

Draft Plan for the Science City Adventure

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Plan for the Science City Adventure

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Science City Adventure: Summary

Introduction

The nation is presently facing very serious problems that have their origins in (1) our educational system; (2) our historical and ever-growing reliance upon petroleum and petroleum-derived products that have negatively impacted our economy and our environment; and (3) our tendency to “back fit” environmental considerations into the larger scheme of energy production, supply, and use. While these problems will be addressed via a number of venues, the proposed Science City Adventure is a unique, and most probably, a singular, opportunity to engage and educate teachers, elders, and students – our most valuable intellectual resource. The Science City Adventure will enhance the education of science and technology; provide participants with a systematic perspective on society’s needs; and provide hands-on opportunities for exploring ramifications of alternative choices in addressing energy, health care, transportation, and other technology issues. In addition, the Science City Adventure will address four other of societal trends: (1) an insufficient number of U.S. students, particularly minority students, majoring in science, technology, engineering, and mathematics (STEM) in college; (2) the need for hands-on training of teachers; (3) an increase in the global demand and competition for STEM graduates as a result of technological development in other countries; and (4) the perceived disconnect between science and society.

To address these issues, Science City Adventure would:

- Engage students, educators, and others in exciting, highly motivating areas of science and technology;
- Offer hands-on participation in authentic, laboratory-based research projects from an offsite location;
- Provide career-development opportunities for educators, particularly those teaching middle school and high school math and science courses;
- Increase science literacy, particularly as it relates to the science and technology being developed at Oak Ridge National Laboratory (ORNL) and associated institutions;
- Demonstrate the important role of science in modern life;
- Increase awareness of career opportunities in STEM fields; and
- Encourage students to pursue degrees and careers in critical science and technology fields.



During the past years, discussions about Science City Adventure have been held with state educational institutions, national and international research institutions, local government officials and educators, and an informal advisory group. All groups have been quite enthusiastic about the program and the opportunities that it will provide to the institutions, the participants, and the nation. They also endorse the concept of a small-scale pilot as a first step. We have developed a Strategic Plan and a companion Business Plan that considers the long-term viability and concepts for Science City Adventure (as shown in the Appendices). If implementation move forward in a disciplined manner, then Science City Adventure could be a bridge to future abilities to being able to aggressively address the science and technology needs of society.

To investigate the promises and challenges of a year-round, residential, multidisciplinary Science City Adventure, a pilot project is proposed to

- Begin curriculum development;
- Develop relationships with regional research, educational, and industrial institutions;
- Conduct a logistics run-through via a pilot program; and
- Identify strategies and channels for engaging students who might participate in the Science City Adventure and for informing their families and teachers.
- Evaluate the successes and challenges of the pilot program and identify needs and opportunities of the full-scale program; and
- Have the Director and the Steering Committee engage over the 2 years in fully fleshing out the concept of a big program, its costs, fund raising needs, competition, etc.



ORAU has taken the lead, in developing and implementing the pilot program. The next stage is for Science City Adventure to find its home under another entity or its own NGO. This approach is consistent with ORNL's leadership style in science and technology, whereby it develops new approaches and then passes the proven technology to private institutions.

Phase I Project Description

The phase I project could be a three-day, two-night residential program oriented toward a single scientific or technological theme, such as energy options in today's society. It might occur during the fall break and be intended for 10 to 20 middle school students recommended by their teachers. Participants would receive classroom instruction, take field trips, be organized into problem-solving teams, consider problems presented to them by their instructors, be guided in their deliberations by student mentors, use professional tools for data gathering and analysis, and present and defend their findings about the problems they investigate. Evaluations of the students would be conducted before and after the program. The entire program will be formally evaluated by the Director and Steering Committee after each pilot program leading to a decision for a path forward regarding the full-scale Science City Adventure.

Personnel

The phase I project could be managed by an UT employee (referred to as the Project Manager). A part-time Director would be hired under contract to develop the initial curriculum, run the program, and perform the evaluations. Together with the Project Manager, the Director would develop strategic alliances with area colleges and universities, research institutions, and industries. The Director would make arrangements for housing the students; hiring the staff of teachers, chaperones, and student mentors; taking field trips that complement the curriculum; negotiating transportation; developing an hour-by-hour schedule; producing publicity about the program; and recruiting students. The Director will provide monthly status/progress reports and meet with the steering committee.

The Phase I Project will require a Director, two counselors (teachers or scientists), two chaperones, and two to four student mentors (high school juniors or seniors or college students). The Director and counselors would receive personal-services contracts. The chaperones and student mentors might receive stipends or be volunteers. Additional volunteer services might be needed.

Governance

A Project Manager will oversee all financial transactions (including contracts for professional and personal services) and approve all appropriate expenditures. A Steering Committee will be appointed by the Project Manager with the approval of UT, ORNL, ORAU and/or other led groups management. The members of the Steering Committee will be drawn from the City of Oak Ridge, local teachers and school-system administrators, the State of Tennessee Governor's School, participating research facilities, institutions of higher education, and regional industries. Under the advisement of the Director, the Steering Committee will recommend appointments for all personnel contracted to carry out the phase I project. The Director will report to the Project Manager.

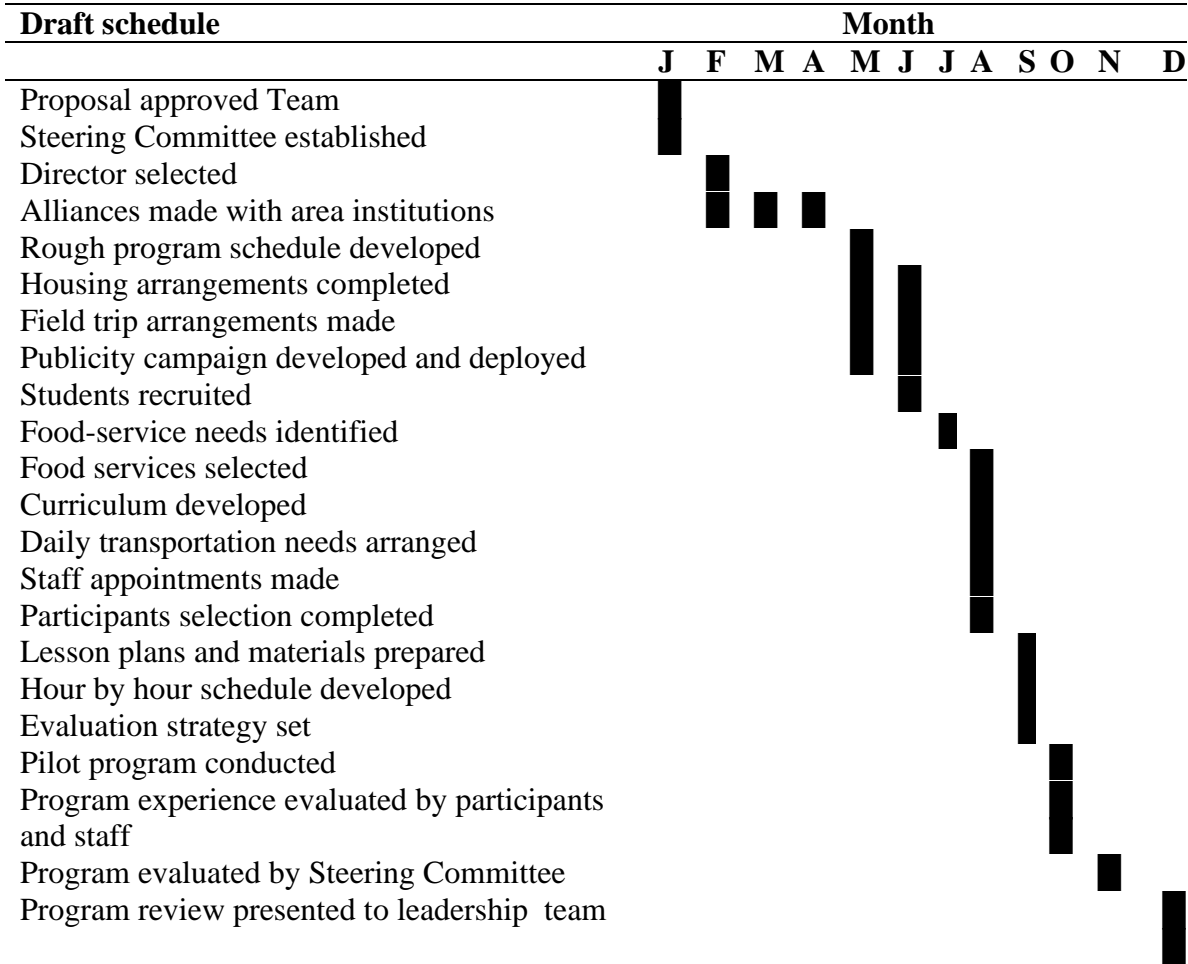
Steering Committee

A Steering Committee for the Phase I Program will be established. The Committee members will serve for two years and will participate in monthly one to two hour meetings that will be chaired by the Project Manager. Committee members will agree to focus on certain subtopics (e.g., budget, personnel management, curriculum development. etc.). For all committee members, it will need to be determined that there is neither conflict of interest nor liability by serving on this committee.



Schedule

All dates are approximate. The Steering Committee should be appointed and start meeting in January. The Director should be named and put under contract by Feb. 1. The Director will submit proposed tasks and milestones to the Project Manager and Steering Committee for their approval. Plans for the program will be set during the spring and summer. The Science City Adventure will be held during fall break. A program evaluation and analysis will be submitted by the Director to the Project Manager. After reviewing the analysis with the Steering Committee, the Project Manager will report to the UT, ORNL, and ORA U Team with a recommendation about the future of the project.



Physical Facilities

Instructional space would be requested of Oak Ridge National Laboratory and the Oak Ridge School System and might be the new building at the UT Arboretum. Lodging for the students and staff would be negotiated by the Director under the guidance of the Steering Committee and might include local schools, churches, and the hospitality industry.



Funding

The Phase I Science City Adventure will be funded via solicitation from other institutions. Tuition will be charged to the students; scholarship aid will be made available on the basis of need. Participation in the Steering Committee will be funded by the members' institutions; no compensation or travel expenses will be provided. Office services (office space, printing, copying, postage, Internet access, e-mail service, and telephone service) will be provided for the Director by sponsoring institutions.

Budget

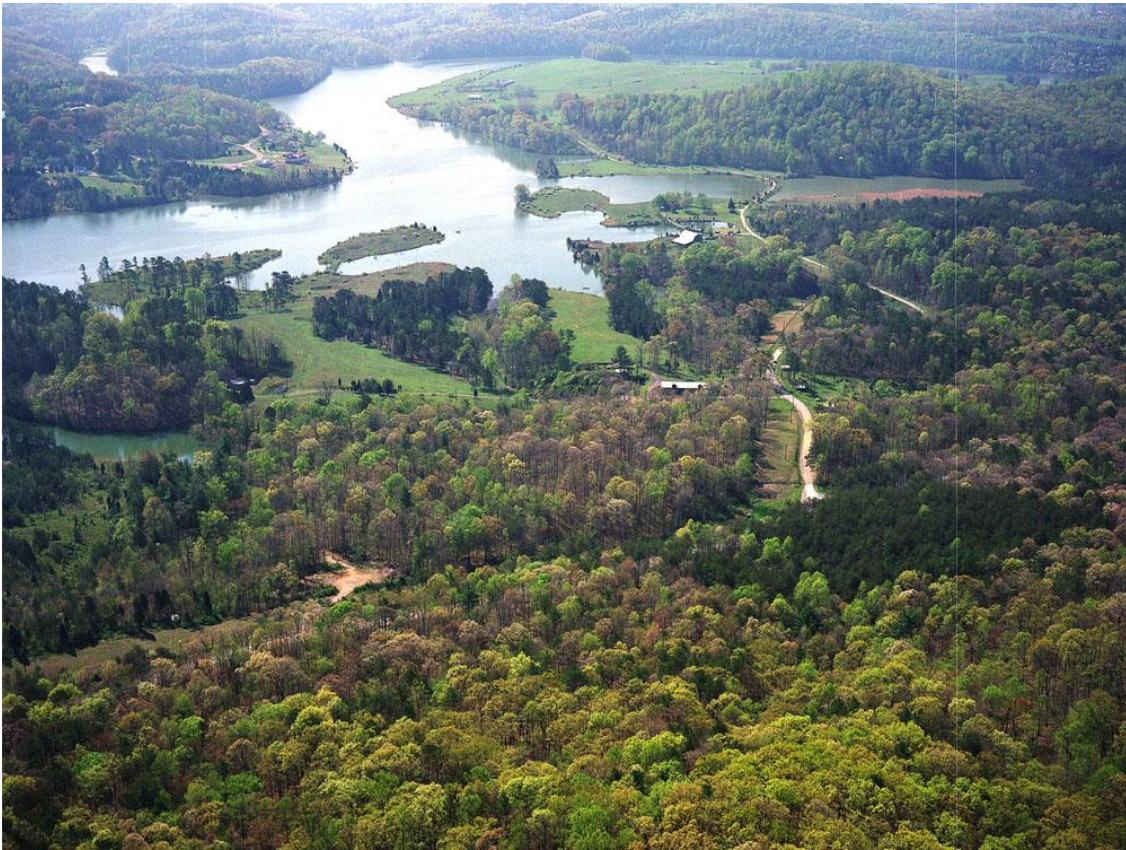
The proposed budget will cover the costs of developing and planning for the three-day pilot program and its evaluation. A final budget will be proposed by the Director and approved by the Steering Committee.

Estimated Science City Adventure Phase I Costs (20 participants for 3 days and 2 nights)		
Personnel	Cost (\$)	Donations
Program Director (part time)	74,000	
Two part-time counselors (10 days)	6,500	
Part time evening counselors or volunteers	500	
Student helpers	500	
Subtotal	81,500	
Direct Participant Support (20 Participants)		
Food* (catered by local businesses)	5,250	
Transportation (field trips)	3,000	
Housing for participants and counselors		√
Janitorial and kitchen services	3,250	
Security for housing	0	
Insurance, liability	5,000	
Lab kits/field equipment	4,000	
Curriculum kits (will be developed)	3,000	
Extras (tee shirts, caps, pens, etc.)	0	√
Subtotal	23,500	
Indirect Participant Support		
Dues and subscriptions	0	
Marketing/advertising/web site development	0	√
Materials and supplies	1,000	
Nurse	0	
Miscellaneous equipment	2000	
Additional insurance required	0	
Subtotal	3,000	
Total start-up expenses	108,000	
Scholarships provided by others (for 5 participants)	<2,000>	√
Income from participants' tuition (\$400*15)	<6,000>	
Total Requirements	100,000	

* 25 people and \$25 each for 2 dinners, \$20 each for 3 lunches, \$20 each for 2 breakfasts, \$20 each for 3 snacks

Transition to Full Implementation of Science City Adventure

The phase I program should lead to new ideas to be tested by the next year's program. Together these two pilot efforts will help direct the full implementation of the Science City Adventure. The Steering Committee will make a recommendation to the ORNL Leadership Team, ORAU, Tennessee universities, and other interested parties as to the schedule, scope, management, and scale of the full implementation. The current vision for the full-scale program is presented in the next section and detailed in the attached appendices.



Strategic Plan for Full Implementation of the Science City Adventure

Introduction

The Vision

Visualize a place where students, educators, and others will come to learn through hands-on involvement in authentic research at ORNL, using advanced technologies. Communication and information technologies will be used along with the physical and environmental resources of the Tennessee Valley Corridor, a region steeped in science and technology and committed to pursuing solutions to energy, national-security, environmental, and other national issues. In a comfortable, indoor-outdoor research environment, participants will engage in creative problem solving as they work directly with nationally recognized scientists. Simulation, visualization, and remote access to laboratory resources will be used as ways for participants to collect data, analyze information, communicate their results, debate findings, and disseminate the results of their research. What's more, when they leave the program, they will continue to have access to the program's resources through Web-based applications and networking systems. The experience will be both personal and motivating. It will increase science literacy and encourage students to pursue degrees and careers in critical science and technology fields.

The primary purpose of the proposed Science City Adventure is to provide a setting for groups of middle and high school students, teachers, Elderhostel participants, and others to engage in intensive, challenging, and enjoyable hands-on science experiences. The programs will introduce the participants to scientific methods for examining real-life problems, to scientists who are looking for solutions to important problems, to the modern technologies they use, to science's contributions to 21st-Century life, to science's need for new practitioners, and to the educational requirements of scientific and technical careers. The programs will include laboratory and field work led by science mentors, visits to ORNL and the UT Arboretum, trips to advance scientific and technical facilities, a platform to contribute to and access scientific data at those laboratories and facilities, analysis of those data in ORAU's classroom of the future, and evaluation of the analyses with other participants and mentors.

Other elements of the Science City Adventure will include

- Science teacher in-service training
- Science teacher career-development programs
- Science teacher research-participation programs
- Middle and high school student introduction to college programs in STEM subjects
- Middle and high school student enrichment programs on advanced topics in science and technology



- Elderhostel participation in using science, technology, engineering and mathematics to formulate solutions to real problems
- Opportunities to use the latest technology advances, facilities, and data

All of these uses will highlight a range of STEM disciplines, from basic fields (mathematics, chemistry, biology, and physics) to multidisciplinary approaches (materials science, medical imaging, environmental science, high-performance computing, visualization, simulation, energy production, transportation, genomics, and nuclear science). Initially, the Science City Adventure will focus on underrepresented students who are not turned on to science via traditional instruction in schools. Engaging these students in authentic hands-on research might motivate them to pursue more science classes and/or STEM majors in college.

Accommodating such a range of topics, audiences, and approaches will build on the expertise of a wide-ranging and disparate network of organizations that have STEM education as a priority. These organizations include, but are but not limited to,

- Oak Ridge National Laboratory
- The University of Tennessee
- The Jason Project
- UT-Battelle
- USDOE Oak Ridge Office
- Middle Tennessee State University (MTSU) STEM Education Center
- East Tennessee Economic Council
- Oak Ridge Associated Universities (ORAU)



The programs will also be enhanced by the help and cooperation of local industries and utilities throughout the Tennessee Valley Corridor (such as those engaged in electricity generation, medical imaging, gas liquefaction, biofuel production, and computational sciences).

Goals and Objectives

The goals of Science City Adventure are to provide participants with hands-on science experiences designed to strengthen STEM education, encourage students to pursue degrees and careers in science and technology, and improve science literacy. These goals will be achieved by working on the following specific objectives:

- Each year a diverse group of 500 participants will take part in a residential program where they will be exposed to science and technology resources at ORNL and elsewhere in the Tennessee Valley Corridor.
- Science educators will develop instructional modules that engage participants in authentic research and involve them in the scientific processes of collecting information, analyzing data, interpreting results, debating their findings, and presenting their results.

- A Web-based networking system will be implemented to enable participants to communicate with one another and to utilize the programs resources and capabilities after they return home and to the classroom
- Entry, exit, and follow-up surveys will be used to assess the impacts the program experiences have on participants.
- Regional and international networks of educators will be created, and those educators will collaborate in programs with their classes and engage increasing numbers of students in the Program's remote, Web-based activities.
- Public/private partnerships will be established to sustain the program and its programs as they grow and become an integral part of the science education programs of the region.

The Need

A number of studies and reports have highlighted the importance of increasing the number of U.S. students pursuing undergraduate and graduate degrees in STEM disciplines. The potential for shortages are of particular concern in critical fields, such as high-performance computing, neutron sciences, accelerator physics, nuclear engineering, material sciences, genomics, and other fields that can be highlighted in Oak Ridge.

Today, science and technology are so complicated and specialized that scientists often find it difficult to communicate with managers who must make a case for funding science and technology to the general public, which must fund much of it through taxes. The situation is even more challenging when one considers communicating scientific endeavors to the junior and senior high school students who are forming images of adulthood and potential careers. Only a small, tenuous interface exists between precollege students and the scientific and technical community. The products of science and technology (cars, cell phones, computers, medicines, iPods, Gore-Tex jackets, Pampers, and Post-it Notes) are mass marketed to a society without any reference to the mathematical algorithms, chemical processes, engineering analyses, or materials science that went into the research and development of the items.

Science City Adventure will provide a look inside of ORNL and other high-technology facilities and provide an interface between today's science and tomorrow's scientific leaders. It will be a bridge between students and scientists so students, their teachers, and others can visit, see, and participate actively in the scientific community. There, they will experience the excitement of what scientists do, take part in the process of scientific discovery, and become interested in making the personal investments of time and energy needed to join the scientific community and to participate in the scientific enterprise.

Key Elements

Mission

Science City Adventure will offer youth, adults, and teachers from across the nation the opportunity to engage in a hands-on scientific experience of how teams use scientific approaches, tools, and technology to solve today's pressing problems and to develop possible approaches to the longer-term issues. The curriculum of the basic year-round Science City Adventure is designed to allow the students to team with scientists and

educators to create and develop strategies to solve current challenges. The focused three-to-six day overnight program will pair teachers and scientists to allow participants to bring diverse scientific, computer, and mathematical tools to bear on issues related to energy, transportation, housing, health care, and climate change. Most activities will be open-ended and interactive.

Management Structure

The staff will include a Science City Adventure Director, a Curriculum Coordinator, and other staff (see Fig. 1), who may include retired scientists and educators. All of the structured activities will be led by scientist-educator teams. A companion web site and other technology outreach tools will allow participants to prepare for the activities of the Science City Adventure and keep engaged after their on-site experience. Participating in this focused experience should foster participants' interest in science and let them see the opportunities to use science for problem solving. This program will educate students and educators in the sciences and build a lifelong appreciation for the sciences.

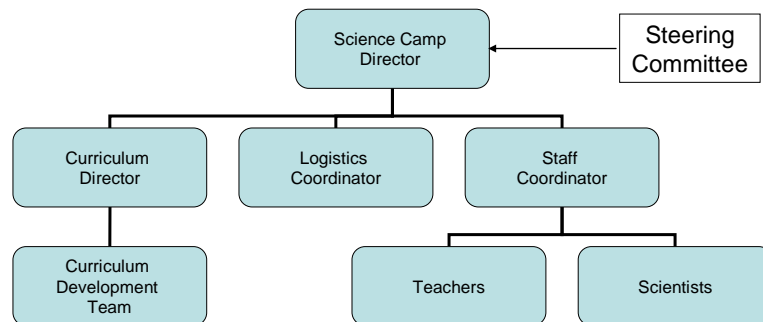


Fig. 1. Organization Chart for the Science City Adventure.

Uniqueness

Hundreds of science opportunities are offered to K-12 students every year. The great majority of these are day programs that address the needs of local students. A few offer a residential experience that can offer a more intensive and extensive immersion experience of science, computers, engineering, or mathematics. Most programs, day and residential, introduce the participants to a limited range of subject matters and enrich the students' understanding of that topic through demonstrations, lectures, field trips, and hands-on learning..

The Science City Adventure will be unique in that it will

- Offer an immersion experience in a broad range of sciences and technologies,
- Expose the participants to world-class science and scientists,
- Emphasize the multidisciplinary and collaborative nature of current-day research and development,
- Explicitly link science and technology with solving societal problems, and
- Engage participants in authentic research problems and in the search for scientific solutions.

Oak Ridge is uniquely situated in the scientific landscape. Its scientific and educational resources can be combined to create and sustain a Science City Adventure that enjoys an unparalleled equal. Its resources include world-class facilities in computing, mathematics, neutron science, nanoscience, materials science, high-temperature materials, transportation, genomics, climatology, environmental management, energy production, electricity transmission, bioenergy, national security, and many more topics. However, the people of the Oak Ridge area are its true treasures. Large numbers of scientists, technicians, administrators, educators, and computer scientists and programmers, both active and retired, are supported by government laboratories, academic institutions, electric utilities, scientific institutes, and private industries. This combination of facilities and personnel make Oak Ridge an unparalleled site for an immersion experience in STEM topics.

In addition, the presence of the USDOE's Oak Ridge Operations Office, which oversees the activities of DOE's Office of Basic Energy Sciences and other offices, offers unique opportunities. The experience of managers could be tapped to explore and understand the system that supports, directs, and funds much of the basic science in the nation. Such expertise could reveal the great breadth of scientific research supported and the complex institutional infrastructure that makes the conduct of that research possible.

One potential location of the Science City Adventure is in conjunction with the UT Arboretum in such a way as to take advantage of the Three Bends Area of the Oak Ridge Reservation on Melton Hill Lake, which provides recreation, water, transportation, and energy for the region. The forests, fields, and waters of the UT Arboretum and Three Bends areas also support

- Real-time monitoring of environmental parameters that feed into global models,
- Experiments on ecological genomics and climate change, and,
- Potentially, a scientific field station.

These locations, then, would put the participants in the midst of several ongoing scientific endeavors.

The Path Forward

Getting Started

Authorization is being sought from ORNL to take step two (phase I for the Science City Adventure) in the five-step process of establishing the program:

1. Refining the strategic plan
2. Holding a pilot program

3. Evaluating actions and needs
4. Developing a business plan
5. Transitioning to full-scale implementation and continuous operation

The plan is that the five steps would be taken in three distinct phases: a start-up pilot program (Phase I), a transition (Phase II), and full implementation (phase III).

Timeline and Milestones

<i>January</i>	<ul style="list-style-type: none"> • Strategic Plan completed and sent to ORNL Leadership Team • Project Manager selected • Steering Committee established and its tasks defined • Job description developed for Science City Adventure Director • Selection process for the Science City Adventure Director defined and initiated • Science City Adventure Director engaged
<i>Spring</i>	<ul style="list-style-type: none"> • Business plan and milestones re-evaluated by Science City Adventure Director and Steering Committee • Phased curriculum plan developed and vetted • Logistics plan for pilot program developed and vetted [to include where program is held, where participants sleep, transportation, role of counselors, safety, equipment and materials needs, insurance (i.e., what, when, how, and where)] • Criteria for participant selection developed • Proposal-development process developed and begun to be implemented (to obtain ongoing financial support); this will require a strong management plan and use of 501(c)3 nonprofit corporate status of a related institution
<i>Summer</i>	<ul style="list-style-type: none"> • 10 to 20 participants recruited and selected for pilot program • Counselors for summer pilot program engaged • Evaluation plan developed
<i>Fall</i>	<ul style="list-style-type: none"> • Pilot program with 10 to 20 participants conducted for about 3 days • Pilot program evaluated by Steering Committee and ORNL Leadership Team
<i>Next year</i>	<ul style="list-style-type: none"> • Business plan revisited • Pilot program planned • Pilot program with 10 to 20 participants conducted for about 3 days • Pilot program evaluated
<i>January next year</i>	<ul style="list-style-type: none"> • Steering Committee makes recommendation for path forward <p>ORNL, UT-Battelle, UT, DOE, Jason and other interested institutions decide on next steps</p>

Reporting Requirements

Monthly progress reports to Steering committee by the Program Director will cover

- Goals and any needed re-evaluation of goals
- Progress toward goals
- Issues and actions to resolve (any guidance needed)
- Financial status (amount spent and projected to be spent)
- Time spent and projected to be spent
- People and support involved and expected to be needed

Quarterly reports to ORNL, DOE-ORO, UT, ORAU, and other stakeholders will contain rolled-up data and information from the monthly reports.

Appendix A

First Draft of a Business Plan for the Science City Adventure

Each section below gives a description of the section in *italics* and the information developed to date in the “**Description**” section. A business plan is always a work-in-progress. Even when successfully established, the Science City Adventure will maintain a current business plan consisting of the following elements.

A.1 Executive Summary

The Executive Summary provides a concise overview of the entire plan along with a history of the Science City Adventure Organization. It includes the mission statement; names, key dates for activities to occur, and job descriptions of employees; location of program facilities; services rendered; banking relationships and information regarding current investors; and summary of company growth and future plans.

A.2 Market Analysis

The market analysis demonstrates knowledge about the business of science programs. This section includes an industry description and outlook, target market information, market test results, lead times, and an evaluation of the competition.

Description

Marketing is the process of creating customers; and because customers are the lifeblood of the Science City Adventure, marketing will be given specific attention. A marketing strategy needs to be developed in partnership with ORNL; ORAU; UT; MTSU; and the visitor bureaus of Oak Ridge, Knoxville, the East Tennessee region, and the State of Tennessee. This marketing will be conducted in coordination with an ongoing self-evaluation process. The Science City Adventure marketing strategy has three components:

- The market-penetration strategy for growing the Program will include an internal strategy as to how to increase the participants and staff, a strategy for enhancing facilities and modifying and expanding the modules, and an external strategy on how to reach out more effectively
- A strategy will be developed for employing channels of distribution for marketing materials.
- The communication strategy will define how the Program will reach teachers, schools, parents, grandparents, and potential participants. It will involve some combination of promotion, advertising, public relations, personal selling, web site, and printed materials, such as brochures, catalogs, flyers, etc. The marketing strategy will largely determine how the program will engage participants.

Specific attention will be given to how the program activities can relate to a school’s curriculum. Ideally, the program experience can relate directly to existing standards. Designing the program as part of the school curriculum will facilitate teacher involvement. In addition, teacher engagement can be enhanced by providing teaching internships for continuing-education units.

A.3 Description of Program as a Business

This section includes a high-level look at how all of the different elements of the Science City Adventure fit together. It includes information about the nature of the Science City Adventure as well as the primary factors that will make the Program a success.

Description

What?

The Science City Adventure will begin as a pilot overnight program for middle schoolers and will develop into an overnight experience that provides a hands-on opportunity for youths (9 to 17 years old), teachers, and Elderhostel participants (people 55+ see <http://www.elderhostel.org/>) to learn about “big science” and the scientific process. The participants will participate in working teams and use advanced technology to develop solutions to, for example, today’s and tomorrow’s energy and resource problems. In the process, participants will learn about the innovative science being conducted at ORNL, The University of Tennessee (UT), and other partners. The Program will build upon and expand the interests in science education of Jason, ORNL, UT, MTSU, UT-Battelle, ORAU, DOE-ORO, and regional schools and museums.

The Science City Adventure will provide a set of learning modules to the teachers, students, and adults. One such module focuses on energy. In that module, participants are asked to design an energy-use and -conservation strategy for the future. Through hands-on experience employing experiments and computer simulations, they will learn about aspects of many forms of energy and the implications of its use. This module will draw on knowledge in the fields of chemistry, mathematics, physics, environmental sciences, social sciences, computer sciences, and engineering. East Tennessee offers the chance for visits to facilities that produce energy via coal, wind, hydroelectric, nuclear, and biofuels. Students can perform experiments that compare economic, social and environmental costs, and benefits of these energy alternatives using chemical, physical, environmental, and mathematical analysis and considering efficiency, availability, reliability, costs, and environmental impacts. Other modules focus on transportation, health care, climate change, and housing alternatives as well as the interrelationships and interactions among these concerns. By engaging in ways that science can be brought to bear on problems, the participants will see how their actions can be part of the solution and thus begin to take ownership of the resolution of such concerns. The experience should thus show that science is not only engaging and enjoyable but also is a way to be empowered to find solutions.

All participants will benefit from participating in a team approach to big science in which they learn how sharing experiences and skills can foster creativity and problem solving. By engaging in the scientific process, the participants will learn how logical step-by-step discovery can be used to address complex problems. Applied science research being conducted by ORNL and UT will allow participants to focus on how new technologies, computers, and equipment can be used to address these concerns. Student participants will especially benefit from their first exposure to such fields as applied mathematics, astronomy, biomedical engineering, environmental science, genomics, robotics, applied

physics, specialized materials, and chemistry. Teachers will be engaged in hands-on activities that they can transfer to their classrooms via computer and web-based technologies. The Program will build from the expertise and past experiences of ORAU in engaging teachers and student in hands-on learning. In addition, the Science City Adventure will engage teaching institutions across the State (e.g., MTSU).

Where?

During the day, the participants will be involved in hands-on activities and field trips. During Phase I, this activity was at ORAU. In Phase II, activities will be staged out of a building located on the Oak Ridge Reservation in close proximity to the area where the field work will be conducted at the Three Bends Area of the Oak Ridge Reservation such as the new building on the UT Arboretum. The establishment of a Science City Adventure building where the participants can meet is a most critical need. The ideal concept is to have a low impact "green" building that houses simple classrooms and labs as well as a 100-person auditorium and a catering kitchen (as described more fully in Appendix C). [A fall-back plan is to move onto the site a temporary structure (possible finding a used structure)].

This building will be for day use only; it could provide a permanent location for program activities, library, computer and basic laboratory access, food service (with tables and a catering kitchen), and bathroom facilities. The building will have a large multipurpose room in which chairs can be set in several styles to enhance its functionality. It is envisioned that when the program is not in session that the building can also be used for small workshops and meetings of the host institutions with key advantages being that (1) the building will be outside the restricted area of ORNL and (2) the building will provide workshop participants a secluded and attractive location for meetings.

The concept is to have an energy-efficient and attractive building (as is described in more detail below). The overall experience will be "green" in the sense that resource conservation and efficiency will be a part of all activities (from recycling to energy-efficient buses being used to transport the participants). Thus, by its own demonstration, the Program will show participants how actions can be a part of the solutions to today's energy concerns.

Participants will spend the night in facilities located in Oak Ridge. Evening excursions to local museums and other sites will provide further insights into how science and technology (1) have instigated advancements in the region and the world and (2) hold the potential for making similar contributions to the future. Safety and well-being for students is foremost, and hence participants will always be accompanied by chaperones and advisors who will work to enhance team learning.

Details regarding sleeping facilities are still to be worked out. In the first stage of the Program, student groups could sleep at one of the public schools, and adults will stay in local hotels. In the long term, it is hoped that a group hotel will be established by a private enterprise and shared with other groups that spend short-time periods in the

region (e.g., rowers, builders of homes for Habitat for Humanity, church groups, etc.). The rowing community in Oak Ridge is already pursuing this option.

The Science City Adventure will be the beginning point of the *Oak Ridge Corridor for Education and Recreation* that wraps around Melton Lake from Three Bends to Inspiration Point. This corridor will begin at Gallaher Bend, already a place for swimming, biking and boating and hunting and where the Program will focus as well. It will include scientific experiments and the historic cabin on Freels Bend, the planned biological field station on Solway Bend, world-class mountain bike trails on Haw Ridge, rowing and other boat activities at Melton Lake Marina, and Inspiration Point. The Corridor will be the symbol of Oak Ridge being a Mecca for science education and outdoor recreation.

When?

Program activities will start at a pilot scale first. Eventually, opportunities for teachers and students (5th to 12th grades) will be established during the summer months, weekends, and other school breaks. Elderhostel participants prefer off- season events, and activities will be targeted for them in the spring and fall when East Tennessee is most attractive. The ideal concept is to have the Program building also be used for small workshops and conferences associated with ORNL, UT, ORAU, and other institutions, and thereby encourage ongoing use of the facility.

How?

In designing curriculum, a key focus will be on the perspectives and skills that are desirable for the participants to acquire. These perspectives and skills include

- The importance of asking the right question rather than coming up with an answer.
- The way the scientific process occurs (e.g., activity science, discovery science, and hypothesis science).
- Specific skills of inquiry (e.g., standardized data collection, designed data sheets, data entry, analysis procedures, interpretation, and presentation of final results).

For a particular curriculum, specific skills will be expected to be acquired, and these skills will need to be specified in the curriculum plan.

Specific steps will be taken to ensure that the participants will take back real results for themselves, their schools, and their community. In addition, the Program experience will be designed so that participants produce final reports and presentations that can be made into posters, brochures, and/or web sites about their project. In addition, it may be possible to produce videos of the participants as they engage in problem exploration and could involve youths' videoing a staff member who, in turn, might send a follow-up letter to the participants' teachers so that teachers are made aware of this material's being available. Such "reentry preparation" will enhance the Program's outreach and effectiveness. The key part of thinking about what the participants takes back is that each person must have ownership in the product.

A plan needs to be developed for how the Science City Adventure will relate to existing educational programs in the region and the nation. As the concept for the Program is being developed, efforts are being made to reach out to educational programs in the region to promote complementarities between the Science City Adventure and ongoing programs.

During a typical day at Science City Adventure, the participants might:

- Have breakfast
- Depart from the lodgings for an onsite visit with a scientist
- Hear about the research that the scientist does, how he or she does it, what data are obtained, how the data are analyzed, and how the results of the research are used
- Tour the research facility
- Gather data produced by an experiment being run at the facility
- Participate in a Q&A session with the host scientist
- Have a box lunch
- Return to the classroom
- Divide into teams
- Analyze the data on a team basis
- Present the results of the teams' analyses to the teachers, the host scientist, and each other
- Critique the analyses, noting commonalities and differences
- Have supper
- Depart for evening activity
- Return to the lodgings and prepare for lights out

Who?

The Science City Adventure provides an opportunity for middle and high school students, teachers, and Elderhostel participants from the region and nation to engage in hands-on team science activities that let them learn about big science at ORNL, UT, and other partners; to expand their horizons; and to learn how to work in a team to devise strategies. The Science City Adventure will be a regional and national resource, something like Space Camp at Huntsville.

Science City Adventure staff will include a full-time director and retired ORNL and UT scientists who will work part time with teachers to be designers of and facilitators for the activities. This approach emulates the Appalachian Regional Commission (ARC)/Oak Ridge National Laboratory (ORNL) Math-Science-Technology Institute. In addition, scientists at ORNL and UT who are engaged in relevant big science being covered at the Program will share their expertise.

Implementing and carrying out the Science City Adventure will involve several partners. ORAU is particularly interested in ideas on how the curriculum can be developed under ORAU programs working with teachers and retired scientists from ORNL, UT, and TVA. UT, MTSU, and other teaching institutions can assist in designing curricula so that serving as Science City Adventure staff can be a practicum for student teachers.

A.4 Organization and Management

This section includes the Program's organizational structure, details about the ownership of the Program, profiles of the management team, and the qualifications of the board of directors. As the program moves to full implementation, it will also adopt the organization chart shown in Figure 1.

Description

A critical first step of this plan is to establish a Science City Adventure Director who will oversee the design and implementation of the Science City Adventure. That Director, an ORNL subcontractor, will develop a business plan, project management plan, budget, and financial plans and controls. That Director will also develop an organization plan for management; selecting facilitators and science leaders; designing curriculum; establishing criteria for selecting participants; designing marketing and publicity plans; and implementing a plan for monitoring the Program's execution and effectiveness.

During the startup period, the Steering Committee will meet monthly to oversee key steps of the Strategic Plan implementation. As the Science City Adventure expands to a national, year-round operation, this Steering Committee will be replaced by a Board of Directors. The Steering Committee will include members from ORNL, ORAU, and UT, including teachers, scientists, and administrators.

There are three phases to the development of the Science City Adventure. In all phases, extensive evaluation by participants, staff, Director, and Steering Committee/Board will be used to determine if the Program is on target and to provide information for ways to keep it on track.

Phase I

This phase was largely being a pilot of the basic components of the Science City Adventure experience. The energy module was the focus.

. The participants were in middle school and attended for a week. Participants meet at ORAU. They also did field work in the Oak Ridge vicinity to assess how different power options might affect the environment. Participants went on field trips to and consider effects of wind, energy.

Phase II

A growth phase will occur during years 3 to 10. A The important keys to success for the Science City Adventure during this phase include:

- Engaging a Science City Adventure Director for the Program, thereby providing programming and fund raising 12 months of the year.
- Providing participants with research and technology skills that can open doors to future employment opportunities.

An outside group will be asked to conduct a formal evaluation as to how well Science City Adventure is meeting its goals. Based on that response, additional modules will be developed, the number and age of participants will be expanded (adding an Elderhostel component and summer sessions), and facilities will be constructed (an Science City Adventure building should be completed). In addition, the concept of a privately owned

group hotel in Oak Ridge that could house participants in addition to rowing teams, workers for Habitat for Humanity, and church groups will be explored. The important keys to success for the Science City Adventure during this phase include:

- Expanding the donor/corporate partner base and corporate contributions that add to the financial resources of the Program
- Securing grants

Phase III

During the subsequent stabilization phase, an outside group will be asked to conduct a formal evaluation of Science City Adventure. A decision will be made by the Board of Directors as to the appropriate size and scope of the Program. This decision will be based on a re-evaluation of the need, how well that need is being met, and the success of the business plan. The important keys to success for the Program during this phase include:

- Cultivating an identity (brand) for the Science City Adventure
- Expanding the student base to include high school students as well as middle school students
- Acquiring the necessary equipment to support future growth and offer greater flexibility, leading to expanded services offered, such as professional development for teachers

A.5 Management and Sales Strategy

Marketing is the process of establishing participants and financial supporters, who are the lifeblood of the Program. This section defines the marketing strategy as part of an ongoing self-evaluation process and unique to the Science City Adventure. The overall marketing strategy includes a

- *Market-penetration strategy.*
- *Strategy for growing the business. This growth strategy should include an internal strategy, such as how to increase your human resources; an acquisition strategy, such as buying another business; a horizontal strategy, where you would provide the same type of products to different users; or a vertical strategy, whereby the Program will continue providing similar products but would offer them at different levels of education and ages, such as Elderhostel participants.*
- *Channels-of-distribution strategy.*
- *Communication strategy. How are you going to reach new participants, potential donors, and other stakeholders? Clearly a combination of the following works the best: promotions, advertising, public relations, personal selling, and print materials, such as brochures, catalogs, flyers, and web-based products.*

Description

Market Analysis Summary

During Phase I, Science City Adventure will address junior high school students and teachers in the East Tennessee market. During Phase II, it will expand its focus to include the entire Tennessee market and then scale up to a national level. As soon as possible, the Program will reach out to Elderhostel participants (ages 55 and older). The Program will

particularly focus on under-represented participants who have not had opportunities to engage in scientific endeavors.

Market Segmentation

Using a broad definition of our market, every family with middle school and high school aged students is a potential consumer of the programs and services offered. Simply stated, there are literally millions of households that meet this market definition. The target market is families with children ages 17 and under. Our core market is families with children between the ages of 10 and 18 and people older than 55.

To establish a foothold within this market and create brand awareness for the unique and high-quality programs being offered, the initial marketing efforts need to be focused on a smaller market segment, the school-aged students. The initial marketing effort will extend through the first 12 months of full-scale operation and target a market segment close to the Science City Adventure's location. By any measure, this remains a richly populated market representing >135,000 children between the ages of 5 and 19 (2006 U.S. Census data for a 25-mile radius around Oak Ridge).

The initial efforts will leverage strong ties with the local community, local research laboratory facilities, and educational institutions. To drive awareness, the support received from local institutions will be supplemented with a sweeping outreach program, focused direct-mail campaigns, and media placement. Oak Ridge is a stable area with a history of supporting family-oriented programs offered both locally and throughout the greater metropolitan area. Once established, the market will be expanded with the same techniques, but scaled to reach a much broader audience.

A.6 Service Provided

This section describes the service provided by the Science City Adventure, emphasizing the benefits to potential and current participants. It focuses on the demographic groups in which there is a clear need for science education as well as those in which there is a clear interest. It also identifies the gap in educational programs for which the Science City Adventure provides a benefit. This section gives the reader hard evidence that people are, or will be, willing to pay for the Program. It details the availability of the Program and costs.

Description

The Oak Ridge region will benefit economically because participants will initially stay in commercial or public facilities in the community. Participants will be bused to the work site. (Adults will stay in hotels and for the first phase, at least; children will stay at one of the public schools, as is happening now with other groups that visit the community.) The economic contribution to the city will be akin to that of the rowers who come to Oak Ridge and spend money there.

A benefit to ORNL and UT will be that the public can then come to a place outside the security area to learn about the kind of science that is occurring at these institutions. The plan is that Science City Adventure will benefit all groups in the region and State that

share an interest in science education [e.g., the Department of Energy, the American Museum of Science and Energy, the Children Museum of Oak Ridge, Ijams Nature Center, the Museum of Appalachia, ORAU, the National Environmental Observation Network (NEON) of East Tennessee, The Nature Conservancy of Tennessee, Tennessee Wildlife and Resources Agency (TWRA), Tennessee Department of Environment and Conservation, Highlands, MTSU, Pellissippi State College, Roane State Community College, the UT Arboretum, and schools in the region].

Science City Adventure will provide an enjoyable and engaging hands-on learning experience that will enhance interest in science. This interest should result in more students in the East Tennessee region taking challenging science courses in high school and college. By attending, students will be challenged and encouraged to pursue careers in science, mathematics, engineering, and/or technology; and teachers will be provided opportunities to strengthen their scientific and content knowledge in their subject areas.

A.7 Funding Plan

This section provides information about the amount of funding needed to start and expand the Science City Adventure. It includes the current funding requirement, future funding requirements over the next five years, how the funds received will be used, and any long-range financial strategies that would impact the funding request.

Description

The Science City Adventure may operate under the auspices of ORAU, which is incorporated as a not-for-profit corporation in the State of Tennessee and is exempt from federal income tax under Section 501(c)(3) of the Internal Revenue Service Code. As a result, all donations to the Science City Adventure will be tax deductible. In addition, by establishing the Program as a private entity, Program funds will be allowed to pay for the time of ORNL staff scientists.

It is estimated that approximately 25% of the Program's annual revenue will be generated by a combination of donations, admissions, and fund-raising activities. The remainder of the funding will come from:

- Proposal-driven grants from foundations
- The solicitation of individuals, corporations, and small businesses
- An annual, large-scale fund-raising event
- A variety of small-scale fund-raising activities

To develop sustainable sources of funding for the Science City Adventure, detailed business and management plans will need to be developed.

The budget and work plan will need to be developed and reviewed annually by the Science City Adventure Director and Board of Directors to ensure that the program is appropriately targeting its audience, addressing its goals, and focusing its assets. A key responsibility of the Science City Adventure Director and the Board is to ensure adequate funding for the Program's longevity.

A.8 Financials

The financials section is based on market analysis and sets clear objectives. The critical financial statements to include are financial data related to the phase I program, such as income statements, balance sheets, and cash-flow statements. In addition, prospective financial data for the next few years includes forecasted income statements, balance sheets, cash-flow statements, and capital-expenditure budgets. Beyond the startup phase, a concerted and continuing effort will need to be made to raise the necessary funding to maintain a viable program.

Description

During the start-up phase (Phase I), funds will be needed to

- Scope out details of the Science City Adventure
- Establish the classroom building
- Develop and test the curriculum
- Develop procedures and materials for marketing and publicity
- Hire a Science City Adventure Director and part-time logistics coordinator and staff coordinator
- Establish procedures for participant selection, travel expenses, program plans, etc.
- Evaluate fully the phase I program and its potential of moving forward to Phase II. See Appendix B for cost breakdowns for the start-up phase. These start-up costs will be covered by grants and donations.

Once the Program is operational, the expenses will largely be for

- Transportation, housing, and feeding of participants
- Insurance
- Salary for a year-round Science City Adventure Director
- Short-term salary for facilitators and science leaders
- Materials and supplies
- Regular upgrading of equipment (e.g., computers)
- Advertising and website maintenance
- Building operations and maintenance
- Evaluation

See Appendix B for cost breakdowns for the operational phase.

During all three phases of the Program's development, extensive evaluation by the Director and Steering Committee/Board of Directors will determine if the Program is meeting its financial targets.

- During Phase I, the financial needs will include support for scoping the activities, curriculum development, marketing, and proposal development as well as initial operating expenses.
- During Phase II, financial needs will include support for scoping the next steps, building construction, curriculum refinement, marketing refinement, proposal

development, and operating expenses. During this phase, funding will be sought specifically to support scholarship youth.

- And during Phase III, financial needs will include support for further scoping the next steps, curriculum expansion, marketing, proposal development, and operating expenses.

During Phase I, the main tasks will be to scope out the details of the plan, to demonstrate the potential for success, and to develop successful proposals that will ensure ongoing success. Potential sources of funding during this phase are:

- ORNL (\$200,000) for overall scoping and leading of two pilot programs
- ORAU for assistance in curriculum development
- UTK for assistance with curriculum development, scoping, and proposal development

Proposals will target

- Government funds (e.g., under the America Competes Initiative)
- Private funds (foundations and individuals who support science education)

During Phase II, the main financial tasks will be to establish a building for the Science City Adventure (see Appendix C), to establish an aggressive marketing campaign, and to acquire operating funds. Potential sources of funding during this phase are:

- Battelle Corporate - for building
- Private individuals and foundations for operating funds
- Government agencies under the America Competes Initiative for operating funds
- Participants (\$133 per day per participant) for operating funds
- Other private donations for operating funds

During Phase III, costs for the Program will be covered by

- Participant fees (~ \$133/day)
- Private individuals and foundations for operating funds
- Donations from private entities
- Commitments from government agencies

See Appendix D for cost comparisons with other programs.

Appendix B Operating Costs

Estimated Science City Adventure Operating Costs under Phase II (100 participants for five days and four nights)

Personnel	Burdened Cost
Science City Adventure Director	\$136,550.70
Curriculum Director	\$109,240.56
Part time counselors	\$6,525.15
Part time jr. counselors	\$3,262.58
Subtotal	\$255,578.99
<hr/>	
Direct Support (100 Participants)	
Food (Catered by local businesses)	\$48,739.69
Transportation (field trips)	\$7,427.00
Housing for Participants and counselors	\$15,915.00
Security for Housing	\$1,200.00
Insurance	\$2,122.00
Lab kits/field equipment	\$26,525.00
Curriculum kits (will be developed)	\$848.80
Extras (tee shirts, caps, pens, etc.,)	\$2,652.50
Subtotal	\$105,429.99
<hr/>	
Indirect Support	
Dues & Subscriptions	\$1,273.20
Marketing/Advertising/Web site development	\$35,543.50
Materials & Supplies	\$28,010.40
Nurse	\$2,000.00
Misc. Equipment	\$21,220.00
Additional Insurance Required	\$15,278.40
Subtotal	\$103,325.50
<hr/>	
Total Start-up Expenses	\$464,334.47
Scholarships	\$66,500.00
Total Requirements	\$397,834.47

Appendix C Building Costs

Estimated Science City Adventure Building Costs

Indirect Participants	Burdened Costs
Site work	\$265,250.00
Water/Sewer if in Freels Bend area	\$132,625.00
Paving	\$106,100.00
New Construction (5000 sq ft)	\$1,273,200.00
Furniture, Fixtures, Equipment	\$477,450.00
Architect & Engineering	\$318,300.00
Contingency	\$610,075.00
Security	\$3,500.00
 Labs, refrigerators, centrifuge, hoods, grow lights, piping, drainage	 \$ -
Total	\$3,186,500.00

Appendix D Examples of Tuitions

Example Day Camp Costs

Name	Price	Days	Daily Rate	Type of Camp
River City Robotics Day Camp	\$200	5	40	Robotics
River City Robotics Day Camp	\$249	5/half day	\$49.80	Robotics
Day Camp: Robotics 101	\$50	1	\$50	Robotics
Union College Robot Camp	\$350	5	\$70	Robotics
Lego Robotics Summer Day Camp	\$450	5	\$90	Robotics
Rocks and Robots (CA)	\$479	5/full day	\$95.80	Robotics
Average Cost:	\$259.80			

Name	Price	Days	Daily Rate	Type of Camp
Summer Teen Academy (San Diego State U)	\$299	5	\$59.80	Computer
Camp Caen (U of MI)	\$895	10	\$89.50	Computer
Camp Caen (U of MI)	\$495	5	\$99	Computer
Emagination Computer Camps	\$2,390	4 weeks	\$119.50	Computer
Emagination Computer Camps	\$1,245	2 weeks	\$124.50	Computer
ID Tech Camps	\$749	5	\$149.80*	Computer
Cyber Camps Academy	\$797	5	\$159.40	Computer
Average Cost:	\$981.43			

Name	Price	Days	Daily Rate	Type of Camp
Be Wise Day Camp (OH)	\$165	3	\$55**	Forensics
Florida Forensics Camp	\$299	5	\$59.80	Forensics
CSI Camp (NY)	\$300	5	\$60	Forensics
Findlay Forensic Science Camp	\$375	5	\$75	Forensics
Forensic Science Camp	\$425	5	\$85	Forensics
Average Cost:	\$313			

Name	Price	Days	Daily Rate	Type of Camp
Smarter Girls Day Camp (MI)	\$20	Weekend	\$10	Building fuel efficient cars
Summer Camp at the Pete (Peterson Auto Museum)	\$230	4 days	\$57.50	Building fuel efficient cars
Average Cost:	\$125			

* Plus \$50 for lunch: daily rate = \$10.

** No lunch provided.

Example Residential Costs

Name	Price	Days	Daily Rate	Type of Camp
Sally Ridge Science Camp	\$3,500	10	350	Space Science
Odyssey expeditions	\$3,790	10	\$379.00	Marine biology
Sea camp	\$1,000	5	\$200	Marine science
Whale camp	\$1,000	5	\$200	Whales
Seatrek	\$3,850	10	\$385	Marine biology
YWCA Adventure Camp	\$799	5	\$159.00	Camping
Science Camp Watonka	\$2,395.00	10	139	Science
Average	\$2,333	8	\$259	

Appendix E.

Science City Adventure Potential External Funding Sources

Federal Funds

- U.S. Department of Energy (DOE)/Workforce Development for Teachers and Scientists (Subject to a Competes Act)
- National Science Foundation (NSF)/Informal Science Education Program

Other Public Funds

- State of Tennessee
- Counties and school districts

Private Corporations

- Alcoa Aluminum^{1, 2}
- Areva
- Battelle
- BP²
- Clayton Mobile Homes
- Coca Cola³
- CNN^{2,3}
- Dell computers^{1,2}
- Exxon²
- Fed Ex^{1,3}
- Pilot Oil^{1,2}
- Shell Oil²
- Volkswagen^{1,2}

Private Foundations

- Ford Foundation²
- Hewlett Foundation^{1,2}

¹ Interest in Tennessee

² Interest in science, energy, health, education, global change, work force development, and education

³ Interest in southeastern United States

**Appendix F. Donors to NASA Space Camp:
A Benchmark for Science City Adventure**

Reported July 14, 2008

Saturn V Level (\$400,000 and Up)

NASA Appropriation - FY06
Julian and Dorothy Davidson
Madison County Commission
City of Huntsville
Save Americas Treasures Grant

Apollo Level (\$100,000-\$249,000)

State of Alabama - Specialty License Plate Revenue
SAIC
The Boeing Company
Frederick I. Ordway III & Maria Victoria Ordway Trustees Frederick I Ordway III Trust
Elizabeth (Betty) Huth Schonrock
State of Alabama - Department of Tourism & Travel
ADECA

Gemini Level (\$50,000-\$99,000)

John & Maureen Hendricks Charitable Foundation
Madison County Commission District 5
Mercury Level (\$30,000-\$49,999)
Pratt & Whitney Rocketdyne, Inc.
MSFC Retiree Association
Mr. & Mrs. William H. Gurley
Bobby Bradley
COLSA CORPORATION

Jupiter Level (\$15,000-\$29,000)

CAS, Inc.
DaimlerChrysler Corporation Fund
John Hendricks-Discovery Communications
John I. Lee in Memory of Mildred Greene Lee
Siemens VDO
System Studies & Simulation, Inc.
Wachovia Foundation
Bellsouth

Explorer Level (\$5,000-\$14,999)

Turner Universal Construction Co. Inc.
Apogee Books/C.G. Publishing
DESE Research, Inc.
Lockheed Martin