Walking Box Ranch Planning and Design Quarterly Progress Report: Period ending July 10, 2010

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Executive Summary

- UNLV participated in several meetings with BLM regarding updating the current Task Order, obtaining a two-year no-cost extension for the two Assistance Agreements, and to develop the future WBR operating agreement between BLM and UNLV.
- UNLV met with Sara Moffatt, one of Senator Reid’s staff, to provide an update on project progress. UNLV also requested the Senator’s support in obtaining additional funding for the project for construction, and also for UNLV to bridge the transition from construction through the first two years of operation.
- UNLV held several internal meetings to advance planning for a July VA meeting with BLM to identify where cuts can be made to the project to bring it in line with the construction and renovation budget.
- Weather station progress included: 1) building a grid-power independent power system to supply power to the weather station, thus making the weather station power autonomous, 2) acceptance of a technical paper on experimental comparison and economic analysis of various PV technologies (in the desert-type climatic conditions of south-western USA) for publication, 3) submittal of a manuscript containing a technical review on the recent developments in various building envelope components and their effects on the energy sustainability of a building to the journal Renewable and Sustainable Energy Reviews, 4) Completion of a preliminary analysis comparing ground-source heat pump technology, air-source heat pump technology and PV technology, and 5) initiation of a comprehensive review of the solar tracking systems.
- UNLV is funding research to prepare ranch pamphlets describing birds and amphibians native to the area and also describing the local geology.
- Progress on the Multimedia Field Guides project that will develop and disseminate a modern geological and environmental field guide includes: 1) Production of seven podcast-style modules, highlighting the local geology on the
drive from Las Vegas to Walking Box Ranch, 2) Design of a field guide portal for smartphones, 3) Completion of the WBR Regional Geologic Map, and 4) New enhancements for the visualization of GoogleEarth KMZ files in the mobile GoogleMaps format.

- PLI educators have submitted an application to CCSD for a Professional Development workshop on Environmental Literacy to be held at the ranch in November 2011. The workshop will offer one professional development credit and be directed at middle and high school teachers who teach earth science, life science, and environmental science.
- UNLV and BLM met to discuss the business plan prepared by Dornbush and Associates. UNLV is making minor modifications requested by BLM.

Summary of Attachments

- Weather_Station_Progress_070511.doc.doc
- Multimedia_Progress_062911.doc
- Walking Box Ranch Timeline_0611

Planning and Design, and Construction Phase Items:

1. Provide BLM with consultation and advise to assist the BLM in defining the scope of work for the design of this project. The UNLV shall coordinate with the University departments and schools and act as the academic focal point for information relative to the design of the Science and Training Center for arid land studies.

   - UNLV has participated in the following meetings with BLM during the past quarter:
     o Met with BLM April 12 to discuss the business plan
     o Met with the VA team 3 times during their June 13-17 meeting
     o Met with BLM to discuss project issues June 14
     o Met with BLM to discuss the future operating agreement June 21
   - Prepared Statement of Programmatic Involvement and Cover Memo for BLM’s use in no-cost extension for UNLV Assistance Agreements for Walking Box Ranch which are due to expire 9/12/13.

2. Participate in all phases of scoping and planning meetings and meetings with the BLM’s planners, architects, and contractors for the design and development of the Walking Box Ranch as a Science, Research, and Training Center and Museum for the study of arid lands and development of the Headquarters as a Museum and interpretive center. The UNLV’s participation is to provide input to the BLM relevant to the specific educational and research goals of the project.
• UNLV met with Sara Moffatt, one of Senator Reid’s staff, to update his office at his request about project progress. UNLV provided a timeline of project progress and also requested support from the Senator for additional funding for project construction costs, and to UNLV to support the transition from construction through the first two years of operation. See Attachment Walking Box Ranch Timeline_0611.pdf.

• Cline/UNLV and McAboy/BLM met April 12 to discuss the business plan prepared for UNLV by Dornbush and Associates in December 2010. BLM requested some minor changes to the document that UNLV is now making.

• UNLV participated in the weeklong VA meeting 3 times during June 13-17: the VA introduction at the ranch on Mon, June 13, Wed June 15 to provide detailed information about the project history and decisions, and on Fri June 17 during the VA presentation. UNLV has held internal meetings to identify how to cut costs and is preparing for a meeting on this topic scheduled for July 7 with BLM and AECOM.

• UNLV met with BLM (McAboy and Giani) on June 14 to discuss project problems and issues. The meeting included discussions about project costs and potential ways to attract additional funds for the project.

• June 21 meeting between BLM and UNLV to discuss future challenges of the operational transition of Walking Box Ranch. Set up a facilitated meeting July 27, 2011 with the purpose of creating foundational components that will need to be incorporated in the future instrument for management and operations of Walking Box Ranch.

  Preliminary research was conducted to gain answers to predictable challenges for transition of Walking Box Ranch in to full operations:
  o Federal Lands Recreation Enhancement Act
  o National Historic Preservation Act
  o Operating agreements between federal agencies and universities (via internet)
  o Contacts of contracting officers/Agreements Officers for samples of operating agreements

3. **Assist BLM in developing the environmental assessment by providing technical input and review of the draft environmental assessment.**

• There were no environmental assessment activities this quarter. However, UNLV is aware that BLM is working on completing this assessment so that geotechnical investigations at the ranch can begin on schedule. UNLV is available to help as needed.

4. **Provide technical and academic advice to BLM in the development of the museum facilities, by conducting research into the historic records of the ranch and providing recommendations about the appropriate interpretive and environmental education programs that may be presented at the ranch.**
• Additional research is now underway to prepare brochures describing birds and amphibians that are native to the ranch locality and also the local geology.

• Weather Station accomplishments:
  o Power-autonomous weather station: The target of this task is to build a grid-power independent power system to supply power to the weather station, thus making the weather station power autonomous. The auxiliary power system components such as photovoltaic module, battery system, charge controller, Sun-protection enclosure, wiring and the other necessary fittings have been sized and procured for installation at the WBR. The prospective installation will make the weather station power-autonomous.
  o WBR weather station website monitoring, maintenance and continuous meteorological data collection: The intent of this task is to ensure unhindered collection of meteorological data at the WBR location and analyze the data thus obtain to infer important conclusions on the renewable energy potential at the WBR geographic location. The meteorological data collection was initiated in June, 2010 and had been continuous since then. Thus, a set of meteorological data which is collected for one complete year is available now. The following are some of the important conclusions that are easily inferred from the collected data.
    ▪ The WBR location has a wind resource with average speeds greater than 3 and less than 5 miles/hour. Areas with annual average wind speeds around 6.5 m/s or higher at a height of 80 meters are generally considered to have suitable wind resource for wind development. Thus, this area might not be a good prospective location for wind power development, although further research may be needed to arrive at a concrete conclusion.
    ▪ The monthly average insolated solar energy (in terms of kWh/m²) collected by a horizontal surface is high during the summer months compared to the winter months. Also, the total annual average global horizontal irradiation is 2158.5 kWh/m². This is suggests that geographic location of WBR has a very good solar resource and can be harnessed by using appropriate solar technologies such as photovoltaics, evacuated glass tube solar water heaters etc.
  o A technical paper on experimental comparison and economic analysis of various PV technologies (in the desert-type climatic conditions of south-western USA) was accepted for publication at the ASME 2011 Energy Sustainability Conference, August 7-10, 2011. The daily performance results from the experimental test setup of various PV panels were used in this technical paper. An economic model is developed in the effort to compare various market available PV technologies. The model performs a life cycle cost analysis of different PV technologies for a user-defined installed power and PV life expectancy (generally 25 years or more).
- A technical review on the recent developments in various building envelope components and their effects on the energy sustainability of a building has resulted in a technical review article on building envelopes. The paper was submitted to the journal Renewable and Sustainable Energy Reviews. This paper is currently under review. Title: Passive Building Energy Savings: A Review of Building Envelope components.
- A preliminary analysis that compares the life cycle costs of both the technologies (the ground-source heat pump technology and the PV technology) was completed. This preliminary report concludes that through upgrading to GSHP technology from air-source heat pump technology, a monetary worth of each kWh saved is $0.15 to $0.19. Similarly, electrical energy can be generated at $0.158/kWh to $0.198/kWh by solar photovoltaic technology with a life time operation of 25 years.
- Study of solar tracking systems: A comprehensive review of the solar tracking systems had been initiated. An experimental test setup of a single axis tracking system is constructed and is currently under testing. A logical computer program that guides the single-axis tracking system had been developed, and the installed tracking system uses this algorithm. This experimental data will be compared to the data from stationary systems that had been on continuous testing already. This will yield to accurate results on the improvement of solar collection in single-axis tracking over stationary installations in the meteorological conditions of desert southwest. See Attachment Weather_Station_Progress_070511.doc for quarterly progress.

- UNLV is funding an education project to develop and disseminate a modern geological and environmental field guide designed to engage and educate students and the public at the Walking Box Ranch field station in southern NV. A series of geospatially-enhanced pod/vodcast-style field guides is being developed in which participants at the ranch observe the landscape while guided by audio tracks, remote sensing imagery, and digital animations. Aimed at the inexperienced user, the employment of hand-held devices will provide users the ability to tailor their experience and view information about remote sensing, geology, and geospatial technology. Recent work for the development of the Walking Box Ranch field guide has included: 1) Production of seven podcast-style modules, highlighting the local geology on the drive from Las Vegas to Walking Box Ranch, 2) Design of a field guide portal for smartphones, 3) Completion of the WBR Regional Geologic Map, and 4) New enhancements for the visualization of GoogleEarth KMZ files in the mobile GoogleMaps format. Over the next few months, we will complete the podcast modules and finish design and implementation of the web portal for users. It is anticipated that by October, a fully-operational site will be available to go public on the WBR PLI website. See Attachment Multimedia_Progress_062911.doc for quarterly progress.
5. **Contribute technical and educational-based assistance to the BLM for the BLM's consideration during construction development for the Science and Training Center and Museum as it relates to the future operations of these facilities as education centers.**

- UNLV held internal security meetings and has hired a security consultant who has visited the ranch and provided preliminary security costs for the VA meeting. He is currently refining his security recommendations in consultation with UNLV IT and security personnel.
- UNLV has held internal IT meetings and the IT team has provided a cost estimate for the VA meeting that includes anticipated costs for campus IT and also to bring internet access to the campus. The IT team is working with the security consultant to create a seamless interface for security and IT.
- PLI educators (Brody and Page) have completed and submitted an application to the CCSD for a Professional Development workshop on Environmental Literacy. The workshop will be directed at middle and high school teachers who teach earth science, life science and environmental science. The workshop, which will be held at WBR in November 2011, will last about 2.5 days, will require 15 hours of contact time, and will offer one professional development credit. The application was submitted to the Clark County School District in June.

6. **Provide input and feedback to the BLM during the construction of the Field Research and Training Center and the Museum.**

- The project is not under construction at this time.

**Phase 1 Deliverables:**

1. **Provide a Facility and Future Needs Alignment Report that will identify the types of future research and training programs that will be conducted at Walking Box Ranch Field Research and Training Center and Museum. The report will also include a matrix that aligns predicted future activities with facility, construction, furnishing, and equipment needs.**

   - This report will be prepared after BLM has approved of the recently received business plan and after a conceptual plan for operation of the ranch after construction is identified by BLM and UNLV. UNLV and BLM are meeting over the summer 2011 to work to define a workable future operations plan.

2. **Assist the BLM in developing a Preservation Plan for Existing Structures on the Headquarters Parcel of the Walking Box Ranch.**

   - UNLV continues to work with project architects by providing information and responses to questions about the facilities to determine how best to renovate the historic buildings for preservation.
3. Provide a Business Plan detailing anticipated future research, training, and other use goals and a financial plan for reaching those goals. The Business Plan should also describe income and operations and maintenance costs.

- UNLV has received the final version of the business plan from Dornbusch and Associates and has distributed the plan to BLM and the Architecture team. UNLV (Cline) and BLM (McAboy) have met and discussed the plan and UNLV is making minor modifications to the plan at BLM’s request.

Phase 2 Deliverables:

1. Prepare a Project Development Plan that reflects UNLV’s Business Plan. The Project Development Plan should refine the anticipated research, residential training activities, and Museum use; identify recommended new facilities and renovations; outline construction; and plan center management (print and PDF).

- The project development plan, which is essentially the future operating plan, is now under discussion between UNLV and BLM. We are meeting July 27 to produce a conceptual operating plan that meets the needs of both BLM and UNLV. An agreement that details future operations will follow.

2. Assist the BLM in creating a detailed Work Plans for each aspect of project development such as, but not limited to, existing building use, new construction, interpretive programs, and center management, based upon the Comprehensive Master Plan and Preservation Plan.

- The detailed work plans will be a component of the future operating plan, which is now being discussed in meetings between UNLV and BLM.

Phase 3 Deliverables:

1. Assist in the development of Facilities Design Drawings according to the recommendations of the Comprehensive Master Plan generated by the SAT project, in conformance with existing significant architectural features and historical attributes of the property, in a fashion responsive to LEED goals to the extent funding permits, and to meet all property easements.

- UNLV continues to respond to questions by the architectural and engineering team as they work to complete their respective drawings.

2. Assist in the development of Facilities Design Drawings for the preservation of facilities according to the recommendations of the Comprehensive Master Plan.
and Preservation Plan in conformance with historical and architectural attributes of the buildings and property, and to meet all property easements.

- UNLV continues to respond to questions by the architectural and engineering team as they work to complete their respective drawings.

Phase 4 Deliverables (During Construction):

1. Provide the BLM consultation and advice during construction to help the BLM ensure the construction meets the goals of the project.
   - The project is not under construction at this time.

2. Provide the BLM consultation and advice as needed during renovation of preserved facilities, to help the BLM ensure that the renovation meets goals of projects and is in accordance with historical restoration requirements and according to approved designs.
   - Project buildings are not being renovated at this time. However, UNLV is working with BLM to plan future renovations as needed.

Phase 5 Deliverables:

1. Assess and identify furnishings and equipment based upon facility needs; provide the BLM information related to furnishings and equipment for new and preserved facilities so that the BLM can procure these items, within project funding under this Cooperative Assistance Agreement. The UNLV may provide additional furnishings and equipment outside of this Agreement at the UNLV’s sole discretion.
   - While we are not acquiring furnishings at this time, we are continuing to work with Rex Bell Jr. about his desire to see original ranch furnishings now in his possession returned to the ranch.
### Year One Deliverables

<table>
<thead>
<tr>
<th>Planning and Design:</th>
<th>Percent Complete as July 10, 2010</th>
<th>Plan for Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Provide BLM with consultation and advice in defining the scope of the design of the Science and Training Center.</td>
<td>55%</td>
<td>Continue to consult and advise BLM in the scope of design of the training center.</td>
</tr>
<tr>
<td>2. Participate in all phases of scoping and planning team meetings for the design and development of WBR as a Science, Research, and Training Center and Museum.</td>
<td>55%</td>
<td>Continue to participate in scoping and planning of the Museum and the training center.</td>
</tr>
<tr>
<td>3. Assist BLM in developing the environmental assessment process with technical input and review of drafts.</td>
<td>65%</td>
<td>Continue to work with EDAW and BLM on the Environmental Assessment process, scheduled to be complete later summer/early fall 2009, but now delayed until 2010.</td>
</tr>
<tr>
<td>4. Provide technical and academic advice to BLM in development of the museum facilities with recommendations of interpretive and environmental programs for presentation at the Ranch.</td>
<td>55%</td>
<td>Continue to provide technical and academic advice for interpretive and environmental programs.</td>
</tr>
<tr>
<td>5. Contribute technical and educational-based assistance to the BLM for the BLM’s consideration during construction development for the Science and Training Center and Museum as it relates to the future operations of these facilities as education centers.</td>
<td>55%</td>
<td>Continue to contribute technical and educational-based assistance to the BLM for the Science and Training Center and Museum.</td>
</tr>
<tr>
<td>6. Provide input and feedback to BLM during the construction of Field Research and Training Center and the Museum.</td>
<td>0%</td>
<td>Project is not under construction.</td>
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### Phase 1 Deliverables:

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<thead>
<tr>
<th></th>
<th>Percent Complete as July 10, 2010</th>
<th>Plan for Completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Provide a Facility and Future Needs Alignment Report that will identify the types of future research and training</td>
<td>20%</td>
<td>Work with faculty at UNLV to identify future research and training programs and incorporate</td>
</tr>
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</table>
programs that will be conducted at Walking Box.

<table>
<thead>
<tr>
<th>Program</th>
<th>Progress</th>
<th>Description</th>
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<tbody>
<tr>
<td>2. Assist the BLM in developing a Preservation Plan for Existing Structures on the Headquarters Parcel of the Walking Box Ranch.</td>
<td>55%</td>
<td>Work with BLM and ARG architects to develop preservation for existing structures.</td>
</tr>
<tr>
<td>3. Provide a Business Plan detailing anticipated future research, training, and other use goals and a financial plan for reaching those goals.</td>
<td>85%</td>
<td>A final version of a detailed business plan has been prepared by Dornbusch and Associates. This plan has been distributed to BLM and the AECOM team. UNLV and BLM have discussed the plan and UNLV is making minor modifications.</td>
</tr>
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### Phase 2 Deliverables:

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Progress</th>
<th>Description</th>
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<tbody>
<tr>
<td>1. Prepare a Project Development Plan that reflects UNLV’s Business Plan. The Project Development Plan should refine the anticipated research, residential training activities, and Museum use.</td>
<td>0%</td>
<td>This will begin in conjunction with preparation of the operating agreement.</td>
</tr>
<tr>
<td>2. Assist the BLM in creating a detailed Work Plans for each aspect of project development based upon the comprehensive master plan and preservation plan.</td>
<td>10%</td>
<td>This will begin as BLM needs to develop the work plans.</td>
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### Phase 3 Deliverables:

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Progress</th>
<th>Description</th>
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<tbody>
<tr>
<td>1. Assist in the development of Facilities Design Drawings according to recommendations of the comprehensive master plan generated by the SAT projects.</td>
<td>55%</td>
<td>We will continue to work with BLM, AECOM and AECOM subcontractors to assist with design of the facilities</td>
</tr>
<tr>
<td>2. Assist in the development of facilities design drawings for the preservation of facilities according to the recommendations of the Comprehensive Master Plan and Preservation Plan.</td>
<td>55%</td>
<td>We will continue to work with BLM, AECOM and AECOM subcontractors to assist with design of the facilities</td>
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### Phase 4 Deliverables (During Construction):

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Progress</th>
<th>Description</th>
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<tbody>
<tr>
<td>1. Provide the BLM consultation and advice during construction to help the BLM ensure the</td>
<td>0%</td>
<td>The project is not yet in construction.</td>
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<tbody>
<tr>
<td>2. Provide the BLM consultation and advice as needed during renovation of preserved facilities, to meet goals of the project.</td>
<td>0%</td>
<td>The project is not in construction.</td>
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**Phase 5 Deliverables:**

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<tbody>
<tr>
<td>1. Assess and identify furnishings and equipment based upon facility needs; provide the BLM information related to furnishings and equipment for new and preserved facilities so that the BLM can procure these items, within project funding under this Cooperative Assistance Agreement.</td>
<td>25%</td>
<td>We are in the process with Rex Bell Jr of completing an inventory or items he will donate or sell to be exhibited in the planned museum at the ranch. Most equipment and furnishing planning will occur during the construction period.</td>
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Margaret N. Rees,  
Principal Investigator  

07/06/11  
Date
ATTACHMENTS
Walking Box ranch project- quarterly progress report (April 2011 – June 2011)

Project Goal

The final objective of the project is to assess the sustainable (renewable and/or energy efficient) energy potential of the Walking Box Ranch. This led us to divide the project into various tasks. The following is a brief report on the progress of each task in this quarter.

Task 1: Building Envelope studies

Goal: The prospective Walking Box Ranch (WBR) buildings are expected to be highly energy efficient and the building envelope plays a very important role in improving the energy efficiency of any building. Thus, the objective of this task is to study the passive energy efficiency strategies through improvements in the building envelopes and document them for applicability at WBR buildings.

Progress: Recent years have seen a renewed interest in passive energy efficient strategies due to their cost effectiveness and environmental friendliness. They are being envisioned as a viable solution to the problems of energy crisis and environmental pollution. A technical review on the recent developments in various building envelope components and their effects on the energy sustainability of a building is, therefore, highly relevant given the present context. The study has resulted in a technical review article on building envelopes. The paper was submitted to the journal -- Renewable and Sustainable Energy Reviews. This paper is currently under review. The research support of Public Lands Institute (PLI) is duly acknowledged in this technical paper. This article strives to make an exhaustive technical review of the building envelope components and respective improvements from an energy efficiency perspective. Different types of energy efficient walls such as Trombe walls, ventilated walls, and glazed walls are discussed. Performance of different fenestration technologies including aerogel, vacuum glazing and frames are presented. Advances in energy efficient roofs including the contemporary green roofs, photovoltaic roofs, radiant-transmittive barrier and evaporative roof cooling systems are discussed. Various types of thermal insulation materials are enumerated along with selection criteria of these materials. The effects of thermal mass and phase change material on building cooling/heating loads and peak loads are discussed. Application of thermal mass as an energy saving method is more effective in places where the outside ambient air temperature differences between the days and nights are high. Air tightness and infiltration of building envelopes are discussed as they play a crucial role in the energy consumption of a building. Energy efficiency approaches sometimes might not require additional capital investment. For example, a holistic energy efficient building design approach can reduce the size of mechanical systems compensating the additional cost of energy efficiency features. The journal publication of this technical article will mean authentic endorsement from the technical community.

Task 2: Ground-source heat pump (GSHP) Vs Photovoltaic (PV) technology

Goal: The intention of this task is to make a detailed life cycle comparison of the two sustainable technologies: ground-source heat pump and solar photovoltaics (PV).
Progress: A preliminary analysis that compares the life cycle costs of both the technologies (the ground-source heat pump technology and the PV technology) was completed. This preliminary report concludes that through upgrading to GSHP technology from air-source heat pump technology, a monetary worth of each kWh saved is $0.15 to $0.19. Similarly, electrical energy can be generated at $0.158/kWh to $0.198/kWh by solar photovoltaic technology with a life time operation of 25 years. A complete, more detailed analysis is initiated. This analysis should be able to bring out the economic and environmental benefits of using either or both of these technologies. A few of the available federal and regional incentive programs for both the technologies will also be discussed in this study. Preliminary report is complete, initiated a further thorough study.

Task 3: Solar PV performance and economic studies

Goal: Prospective net zero (electric) energy buildings at the Walking Box Ranch can be achieved by applying solar PV systems. Thus, the focus of this task is to identify the most suitable and economically viable PV technology/technologies for applicability at the ranch buildings.

Progress: A technical paper on experimental comparison and economic analysis of various PV technologies (in the desert-type climatic conditions of south-western USA) was accepted for publication at the ASME 2011 Energy Sustainability Conference which will be held during August 7-10, 2011. The daily performance results from the experimental test setup of various PV panels, established with the financial support of PLI, were used in this technical paper. The research support of Public Lands Institute (PLI) is duly acknowledged in this technical paper. Acceptance for technical publication at the reputed ASME conference means the validation of experimental results from the scientific fraternity. In the same paper, an economic model is also developed in the effort to compare various market available PV technologies. The model performs a life cycle cost analysis of different PV technologies for a user-defined installed power and PV life expectancy (generally 25 years or more).

![Figure 1. Experimental Setup – Clockwise from top: a-Si TJ, a-Si, poly-c-Si, HIT-Si.](image)

Task 4: Study of solar tracking systems

Goal: The annual solar energy collected by a dual-axis tracking solar collector is usually 25 to 55% more than that of an optimally inclined solar collector. But it is cost prohibitive to
implement dual-axis tracking for small-scale applications. Experiments in the past have revealed that single-axis tracking systems can yield as much as up to 95% of the energy collection achieved through dual-axis tracking. They are also cost-effective to construct and operate. Thus, the aim of this task is to make a comprehensive review of the solar tracking systems and also conduct an experimental study on the improvement in energy generated by PV using a single axis tracking system.

**Progress:** A comprehensive review of the solar tracking systems had been initiated. An experimental test setup of a single axis tracking system is constructed as shown in Figure 2 and is currently under testing. A logical computer program that guides the single-axis tracking system had been developed, and the installed tracking system uses this algorithm. This experimental data will be compared to the data from stationary systems (as shown in Figure 1) that had been on continuous testing already. This will yield to accurate results on the improvement of solar collection in single-axis tracking over stationary installations in the meteorological conditions of desert south-west.

![The single-axis tracking system installed on the roof-top of TBE building, UNLV.](image)

**Task 5: Power-autonomous weather station**

**Goal:** The target of this task is to build a grid-power independent power system to supply power to the weather station, thus making the weather station power autonomous.
Progress: The auxiliary power system components such as photovoltaic module, battery system, charge controller, Sun-protection enclosure, wiring and the other necessary fittings have been sized and procured for installation at the WBR. The prospective installation will make the weather station power-autonomous.

Task 6: WBR weather station website monitoring, maintenance and continuous meteorological data collection.

Goal: The intent of this task is to ensure unhindered collection of meteorological data at the WBR location and analyze the data thus obtained to infer important conclusions on the renewable energy potential at the WBR geographic location.

Progress: The meteorological data collection was initiated in June, 2010 and had been continuous since then. Thus, a set of meteorological data which is collected for one complete year is available now. The following are some of the important conclusions that are easily inferred from the collected data.

As shown in Figure 3, the WBR location has a wind resource with average speeds greater than 3 and less than 5 miles/hour. Areas with annual average wind speeds around 6.5 m/s or higher at a height of 80 meters are generally considered to have suitable wind resource for wind development. Thus, this area might not be a good prospective location for wind power development, although further research may be needed to arrive at a concrete conclusion.

As shown in Figure 4, the monthly average insolated solar energy (in terms of kWh/m²) collected by a horizontal surface is high during the summer months compared to the winter months. Also, the total annual average global horizontal irradiation is 2158.5 kWh/m². This is suggests that geographic location of WBR has a very good solar resource and can be harnessed by using appropriate solar technologies such as photovoltaics, evacuated glass tube solar water heaters etc.
The continuous collection of meteorological data is ensured with occasional troubleshooting. Some technical errors that caused the interruption of automated data collection and scheduling are fixed. Timely update of the weather database by using Microsoft SQL Server Integration Services (SSIS) is monitored at regular intervals. The RTMC web server and the reporting web server that displays the ‘Live data’ and ‘Historic data’ respectively are being maintained.

The web interface that is used to view the past and current meteorological information is updated with an option for viewing monthly and yearly plots. Users can access the monthly and yearly data by selecting those options located just above the ‘Select parameter’ option as shown on the screen shot in Figure 5. Similar monthly and yearly reports can be generated for other parameters such as:

- Maximum and Minimum Relative Humidity
- Wind Speed.
- Wind Direction.
- Total energy received or Global horizontal irradiance in kWh/m$^2$.

Additional details of the sensors and what they measure is updated in the present version of the webpage as footnotes.
**WALKING BOX RANCH**  
Searchlight, Nevada.

<table>
<thead>
<tr>
<th>Latitude</th>
<th>Longitude</th>
<th>Elevation</th>
<th>Time Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>35° 29’ 21” N</td>
<td>115° 02’ 20” W</td>
<td>1196 m</td>
<td>PST (GMT-8)</td>
</tr>
</tbody>
</table>

**HOME**  
**LIVE DATA**

**Historic plots** *(Available from June 1, 2010)*

**Instructions:**
- Step 1: Select the option and then the parameter and click "select" that navigates to "Report Viewer" page.
- Step 2: Select the date or month for which report is required in the "Report Viewer" page.

<table>
<thead>
<tr>
<th>Select Option:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily Monthly Yearly</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Select Parameter:</th>
</tr>
</thead>
</table>
| Global Horizontal (kW/m²)  
Direct Normal (w/m²)  
Dry Bulb Temperature (° F)  
Relative Humidity (%)  
Wind Speed (m/s)  
Wind Direction (° from N) |

[Select button]

*Figure 5. Screen shot displaying the selection to view yearly data.*
Progress Report for Walking Box Ranch Research and Education Grant  6/29/2011

Title: Multimedia Field Guides for Public Engagement at Walking Box Ranch, Mojave Desert

PI:
Dr. Scott Nowicki
Assistant Professor in Residence
UNLV Department of Geoscience
702-895-1239
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Project Dates:
April 1, 2011 - June 30, 2011

Results:

Recent work for the development of the Walking Box Ranch field guide has included: 1) Production of seven podcast-style modules, highlighting the local geology on the drive from Las Vegas to Walking Box Ranch, 2) Design of a field guide portal for smartphones, 3) Completion of the WBR Regional Geologic Map, and 4) New enhancements for the visualization of GoogleEarth KMZ files in the mobile GoogleMaps format.

The majority of the content has been developed, which is accessible by smartphone or downloadable from the web, and covers the drive from Las Vegas to WBR, with three modules on site that describe the geologic history, basic flora and fauna, and the geomorphic features that define the region. The smartphone portal and geologic map have been completed, so that as we complete the development of the main web portal, these features will be ready for viewing by the public and WBR community. With ongoing changes to the GoogleMaps API, content is becoming easier to import, and we are developing flexibility into the portal, so that in the future, new maps and content can be included for public use.

On June 23, 18 participants in the NSC NeCoTIP teacher education workshop field tested the first set of modules in a half-day field trip to the Ranch. These NV middle and high school science teachers utilized the modules in a non-smartphone application, with an MP3 player and guidance by the PI. These participants are providing feedback on content and applicability, which will be used to refine the modules. After completing the modules, the participants were given a tour of Walking Box Ranch structures.

Over the next few months, we will complete the podcast modules and finish design and implementation of the web portal for users. It is anticipated that by October, a fully-operational site will be available to go public on the WBR PLI website.