Independent Technology Evaluation Study
Phase 1 – Test Plan Development
for
Blacklight Power CIHT Technology

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Independent Technology Evaluation Study

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Blacklight Power CIHT Technology

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1.0 INTRODUCTION

This work was performed for Blacklight Power (BLP) under a mutual Non-Disclosure Agreement (7-15-11), TT Engineering Services Agreement (11-30-11), and BLP Purchase Order (11-30-11).

The purpose of this study is to evaluate the Catalyst Induced Hydrino Transition (CIHT) technology on-site (at BLP's facility) and to develop a test plan for independent validation testing off-site (at TT's facility).

TT sent a technical team to BLP's facility to learn about the CIHT technology and to witness assembly and test of CIHT cells. The visiting team included:

- Program Manager and Principal Engineer
- Physicist
- Ceramics Engineer (Chemist)

This report includes:

- The Technical Team's findings based on the visit to BLP's facility and subsequent review of test data and other documents.
- A proposed test plan for an off-site independent CIHT device validation effort.

2.0 REFERENCED DOCUMENTS

Table 1 - Referenced Documents

Reference No.	Title	Revision
1	Catalyst Induced Hydrino Transition (CIHT) Electrochemical Cell – TT Validation Visit (Briefing), R. Mills, Blacklight Power, Inc.	Dec. 13, 2011
2	Catalyst Induced Hydrino Transition (CIHT) Electrochemical Cell120811, R. Mills, X. Yu, G. Zhao, Blacklight Power, Inc.	Dec. 8, 2011
3	Validation of Electrical Power Generation by Second-Generation CIHT Technology, K.V. Ramanujachary, Rowan University, Glassboro, NJ	Nov. 2011
4	Cell Parameters	Dec. 29, 2011
5	Validation Cells Updated, Gaosheng Chu	Dec. 22, 2011
6	Validation Cells 010512 - Control Cells, Gaosheng Chu	Jan. 6, 2012
7	Ni/LiOH-LiBr-MgO Matrix/NiO Validation Cells, Guibing Zhao *	Dec. 30, 2011, Jan. 6, 2012, Jan 13, 2012
8	Oxygen reduction on Ni electrode in molten hydroxides (LiOH, NaOH, KOH)	Jan. 6, 2012
9	Validation of the Observation of Soft X-ray Continuum Radiation from Low-Energy Pinch Discharges in the Presence of Molecular Hydrogen, Alexander Bykanov, Harvard Smithsonian Center for Astrophysics (CfA), Cambridge, MA	November 29, 2010
10	M/LiOH-LiBr-Matrix/NiO Validation Cells, Phase II: pre-humidified Ar or water vapor purged closed cells, M = Ni, Mo, H242 alloy Matrix: MgO *	Dec. 23, 2011, Dec. 30, 2011, Jan. 4, 2012. Jan. 9, 2012, Jan 10, 2012
11	Data Acquisition System, John Lotoski *	Dec. 22, 2011, Jan. 05, 2012

* Updated as new data became available.

3.0 VISIT TO BLACKLIGHT POWER

On December 13-14, 2011, the Technical Team (TT) visited Blacklight Power, 493 Old Trenton Road, Cranbury, NJ. The meeting agenda is found in Figure 1.

BLACKLIGHT POWER

Blacklight Power Site Visit
December 13, 2011

Time:	**Agenda Item:**
9:00AM to 9:45AM	Meeting with Dr. Mills and Bill Good to go over agenda and our goals for [redacted]'s visit
	Dr. Mills to cover technical CIHT background materials and supporting topics in Theory and hydrino identification.
9:45AM to 12:30PM	Meet with Dr. Xingwen Yu for CIHT cell discussion, review prior validation results, build cells
	Meet with Dr. Guibing Zhou for discussion of supplemental data
12:30 PM to 1:30PM	Lunch
1:30 PM to 2:00PM	Wrap up CIHT cell discussion
2:00 PM to 2:30PM	Meet with Dr. Ying Lu to review continuum and rovibration experiments
2:30 PM to 3:30PM	Time for [redacted] Team to meet independent of BLP
3:30 PM to 4:30 PM	Meet with Dr. Mills to discuss technical issues
4:30 PM to 5:00 PM	Discuss deliverables and next steps

Figure 1 - Blacklight Power Site Visit Agenda

3.1 THEORY OF OPERATION

BlackLight Power, Inc. (BLP) claims to have developed a proprietary new energy source based on a previously unknown state of hydrogen called "hydrino" [1], [2], [3]. The theory predicts that hydrogen-to-hydrino transitions can release up to two hundred times more energy than burning hydrogen. If this technology is proven and developed to its full potential, then hydrogen from water could be used as a fuel source to provide a cheap, abundant, and non-polluting energy source to meet future energy demands.

The CIHT fuel cell under investigation is illustrated in Figure 2. A cell has a cathode, anode, and electrolyte. The electrolyte serves as a catalyst for forming hydrinos (lower energy state hydrogen). The fuel cell is charged with atomic hydrogen released by electrolysis of H_2O. This is followed by a release of electrical energy from the hydrino-producing electrolyte. This charge-release cycle is regenerative and can be sustained for weeks. The net output power from a single, small-area cell is only a few milliwatts; however, optimization of the cell structure and construction of multi-cell devices holds the promise for achieving practical and competitive electric power generating cells [4].

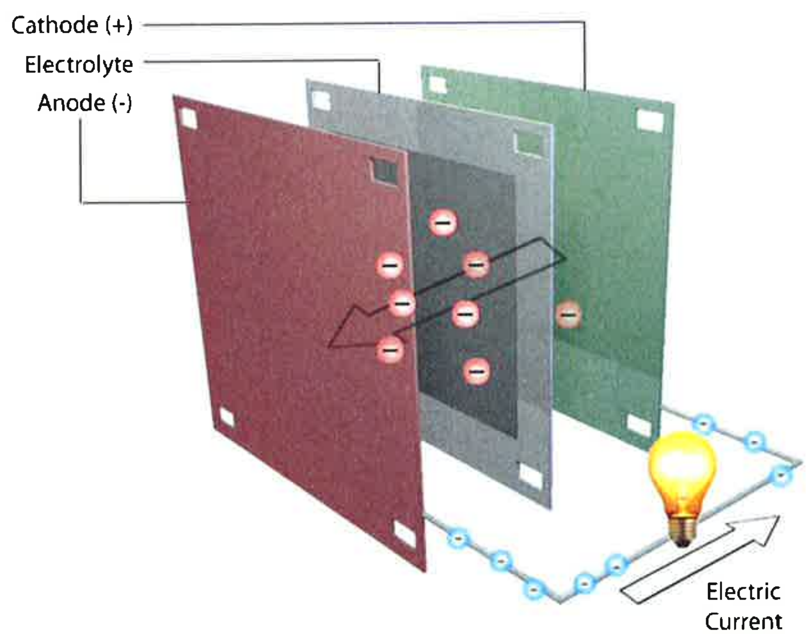

Figure 2 - CIHT Fuel Cell

3.2 TECHNICAL BRIEFINGS, LAB TOUR, AND DEMONSTRATIONS

Blacklight Power's founder, Dr. Randall Mills (Chairman, CEO and President), explained how aspects of his Grand Unified Theory of Classical Physics allow for the creation of energy from water. He gave a detailed technical review of the BLP technology including the unique theoretical basis, the resulting predictions in numerous areas of basic and applied physics and chemistry, molecular modeling, and thermal and electrical power generation. Scientific evidence supporting the hydrino theory includes:

- Calorimetry experiments provide evidence of hydrino formation.
- Spectroscopic data from a continuum light source shows evidence of peaks in the 10-30 nm range, which are predicted by the hydrino theory.
- Hubble Space Telescope images provide evidence of dark matter which could be evidence of hydrino gas.
- The observed hydrogen line broadening of fast hydrogen (due to the Doppler Effect) can be explained by hydrino reactions. This effect is difficult to explain otherwise.
- The upfield shifted peak in Magic Angle Spinning Nuclear Magnetic Resonance (MAS NMR) results is evidence of a reduced-radius hydrogen atom, or lower-energy-state of hydrogen.
- Total bond energy for a wide range of molecules can be predicted by Mills' classical physics model. When predicted energy vs. experimental energy is plotted, the points lie on a straight line to an unprecedented accuracy. This provides strong evidence for the correctness of the underlying physical foundations used in the model.
- CIHT electrochemical cells were fabricated and tested which produced multiple times more electrical energy output than input with no obvious conventional reaction capable of producing the energy.

William Good (Vice President) gave a tour of the experimental lab. Several dozen operating cells are currently undergoing long-term testing. Cells are held at an elevated temperature inside a sealed and insulated chamber. Characteristics of the operating cells are continuously and automatically monitored and recorded.

Dr. Xingwen Yu provided design details of the CIHT electrochemical cells, and built four of them during the visit. We observed each step of cell assembly, continuous operation of the cell while producing excess energy, and verification of the measurement equipment. All cells began operating immediately. The reaction is sustained by trace amounts of water vapor in high-purity argon gas (slightly above ambient pressure) being passed through the cell. Data shows that the reaction ends when the source of water vapor is removed.

Experimental conditions that yielded no net electrical energy gain were tests in which no water vapor was present or that used electrolytes (using conventional chemistry) rather than the CIHT cell electrolyte [5], [6]. All other conditions resulted in energy gains. When the closed cell was evacuated or water was removed, the process ceased to make excess electricity.

Chemical analysis shows no significant chemical changes to the electrodes or electrolyte after continuous operation over weeks of operation [7].

Drs. Guibing Zhao and Gaosheng Chu reviewed experimental test data for the electrical characteristics of cells with and without exposure to water vapor, with various anode materials, with and without an inert matrix material, with variable charge currents, in open and closed flanges, and with and without an evacuation of the flange before introduction of the argon with water vapor. When water is present, the generated power exceeds the supplied power.

Dr. Ying Lu showed the extreme ultraviolet (EUV) spectroscopy laboratory and discussed the hydrogen continuum and molecular hydrino ro-vibrational experimental results. His data shows the existence of a continuum hydrino emission spectrum in the soft 10-30 nm (VUV or soft x-ray) region. This emission spectrum is well beyond the standard hydrogen spectrum.

Other researchers including spectroscopists at the Harvard Smithsonian Center for Astrophysics (CfA) have independently confirmed the continuum light source emissions [9]. This is compelling evidence for the hydrino-state of hydrogen. Molecular hydrino gas collected in a solid KCl matrix from the CIHT cells showed a rotational spectrum wherein the energies identically match the integer four squared, times the rotation energies of ordinary molecular hydrogen. The lines identify and are characteristic of the molecular hydrino in the principal quantum number state n=1/4 predicted for the catalyst utilized in the CIHT cell.

3.3 CELL EXPERIMENTAL RESULTS

Details of the experimental procedures, cell materials (anode, cathode, and electrolyte), and 24 sets of experimental data were reviewed by the Technical Team [10]. The cumulative net energy gain is measured and recorded by an Arbin Instruments tester which uses its standard software programmed for operating the CIHT cell test. The calibration process was demonstrated and calibration data was provided [11].

Typical energy gain is over 200% after stabilization. However, some cells continue to run with almost no excitation energy. These cells produce an output power level that is comparable to other test cells. Because the input energy levels are so small they have exceptionally-high calculated energy gains (e.g., ~ 200,000%).

Cumulative energy gain (%) is summarized in Table 2. Test durations ranged from 5-27 days. The Technical Team witness assembly for four (4) test cells: 1291; 1292; 1293, and 1294. Some tests were stopped. Others continue to run, as of January 10, 2012.

Table 2 –Cell Test Data

Cells with Ni Anodes		
Cell #	Duration (days)	Average Energy Gain (%)
1174	34.5	212
111511GC1	20.4**	181
1217	13.7**	149
1254	25.9**	4,095
1291*	26.1	461
1292*	26.4	458
1318	19.3	1,280
1319	18.7	1,004
1343	5.5	24,657
1344	5.3	31,106
1345	5.3	22,872
1286	11.0**	1,076

Cells with H242 Anodes		
Cell #	Duration (days)	Average Energy Gain (%)
1225	14.4**	770
1235	11.2**	175
1246	19.0**	289
1255	21.1**	203
1294*	27.0	286

Cells with Mo Anodes		
Cell #	Duration (days)	Average Energy Gain (%)
1251	6.3**	391
1256	21.4**	246
1270	27.8**	79,553
1288	7.5**	626
1293*	26.2	188,471
1320	19.3	189,490
1301	24.1**	242,132

* The Technical Team witnesses assembly and start of this cell.

** The cell was stopped at this time.

3.4 TT[redacted] TEST CELLS

Four CIHT test cells were constructed and started on December 13, 2011. The Technical Team witnessed the assembly process, cell startup, and an equipment calibration check. The four test cells used the same basic construction, the same electrolyte (i.e., catalyst) and the same pre-oxidized porous nickel (NiO) cathode. However, three different anode materials were used. Two cells had an electrode surface area of 11 cm^2. Two cells had an electrode surface area of 6.25 cm^2. Cells were designated:

- 1291 (Ni anode)
- 1292 (Ni anode)
- 1293 (Mo anode)
- 1294 (Haynes® 242® alloy anode)

TT cell test data is summarized in Table 3. The four test cells were operated continuously and continue to run at the time of release of this report. The method for "charging" and "discharging" was the same for each of the four cells. Five (5) mA of current is applied to the cell until the voltage reaches 0.8 V. Then the cell is "discharged" at 5 mA constant current until the cell voltage reaches 0.6V or 4 seconds.

With the exception of cell 1293, which required almost no excitation energy to continue generate electricity, the energy gain ranged from approximately 300% to 500%. Average net output power ranged 1-4 mW. This is well within the measurement resolution of the test equipment. This output occurred over more than 26-27 days with a total net energy output at the time recorded ranging from 2-9 kJ. The average output power surface density varied from 0.1 to 0.7 mW/cm^2, where the area is the surface area of the anode in contact with the electrolyte.

Future optimization of cell performance and increasing the electrode surface area by integrating multiple cells into a packaged product should increase the achievable output power to a useful value.

Table 3 - TT Cell Test Data

Cell #	Duration (hr)	Anode Area (cm^2)	Charge Energy (Wh)	Discharge Energy (Wh)	Energy Gain (%)	Average Power (mW)	Net Energy (kJ)	Average Pwr. Density (mW/cm^2)
1291	627	11	0.4016	1.8534	462	2.3	5.2	0.27
1292	634	11	0.1682	0.7707	458	1.0	2.2	0.11
1293	629	6.25	0.0014	2.6386	188,471	4.2	9.5	0.67
1294	648	6.25	0.6503	1.8697	288	1.9	4.4	0.46

4.0 TEST PLAN FOR INDEPENDENT CIHT CELL VALIDATION

Closing discussions focused on development of a test plan for an independent CIHT cell validation effort (Phase II), to be conducted at Technical Team's (TT) facility.

BLP will decide which cell configuration should be tested. The objective of the validation effort is for Technical Team to independently reproduce test conditions and test data.

The ceramics engineer and one other engineer/technician from TT will visit BLP for a period of up to 3 days for hands-on training in all aspects of test cell assembly and experimental setup.

BLP will provide the following equipment for the validation tests:

- Arbin Instruments Tester and associated software
- Eleven (11) test chambers and alumina ceramic crucibles
- Eleven (11) Insulated heaters and rheostats
- Other necessary interconnection items

The Technical Team will provide the following items for the validation tests:

- Argon gas bottle and regulator
- Digital oscilloscope, etc.
- All components and material necessary to construct CIHT cells (inside the alumina ceramic crucible)
- Computers to monitor the CIHT cells using BLP software

When all of the equipment and materials are in place to assemble the CIHT cells and start the validation test, a BLP representative will visit TT to observe the assembly and startup of the tests. Testing will include eleven (11) CIHT cells:

- Five (5) active cells operated under intermittent electrolysis with water vapor
  - Same configuration as Cell # 1291 [10]
- Three (3) control cells operated under continuous discharge without water vapor
  - Same configuration as Cell # 010412GC4 [6]
- Two (2) control electrolyte cells operated under intermittent electrolysis with water vapor
  - Same configuration as Cell # 010312GC1 [6]
  - Same configuration as Cell # 010412GC1 [6]
- One (1) control cell operated under intermittent electrolysis without water vapor
  - Same configuration as Cell # 010312GC2 [6]

A candidate location has been identified that is ideal for the validation testing. See Figure 3. The 11x16 room is inside an analysis lab which has a Scanning Electron Microscope (SEM), scales, microscopes, micro-section tools, work space, and a chemical workstation. The room has good lighting and airflow. Access to the test area will be restricted to a few individuals and secured by a door with a cipher lock.

The cells will be continuously monitored for electrical performance throughout the test period. Testing will be conducted over 1-2 week duration. Near the end of the test period a BLP representative will visit TT to review the TT collected test data and to compare it with BLP collected test data.

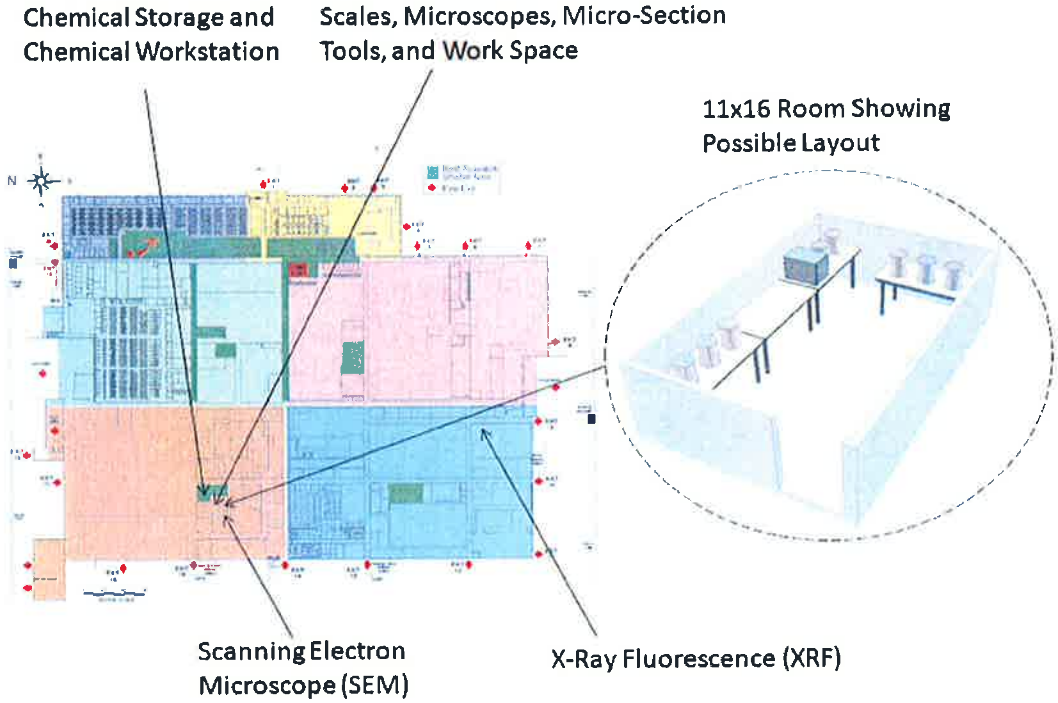

Figure 3 - Candidate Test Location

Material analysis will be performed on cell electrodes prior to and after cell testing. Tests include:

- Visual inspection (up to x500) and image capture (up to x75) of the anode (in-house)
- SEM (photograph and electron spectroscopy) of the anode (in-house)
- X-Ray Fluorescence (XRF) of the electrolyte (in-house)
- X-ray Diffraction (XRD) of the electrolyte (subcontracted)

- Inductively Coupled Plasma Mass Spectroscopy (ICP MS) of the electrolyte (subcontracted)

At the conclusion of the validation tests, all test data and findings will be documented in a test report.