Analysis

A variety of data collection methods are planned. In some cases, more than one method will be used to address a given evaluation question in order to strengthen the credibility of the findings. Both qualitative and quantitative data will be collected and analyzed. Evaluation data will include information from project documents, online and paper-based surveys, interviews with project participants, observations during site visits, and student assessments. The field-test component of the evaluation will include a quasi-experimental design with pre- and post-test assessments of

treatment and non-equivalent comparison groups. This design is employed in order to assess the impact of the Dawn E/PO curriculum materials on student learning.

E/PO team members will have the opportunity to review the interpretation of the information that they provide in interviews and project reports. This process (member checking) verifies that the evaluator has not misrepresented nor misunderstood the perspectives and meanings held by project participants. A database will be created to conduct retrieval, coding, and management of the data corpus for both qualitative and quantitative analyses.

Table 1: Evaluation Matrix

Evaluation Questions	Data Sources	Data Methods
Ultimate Outcomes #1 & #6: E/PO efforts reach broad target audiences through high quality products and dissemination mechanisms. Dawn E/PO products and services are of high quality and utility because they reflect audience needs.		
Objective 1: To increase the availability of E/PO products and services related to the Dawn mission.		
1. Do users of the Dawn E/PO materials and resources perceive them to be of high quality and utility? 2. To what extent do teachers and students access and use the Dawn E/PO materials and resources? 3. To what extent do public members access and use the Dawn E/PO materials?	Internal and external reviewers Web site users Workshop participants Teachers Students Public members	Quality assurance process On-line surveys Participant feedback Web statistics Dissemination data
Ultimate Outcomes #2, #3 & #4 [Students]: As a result of the knowledge and skills obtained from Dawn E/PO products and activities, participants have a better understanding of the formation of the solar system. As a result of using Dawn E/PO products and activities, participants are interested in solar-system science. Students will conduct science within a real-life context leading to increased academic achievement.		
Objective 2: To increase student awareness and interest in space science.		
4. Do participating students have an increased understanding of the formation of the solar system? 5. a. Do participating students have an increased understanding of the formation of the solar system? b. Do participating students using Dawn E/PO materials perform better than non-participants? c. Do participating students have an awareness of and interest in space-related careers as a result of the Dawn E/PO materials?	Students in pilot- and field-test sites Students who access online resources	Pre/post student performance data with non-equivalent comparison groups Student survey (print/online) Teacher reports
Ultimate Outcome #1 & #5 [Educators]: Educators have a better understanding of how to implement inquiry processes leading to improved practices. Primary contacts share what they learn about the Dawn mission and associated science with their colleagues.		
Objective 3: To increase teachers' use of hands-on, inquiry-based educational materials related to the Dawn mission.		
6. To what extent has the Dawn E/PO effort enhanced participating teachers' capacity to teach space science?	Teachers in development networks Participants in workshops Teachers accessing Web site resources	Pre/post assessment of capacity Participant evaluations Web-based surveys
Ultimate Outcomes #2 & #3[Public]: As a result of the knowledge and skills obtained from Dawn E/PO products and activities, participants have a better understanding of the formation of the solar system. As a result of using Dawn E/PO products and activities, participants are interested in solar-system science.		
Objective 4: To increase public interest in and understanding of the Dawn mission.		
7. To what extent has the Dawn E/PO effort affected public interest in and understanding of	Public members accessing Web site resources	Web-based surveys

the Dawn mission?		

WORK PLAN

The work plan describes the major evaluation tasks to be undertaken and their schedule. It should be understood that as the project evolves, tasks may be revised and may change as more information becomes available throughout the project period.

Evaluation Tasks

In keeping with the data sources and methods identified in the evaluation matrix (refer to Table 1) four major data collection and reporting activities are planned. In general, information will be collected and synthesized on an ongoing basis in order to provide timely information for project management and to support contract reporting requirements. (See Table 2 for an evaluation schedule of the evaluation tasks.)

Task 1. Communicate with Dawn E/PO Team

The mutual sharing of information is an important component in the participatory nature of the evaluation. The evaluator will meet with Dawn team members in order to share information about project implementation as well as the evaluation process. The evaluator will be responsible for presenting formative feedback to the team as it is appropriate and relevant to enhancing the outreach effort. At times, informal interviews may be conducted with team members in order to thoroughly address the evaluation questions.

Task 2. Develop Instruments and Recruit Participants

Multiple instruments and data management mechanisms will be used throughout the project evaluation. Databases will be maintained in order to document Web site statistics, product dissemination, E/PO staff presentations and publications, and other relevant outreach activities. Online surveys will be developed in order to collect feedback from public and educator audiences who use the Dawn E/PO Web site and online materials. Interview and observation guides will be developed to address questions in the evaluation matrix. The interview and observation protocols will be revised as appropriate to reflect changes in project work and evaluation focus. In addition, logic models will be developed and used to illustrate relationships among project goals and activities. These will be revised accordingly to reflect programmatic changes.

Instruments for pilot-and field-testing will be developed or adapted as appropriate. A literature review will be conducted in order to identify extant assessments that measure student learning of space science knowledge and skills. It is preferable that a battery of assessments be used in order to detect any effects of the Dawn E/PO curriculum materials on students in field-test sites. Additionally, a power analyses from past research on supplemental science materials will be conducted in order to determine expected effect sizes[6] for the Dawn E/PO classroom materials.

[6] Effect sizes are a measure of practical significance and, in this case, will indicate the difference in learning

E/PO team members will identify a small number of classrooms for pilot-testing Dawn E/PO curriculum materials. Sites will most likely be located in southern California and the Denver, Colorado area. Field-test teachers will be identified through existing McREL E/PO development networks, conference and Dawn E/PO Web site announcements, and other recruiting strategies. Control groups for the field testing will be located within the same school or district as treatment groups.

Task 3. Collect and Analyze Data from Multiple Sources

Project plans, task descriptions, e-newsletters, Web site statistics, project materials, and local district documents (from the field-test sites) will be collected and reviewed throughout the outreach process. E/PO team members are responsible for completing, maintaining, and providing access to these internal documents.

With consideration of resource and time allocations, the evaluator will visit a sample of the field-test sites in order to ensure implementation fidelity and to provide data triangulation through classroom observations and teacher interviews. The frequency of site visits may vary according to changing data collection needs during the evaluation process. Data will also be collected from participants who attend conference presentations and professional development trainings. In addition, data from the on-line surveys will be aggregated and reported to E/PO team member to inform product development.

Analyses will be based on evaluation data from project documents, participant interviews, surveys, student assessments, participant feedback forms, and observations from site visits. Analyses of quantitative data will include descriptive and inferential statistics. A process of analytic induction will be used to analyze qualitative data from interviews and observations. A content analysis will be conducted of open-ended responses to survey items. A database will be created to conduct retrieval, coding and management of the data corpus. Both qualitative and quantitative analyses will be conducted, as appropriate.

Task 4. Report on Findings

Reports for the Dawn E/PO initiative will include the evaluation plan, event-specific data reports, and annual evaluation reports. In addition, oral briefings for formative feedback will be shared with team members, as necessary. Reports will be disseminated to E/PO members and project staff, as requested.

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between students who use Dawn E/PO materials and those who do not.

Evaluation Schedule

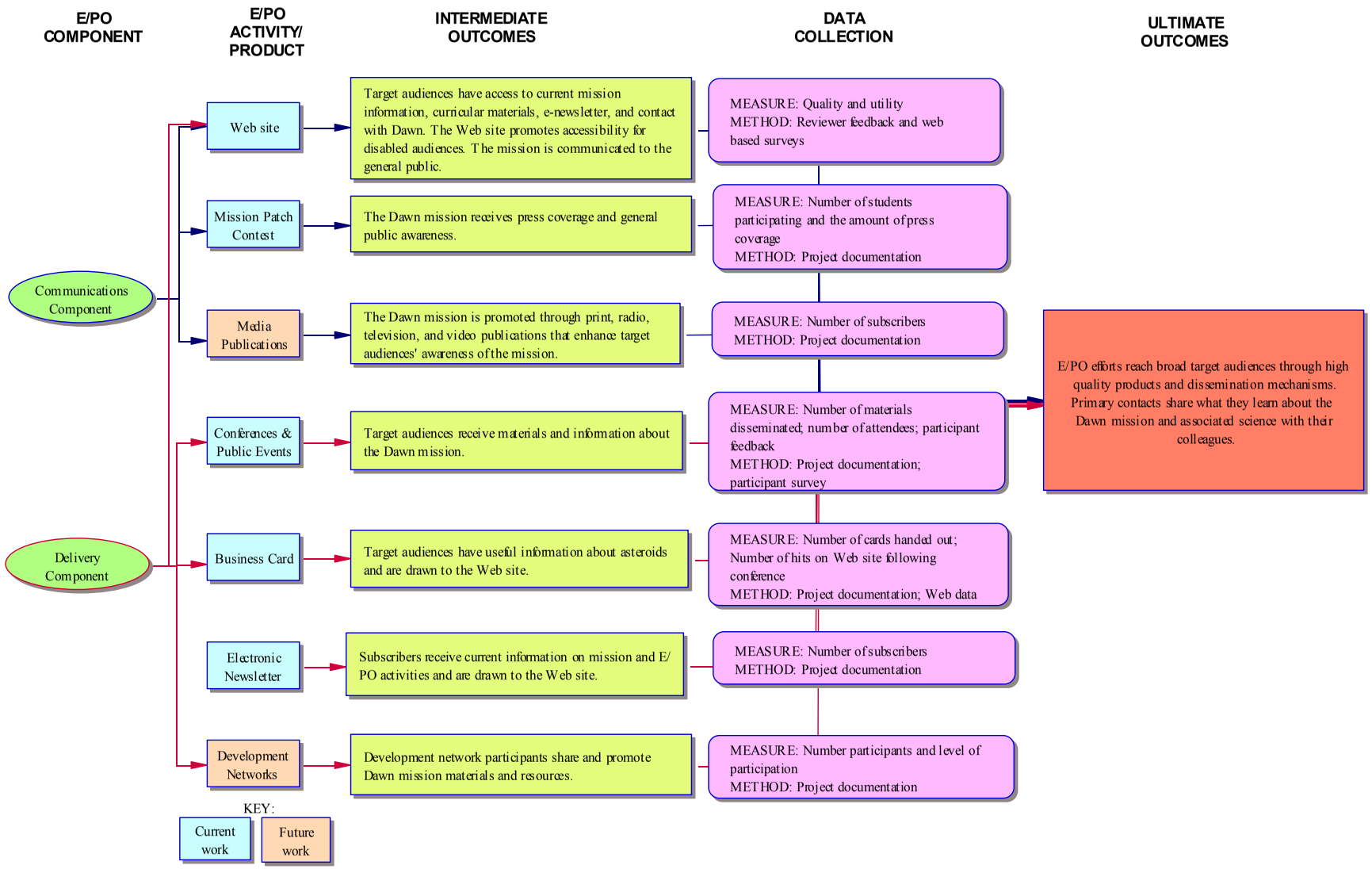
Table 2: Evaluation Schedule

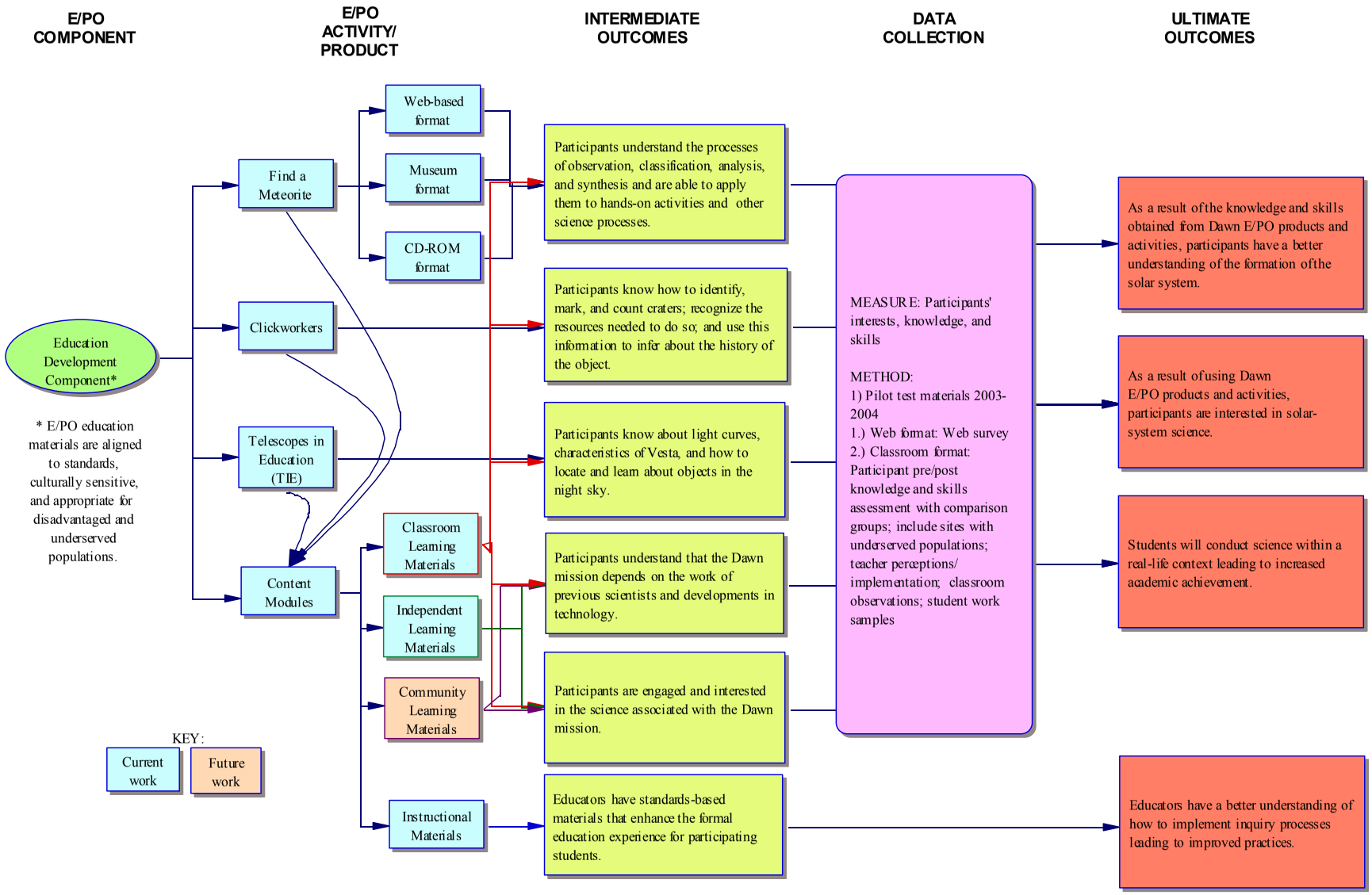
TASK	SCHEDULE	ACTION & RESPONSIBILITY
Task 1. Communicate with Dawn staff		
a. Attend relevant project meetings	Ongoing	The evaluator will meet with Dawn E/PO staff to share information about project implementation and the evaluation process.
b. Distribute evaluation plan	September 2003	
c. Conduct informal interviews with team members	As appropriate	
Task 2. Develop Instruments and Recruit Participants		
a. Conduct literature review & identify assessment instruments	Fall 2003	a.-c. The evaluator will identify, adapt, or develop data collection instruments.
b. Develop and revise Web site evaluation forms	As appropriate	d. The evaluator and project staff will identify & recruit pilot-and field-test participants. Participant consent and Human Subject Review will be conducted as necessary.
c. Develop/modify interest, attitude, and use survey	Fall 2003	
d. Recruit participants for pilot- and field testing	Summer/Fall 2003	e. Interview and observation guides will be developed and revised as appropriate.
e. Develop interview and observation guides	As appropriate	f. Dawn project staff will work with the evaluator to revise program logic models to reflect programmatic changes.
f. Develop and revise logic models	Annually	
Task 3. Collect and Analyze Data from Multiple Sources		
a. Review project documents and materials including the e-newsletter, Web site statistics, project/task plans, and Web site resources.	Ongoing	a. Dawn project staff will provide access to relevant internal documents and user information.

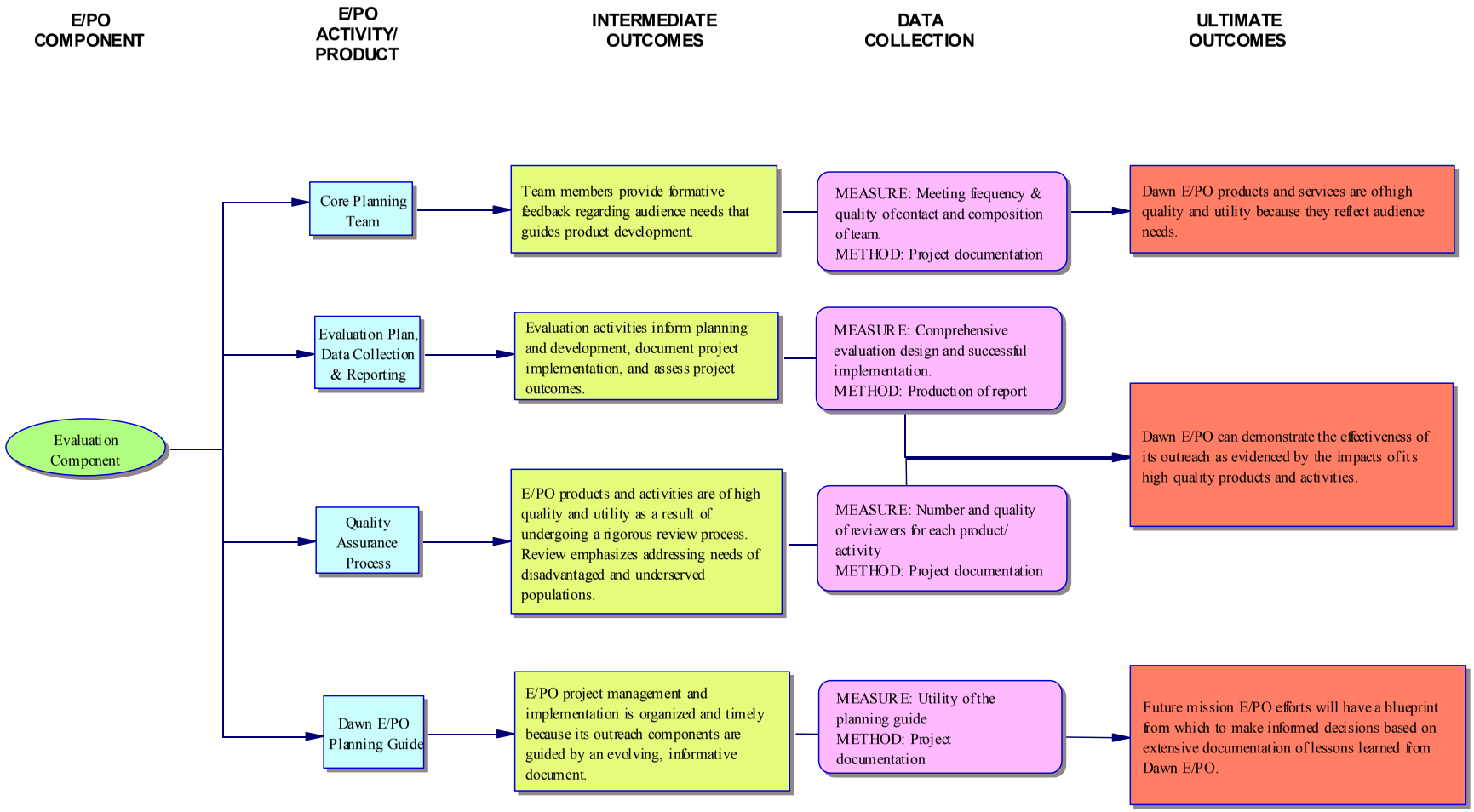
TASK	SCHEDULE	ACTION & RESPONSIBILITY
b. Education development networks i. Pilot testing ii. Field testing c. Professional development participants d. On-line survey data e. Conference presentations and trainings f. Set up database for data management and analysis g. Data entry	2003-2004 2004-2006 As scheduled Quarterly As appropriate Fall 2003, as appropriate As appropriate	b.-e. The evaluator will visit education development networks to make classroom observations, to interview project participants, as necessary, and to better understand the context of project implementation. The evaluator will also interview a sample of teachers participating in the professional development program. Dawn project staff will collect participant feedback. f.-g. The evaluator will synthesize interview and observation data, survey data, assessment data, and document collection information for analysis.
Task 4. Report on Findings		
a. Formative feedback for team members b. Event-specific data reports c. *Evaluation Plan* d. *Annual Evaluation Report*	As appropriate As appropriate September 2003 October, annually	The evaluator will report and disseminate findings as appropriate.

APPENDIX:

Logic Models for Dawn Education and Public Outreach


E/PO COMPONENT
E/PO ACTIVITY/ PRODUCT
INTERMEDIATE OUTCOMES
DATA COLLECTION
ULTIMATE OUTCOMES
Communications Component
Delivery Component
Web site
Mission Patch Contest
Media Publications
Conferences & Public Events
Business Card
Electronic Newsletter
Development Networks
Target audiences have access to current mission information, curricular materials, e-newsletter, and contact with Dawn. The Web site promotes accessibility for disabled audiences. The mission is communicated to the general public.
The Dawn mission receives press coverage and general public awareness.
The Dawn mission is promoted through print, radio, television, and video publications that enhance target audiences' awareness of the mission.
Target audiences receive materials and information about the Dawn mission.
Target audiences have useful information about asteroids and are drawn to the Web site.
Subscribers receive current information on mission and E/PO activities and are drawn to the Web site.
Development network participants share and promote Dawn mission materials and resources.
MEASURE: Quality and utility
METHOD: Reviewer feedback and web based surveys
MEASURE: Number of students participating and the amount of press coverage
METHOD: Project documentation
MEASURE: Number of subscribers
METHOD: Project documentation
MEASURE: Number of materials disseminated; number of attendees; participant feedback
METHOD: Project documentation; participant survey
MEASURE: Number of cards handed out; Number of hits on Web site following conference
METHOD: Project documentation; Web data
MEASURE: Number of subscribers
METHOD: Project documentation
MEASURE: Number participants and level of participation
METHOD: Project documentation
E/PO efforts reach broad target audiences through high quality products and dissemination mechanisms. Primary contacts share what they learn about the Dawn mission and associated science with their colleagues.
KEY:
Current work
Future work


E/PO COMPONENT
E/PO ACTIVITY/ PRODUCT
INTERMEDIATE OUTCOMES
DATA COLLECTION
ULTIMATE OUTCOMES
Education Development Component*
* E/PO education materials are aligned to standards, culturally sensitive, and appropriate for disadvantaged and underserved populations.
Find a Meteorite
Clickworkers
Telescopes in Education (TIE)
Content Modules
Web-based format
Museum format
CD-ROM format
Classroom Learning Materials
Independent Learning Materials
Community Learning Materials
Instructional Materials
Participants understand the processes of observation, classification, analysis, and synthesis and are able to apply them to hands-on activities and other science processes.
Participants know how to identify, mark, and count craters; recognize the resources needed to do so; and use this information to infer about the history of the object.
Participants know about light curves, characteristics of Vesta, and how to locate and learn about objects in the night sky.
Participants understand that the Dawn mission depends on the work of previous scientists and developments in technology.
Participants are engaged and interested in the science associated with the Dawn mission.
Educators have standards-based materials that enhance the formal education experience for participating students.
MEASURE: Participants' interests, knowledge, and skills
METHOD:
1) Pilot test materials 2003-2004
1.) Web format: Web survey
2.) Classroom format: Participant pre/post knowledge and skills assessment with comparison groups; include sites with underserved populations; teacher perceptions/ implementation; classroom observations; student work samples
As a result of the knowledge and skills obtained from Dawn E/PO products and activities, participants have a better understanding of the formation of the solar system.
As a result of using Dawn E/PO products and activities, participants are interested in solar-system science.
Students will conduct science within a real-life context leading to increased academic achievement.
Educators have a better understanding of how to implement inquiry processes leading to improved practices.
KEY:
Current work
Future work


E/PO COMPONENT
E/PO ACTIVITY/ PRODUCT
INTERMEDIATE OUTCOMES
DATA COLLECTION
ULTIMATE OUTCOMES
Evaluation Component
Core Planning Team
Team members provide formative feedback regarding audience needs that guides product development.
MEASURE: Meeting frequency & quality ofcontact and composition of team.
METHOD: Project documentation
Dawn E/PO products and services are ofhigh quality and utility because they reflect audience needs.
Evaluation Plan, Data Collection & Reporting
Evaluation activities inform planning and development, document project implementation, and assess project outcomes.
MEASURE: Comprehensive evaluation design and successful implementation.
METHOD: Production of report
Dawn E/PO can demonstrate the effectiveness of its outreach as evidenced by the impacts ofits high quality products and activities.
Quality Assurance Process
E/PO products and activities are of high quality and utility as a result of undergoing a rigorous review process. Review emphasizes addressing needs of disadvantaged and underserved populations.
MEASURE: Number and quality of reviewers for each product/ activity
METHOD: Project documentation
Dawn E/PO Planning Guide
E/PO project management and implementation is organized and timely because its outreach components are guided by an evolving, informative document.
MEASURE: Utility ofthe planning guide
METHOD: Project documentation
Future mission E/PO efforts will have a blueprint from which to make informed decisions based on extensive documentation of lessons learned from Dawn E/PO.