Quarterly Financial and Progress Reports
1 April thru 30 June 2014

AEA Grant Agreement # 7310058
Amendment 1 and Amendment 2

Project Title:
BRI Cyclo-Turbine™ Energy Production

Grantee:
Boschma Research, Inc. (BRI)
138 Lawler Drive
Brownsboro, Alabama 35741

Delivery Date:
31 July 2014

Boschma Research, Inc.
Quarterly Financial and Progress Report
April-June 2014
"BRI Cyclo-Turbine™ Energy Production"

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BRI Quarterly Progress Report 1April – 30 June 2014

Summary

During this Quarter, April through June 2014, BRI completed all requirements for Milestone 1 *'AEA accepts Tennessee River performance test results'* and Milestone 3 *'AEA accepts Deployment/Retrieval Plan'* (Milestone 3 *'Interconnection Plan'* was previously submitted and accepted). We then transported our system from the BRI facility in Brownsboro, Alabama, to Igiugig, Alaska, where it was assembled and prepped for deployment in the Kvichak River.

In April, we addressed generator-cooling issue in the Dry Box by wrapping most of the generator exterior surface with 1/4" copper tubing secured to the generator via high-conductivity epoxy. A pump feeds cooling water to a manifold that distributes it to the four cooling coils. We resumed testing when the Dry Box was reassembled, aligned, and mounted to the revised Power Drive. The generator cooling plan proved to be very effective.

Also in April, testing confirmed complete end-to-end functionality of the power generation and distribution system (generator, wiring, controller, dump load, and grid tie inverters). We installed the Dry Box outboard cover and all external sensors (flow transducers, load cells, and water temperature). The Dry Box assembly was checked for leaks, the load cells calibrated, and all sensors functionally tested.

Other actions in April included:

- Sent 3" Dry Box support tubes out for fabrication
- Bought lumber to build shipping crates for the Dry Box and the Turbine Blades to transport system for Langston, AL, deployment
- Fabricated and installed rolling bumpers with thrust bearings and washers on the Debris Guard
- Built system cables and potted cable ends
- Added 2 red foot pads for additional support under the Dry Box
- Final system integration for Langston Deployment
- Worked on logistics for Langston Deployment: checked on the availability of a 26' U-Haul truck, a camper, and a 2nd boat, visited site to determine best work areas, and received approval for use of state-owned boat ramp

In May, BRI transported the Cyclo-Turbine system via a 26-foot U-Haul truck to Langston, AL, where we assembled, tested, and deployed it for underwater component testing, crew training, and the Milestone 1 Demonstration requirement. A video was submitted to AEA from this deployment: https://www.youtube.com/watch?v=Nu7gjUCXIY4

BRI also submitted documentation entitled, **"BRI Cyclo-Turbine™ Energy Production Milestone 1 Deliverable–Performance Test Results",** which shows deployment activities at Langston, AL.

The system was submerged, without incident, for 72 hours after anchoring on the designated test site. During this deployment, eight submersions/surfacing events were successfully

accomplished. Maneuvering tests were undertaken after launch of the system, and completed when returning the system to the dock for breakdown, packing, loading for return to BRI.

Thrust test was performed that equaled 129V, 10RPM on the Turbine, and 4 Watts.

From the Alabama in-water testing of the Cyclo-Turbine, BRI made two changes to the system: (1) we installed augers that can be deployed without divers on the diffuser section of the Venturi; and (2) we increased the length and volume of the two forward buoyancy pods.

After the successful deployment/demonstration at Langston, AL, AEA authorized BRI to ship the Cyclo-Turbine system to Alaska.

With this authorization, each piece of the system was cleaned with a bleach solution and a pressure washer to ensure that nothing foreign was transported to the rivers in Alaska. All pieces and components were prepared and packed for transport by U-Haul truck to Anchorage, Alaska, and then on to Igiugig.

On Tuesday, June 3rd, the system and all support equipment was loaded into a 26' U-Haul truck and 5'x8' U-Haul trailer for the 4,230 mile trip to Anchorage, Alaska. Drivers for this trip were David Ross and John Horton.

Due to problems at the Canadian border, BRI was unable to meet the timeline to get our system delivered to Homer to ship by barge. So, arrangements were made with Desert Air Alaska to fly the system from Anchorage to Igiugig by DC-3. Two flights were required.

Dave and John arrived in Anchorage on June 14th and made arrangements to deliver the BRI equipment to Desert Air to store until they could transport it to Igiugig.

Three other members of the BRI crew arrived in Anchorage on Monday, June 16th, and because of limited luggage space on the Lake Clark Air flight, many of the crews' suitcases were left with Desert Air to deliver to Igiugig.

When the DC-3s landed at Igiugig, they were unloaded by our crew with assistance from Iliamna Lake Contractors using their heavy equipment and operators.

Components were removed from packing boxes, and the primary frame was assembled on the steep beach area near the boat ramp. The assembly of the system was complicated by rainy weather and swarms of mosquitoes. But, the crew persevered and the assembly was completed several days later.

The Debris Guard was installed forward of the Venturi inlet. Several days were committed to outfitting the Debris Guard with more than 180 tines that are ½" apart. The Debris Guard system is approximately 5 feet high, and each tine had to be adjusted to required tension.

A 20-foot CONEX container was set in place and leveled using 6x6 beams. It will be the Ground Control Station (GCS) for our system, and is populated with necessary hardware and

communication links. The GCS will offer shelter to the BRI crew members who will be monitoring the Cyclo-Turbine system 24/7.

The BRI team includes Rorik Petersen, Associated Professor of Mechanical Engineering, and Phil Evans, Graduate Student from the University of Alaska, Fairbanks. Rorik will make several short trips to Igiugig to monitor and evaluate the system. Phil will remain on-site to support the deployment, and then the 24/7 monitoring of the system, once operational. Two BRI crew members flew home on June 28th after the system was fully assembled.

During the month of June, invoices for support equipment and personnel at Igiugig assisting with the deployment of the Cyclo-Turbine system exceeded expectations -- with more support required in the coming weeks.

Next Reporting Period:

In July, BRI will continue working to deploy the Cyclo-Turbine system in the Kvichak River.

1) Complete the installation of the anchor at Site #6
2) Complete the installation and outfitting of the CONEX-based GCS
3) Complete installation of power and telemetry cables
4) Complete deployment of the BRI Cyclo-Turbine™ at Site #6

Grant Financial Details

Boschma Research Inc. (BRI), AEA Grant Agreement #7310058 was signed on 1 April 2013, and the fully executed agreement arrived at BRI on 4 April 2013.

- An Advance Payment of $120,481 was received by BRI on 16 April 2013
- A 2nd Advance Payment of $118,453 was received by BRI on 24 June 2013
- A 3rd Advance Payment of $104,368 was received by BRI on 30 August 2013

*Grant Agreement Number 7310058, Amendment 1 was signed 3 December 2013

- A 4th Advance Payment of $43,979 was received by BRI on 23 December 2013

*Grant Agreement Number 7310058, Amendment 2 was signed 27 May 2014

- A 5th Advance Payment of $112,877 was received by BRI on 9 June 2014

BRI Financial Details by Month

April 2014

April Invoice Amount:	**$34,717.52**
April Grant Amount:	**$ 0**
April Matching Amount:	**$34,717.52**
- Boschma Matching Labor	$ 3,612.40
- Matching Subs	$ 2,134.00
- Matching Postage	$ 382.83
- Matching Materials	$ 3,580.22
- Matching Labor/Consultant	$25,008.07

1st Advance Payment Balance:	$ 0
2nd Advance Payment Balance:	$ 0
3rd Advance Payment Balance:	$ 0
4th Advance Payment Balance:	$ 0

Expenditures include the cost of labor, materials, and other costs directly associated with fabricating and testing the Cyclo-Turbine system for Igiugig.

April Matching includes all costs incurred this month, including the labor of Jim Boschma and Judy Boschma, to complete the fabrication and shop testing prior to the Milestone 1 demonstration for AEA representatives.

ODCs (rent, utility, phone, etc.) are no longer being charged to the Grant.

May 2014

May Deliverables Submitted:

Milestone 1: AEA accepts Tennessee River performance test results
Milestone 3: AEA accepts Deployment/Retrieval Plan
(Milestone 3: Interconnection Plan was previously submitted)

May Invoice Amount:		**$57,275.50**
May Grant Amount:		**$11,588.40**
- Direct Labor/Consultant	$ 2,647.36	
- Direct Subs (Task 7 LGL)	$ 5,047.23	
- Direct Postage (Task 7)	$ 80.43	
- Direct ODCs	$ 3,330.42	
- Direct Materials	$ 482.96	
May Matching Amount:		**$45,687.10**
- Boschma Matching Labor	$ 7,102.20	
- Matching Subs	$ 850.00	
- Matching Postage	$ 333.52	
- Matching Trvl (Langston)	$ 4,875.67	
- Matching Materials	$ 3,040.71	
- Matching Labor/Consultant	$29,485.00	

1st Advance Payment Balance:	$ 0
2nd Advance Payment Balance:	$ 0
3rd Advance Payment Balance:	$ 0
4th Advance Payment Balance:	$ 0

Expenditures include the cost of labor, materials, and other costs directly associated with fabricating and testing and water deployment of the Cyclo-Turbine system for Igiugig.

May Matching is all costs incurred this month for Task 4, the fabrication and testing of the BRI Cyclo-Turbine, including the labor of Jim Boschma and Judy Boschma.

Task 5 Direct costs of $ 6,897.54 are charged
Task 7 Direct costs of $ 5,127.66 are charged
May Grant Amount: $11,588.40 is included in the 5th Advance Payment request

ODCs (rent, utility, phone, etc.) are no longer being charged to the Grant.

June 2014

June Deliverables Submitted:
Milestone 3: AEA accepts Deployment/Retrieval Plan (updated)
Firearms Safety Plan (for BRI personnel in Igiugig)

JUNE

June Invoice Amount:		**$107,622**
June Grant Amount:		**$ 97,325**
- Direct Labor/Consultant	$28,726.59	
- Direct Subs (Task 7 LGL)	$16,950.33	
- Direct Subs	$ 180.00	
- Direct Postage	$ 441.86	
- Direct ODCs	$25,358.48	
- Direct Travel	$20,103.75	
- Direct Materials	$ 5,564.29	

June Matching Amount:		**$ 10,297**
- Boschma Matching Labor	$9,538.60	
- Matching ODCs	$ 78.45	
- Matching Postage	$ 182.75	
- Matching Materials	$ 497.18	

1st Advance Payment Balance:	$ 0
2nd Advance Payment Balance:	$ 0
3rd Advance Payment Balance:	$ 0
4th Advance Payment Balance:	$ 0
5th Advance Payment Balance:	$3,963.

Expenditures include the labor, materials, shipping, and other costs directly associated with the cleaning, packing and transporting the Cyclo-Turbine system and support equipment to Igiugig, Alaska, to prepare the system for deployment in the Kvichak River.

June Matching is labor of Jim Boschma and Judy Boschma, and final costs associated with the Task 4 Alabama testing of the system.

ODCs (rent, utility, phone, etc.) are no longer being charged to the Grant.

BRI Progress Reports by Month

April 2014

Task 4. Fabricate and Test System

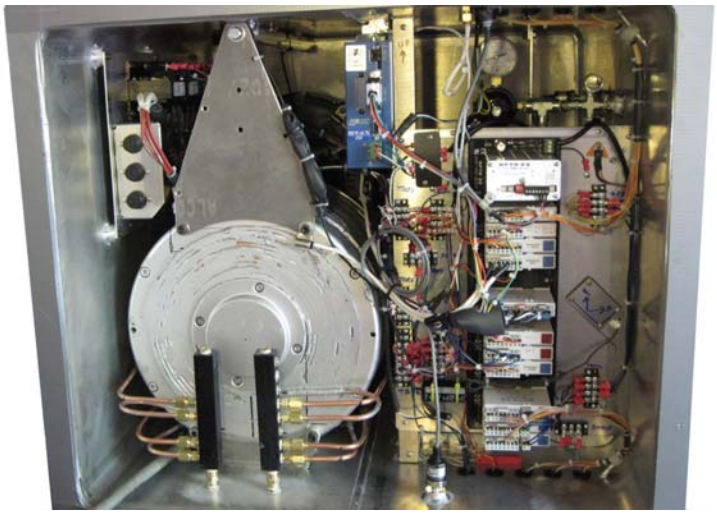
During April, BRI completed the fabrication and testing of the Cyclo-Turbine. We implemented a generator cooling scheme and completed fabrication of the Dry Box mounting components. Most of the generator exterior surface was covered with approximately 180 feet of 1/4" copper tubing to address generator cooling issues. This tubing was secured to the generator via high-conductivity epoxy. A pump feeds cooling water to a manifold that distributes it to four cooling coils.

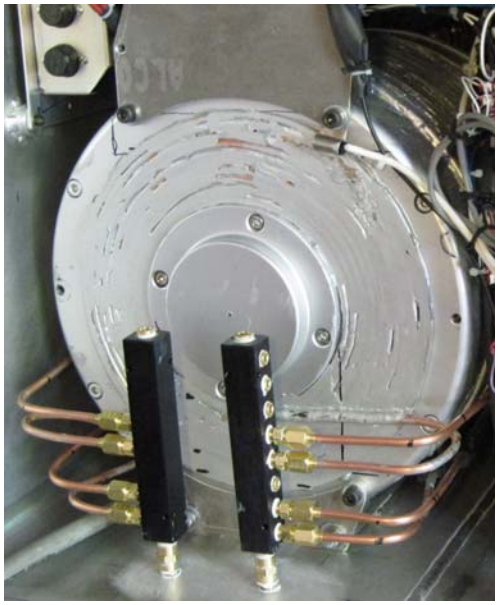
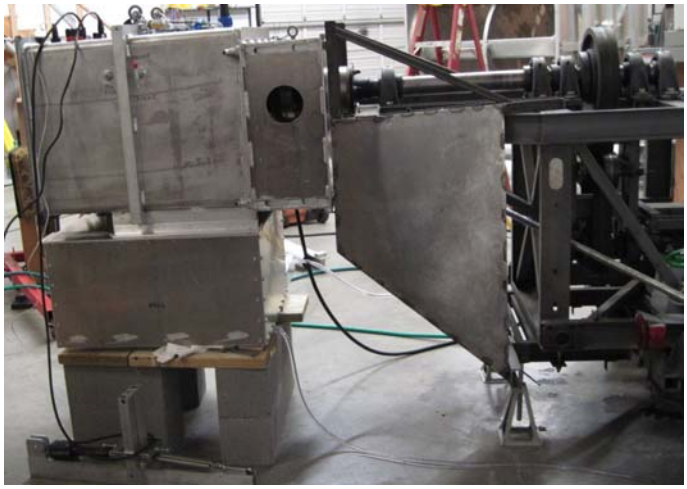
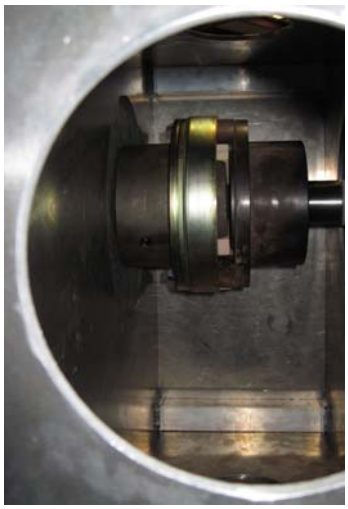
The Dry Box was reassembled, aligned, and mounted to the revised Power Drive. Testing resumed. The generator cooling scheme eliminated the generator heating issue.

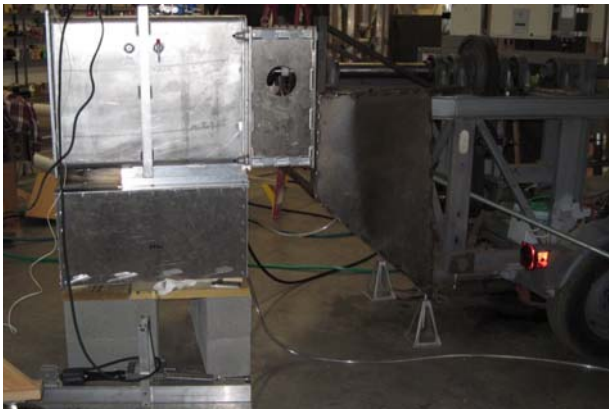
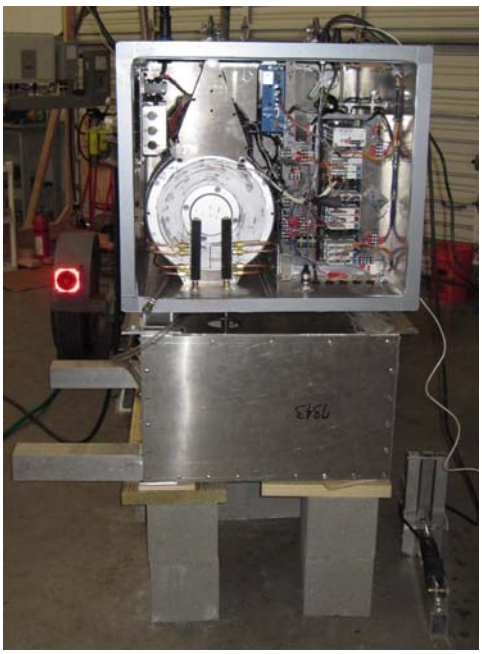
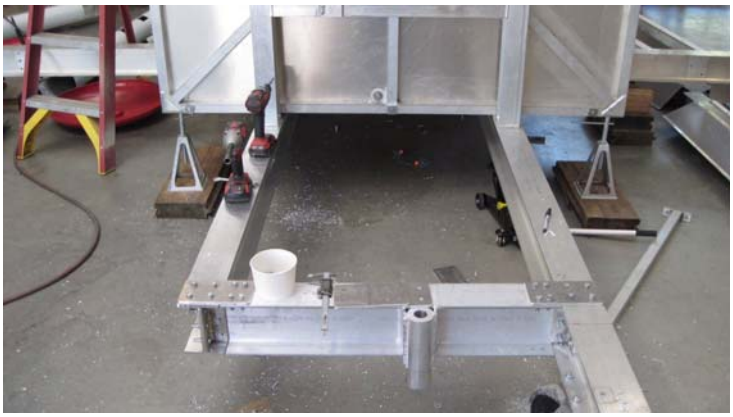
In April, testing confirmed the complete end-to-end functionality of the power generation and distribution system (generator, wiring, controller, dump load, and grid tie inverters). The Dry Box outboard cover was installed and all external sensors (flow transducers, load cells, and water temperature) were installed. The Dry Box assembly was checked for leaks, the load cells calibrated, and all sensors functionally tested.

The Dry Box was then removed from the Power Drive, and aligned and mounted to the turbine box in preparation for Tennessee River system testing in May 2014.

Images of the components and descriptions are provided:

	**Generator with Cooling Scheme Applied** Approximately 180 feet of copper tubing cover the generator ends and barrel.

	**Generator with Cooling Scheme Applied** Detail of inlet manifold (right) and outlet manifold (left).
	**Dry Box on Power Drive** The Power Drive mounting adapter (right) has been made more torsionally rigid by the application of sheer panels. A torque box (center) accommodates the Lovejoy coupling. Both the power drive and Dry Box are now leveled and solidly supported above the shop floor via stands and blocks.
	**Lovejoy Coupling** The Lovejoy coupling can be seen through one of the torque box access holes.

	**Dry Box on Power Drive**
	**Dry Box on Power Drive**
	**Dry Box Mounting Beams** The Dry Box mounts to the turbine box via I-beams.

	Dry Box - Turbine Box Assembly Dry box base and torque box attached to the turbine box.
	Dry Box Installation View looking aft. The Dry Box is being installed on the turbine box.
	Dry Box Installation View looking forward. The Dry Box is being installed on the turbine box.

During April, coordination continued with NASA/Redstone Arsenal for use of their site for the Cyclo-Turbine training and Milestone 1 Demonstration. These discussions became more complex as other government agencies were involved. We may pursue this for future work, but cannot accomplish for the Milestone 1 Demonstration due to the paperwork required for these agencies.

One of the other sites considered for the Milestone 1 Demonstration was Langston, Alabama, which met our requirements water flow and access. This site was chosen for our in-water training, test and demonstration to AEA.

Other activities:

- Sent 3” Dry Box support tubes out for fabrication
- Bought lumber to build shipping crates for the Dry Box and the Turbine Blades to transport system for Langston, AL, deployment
- Fabricated and installed rolling bumpers with thrust bearings and washers on the Debris Guard
- Built system cables and potted cable ends
- Added 2 red foot pads for additional support under the Dry Box
- Final system integration for Langston Deployment
- Worked on logistics for Langston Deployment: checked on the availability of a 26’ U-Haul truck, a camper, and a 2nd boat, visited site to determine best work areas, and received approval for use of state-owned boat ramp

Next Reporting Period:

In May, we will transport the Cyclo-Turbine system to Langston, AL, for crew training, underwater component testing, and the Milestone 1 Demonstration to AEA representatives.

BRI May 2014 Progress Report

Task 4. Fabricate and Test System

In May, we packed the Cyclo-Turbine system into a 26-foot U-Haul truck and transported it to Langston, AL. There, we assembled and deployed it for underwater component testing, crew training, and the Milestone 1 Demonstration requirement. A video was submitted to AEA from this deployment: https://www.youtube.com/watch?v=Nu7gjUCXIY4

BRI also submitted the following document, **"BRI Cyclo-Turbine™ Energy Production Milestone 1 Deliverable–Performance Test Results",** which shows deployment activities at Langston, AL.

The system was submerged, without incident, for 72 hours after anchoring the system on the designated test site. During this deployment, eight submersions/surfacing events were successfully accomplished. Maneuvering tests were undertaken after launch of the system, and completed when returning the system to the dock for breakdown, packing and transport to the BRI facility.

Thrust test was performed that equaled 129V, 10RPM on the Turbine, and 4 Watts.

Cyclo-Turbine system loaded into a 26' U-Haul Truck at BRI Facility

U-Haul Truck unloaded and Cyclo-Turbine assembly underway

Attaching Dry Box

Fully assembled, but on a 'Weather Hold'

Weather Clear: Cyclo Turbine - Fully assembled and Ready to Move

To the Water

'The Brake'

To the Water 2

In the Water

Being towed

Towing upstream

As a result of this in-water testing, BRI made two changes to the system upon return to the BRI facility: (1) installation of augers on the diffuser section of the Venturi that can be deployed without divers; and (2) increased the length and volume of the two forward buoyancy pods.

After the successful deployment/demonstration at Langston, AL, AEA authorized BRI to ship the Cyclo-Turbine system to Alaska.

With this authorization, each piece of the system was cleaned with a bleach solution and a pressure washer to ensure that nothing foreign was transported to the rivers in Alaska. All pieces and components were prepared for transport by U-Haul truck to Anchorage, Alaska, and on to Igiugig.

Next Reporting Period:

In June, BRI will transport the Cyclo-Turbine system to Anchorage, AK, by U-Haul truck and then on to Igiugig by barge or DC-3 (**Task 5. Ship System to Igiugig).**

Also in June, BRI personnel will travel to Igiugig where they will assemble, test and prepare to deploy the Cyclo-Turbine system in the Kvichak River (**Task 6. Set up and Deployment).**

BRI June 2014 Progress Report

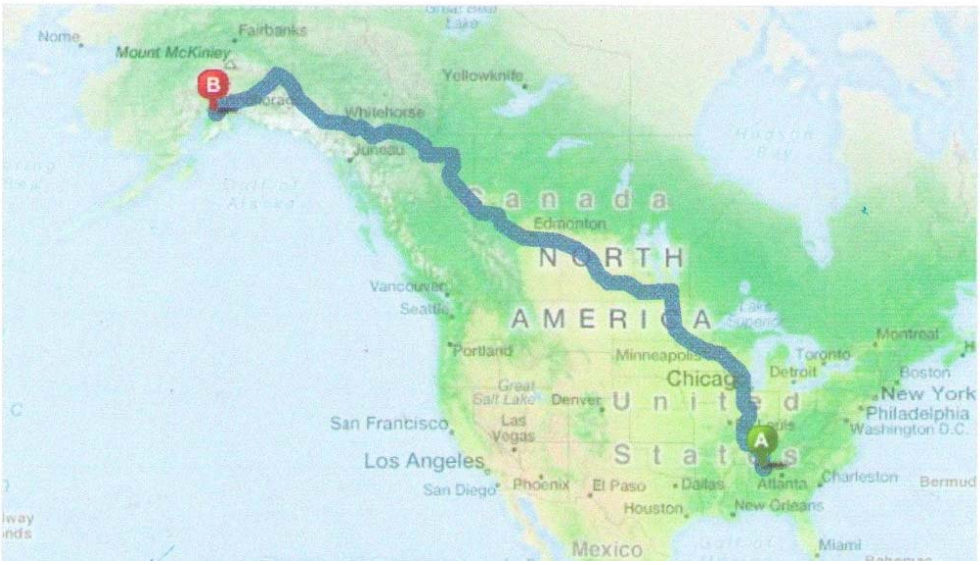
June Deliverables:

Milestone 3: AEA accepts Deployment/Retrieval Plan, 23 June 2014 (updated)
Firearms Safety Plan (for BRI personnel in Igiugig)

In June, the BRI Cyclo-Turbine™ system was transported to Alaska for deployment.

Task 5. Ship System to Alaska

On Tuesday, June 3rd, after each piece of the Cyclo-Turbine system had been cleaned with a bleach solution and a pressure washer, the system and support equipment were loaded into a 26' U-Haul truck and 5'x8' U-Haul trailer for the 4,230 mile trip to Anchorage, Alaska. Drivers for this trip were David Ross and John Horton.



John and David made steady progress across the 'lower 48':
Tuesday, June 3rd, Columbus, Missouri
Wednesday, June 4th, Denver, Colorado
Thursday, June 5th, Billings, Montana
Friday, June 6th, late afternoon – Coutts, Canadian Border - *and there they had a problem...*

John Horton had a traffic ticket in Canada several years ago. This issue had been fully resolved, and all necessary paperwork documenting the event had been filed with the Madison County Courthouse in Huntsville, Alabama. John did not anticipate any problems crossing the border because he had been in Canada several times since the event occurred. But, the border agent on this day stopped them. In order for them to cross into Canada, John was required to provide, to the border agent, the documentation from the courthouse proving that the traffic issue had been resolved. Since they arrived at the border late on Friday, this could not be accomplished until Monday when the Courthouse opened.

Many ideas on how to keep the shipment moving toward Alaska were discussed and rejected. And, in the end, no viable solution was found. So on Monday, John's wife went to the courthouse and spent the entire day getting the documents and faxing them to John.

NOTE: This event at the Canadian border delayed the truck for nearly four days, and ultimately rendered BRI unable to meet the schedule for barge transport from Homer to Igiugig. No delays were anticipated by Mr. Horton when entering Canada. Prior to joining BRI, Mr. Horton operated a Hang Glider business in Canada during summer months and traveled from Huntsville to various parts of Canada. Therefore, he had crossed the border without incident since the legal issue was resolved.

On Tuesday morning, June 10th, they presented themselves to the border agent with documents in hand, and by early afternoon they were on their way. Arrangements had been made previously with Pacific Customs Brokers Ltd to act as our agent at the border. Both truck and trailer were bonded and released for transport across Canada.

On the night of June 12th, 200km south of Whitehorse, Yukon, the U-Haul trailer lost a wheel. During telephone communications with U-Haul, David and John were instructed to leave the trailer clear of, but visible from, the road. They were directed by U-Haul to proceed to Whitehorse, where U-Haul agreed to pay for their lodging. U-Haul would make all arrangements for a tow truck to pick-up the trailer and deliver it to the U-Haul maintenance facility in Whitehorse for repairs. It wasn't until the next afternoon that a wrecker arrived pulling the original tow truck with our trailer on board.

Because of the 'bonded status' of the trailer, U-Haul could not simply provide another trailer and transfer our equipment into it. Therefore, the U-Haul mechanic had to remove the undercarriage from our trailer, and replace it with one from another trailer on the lot – all without breaking the bond on the trailer! This was a tedious and time-consuming operation, but finally the BRI team got on the road again late in the day.

So, their trek across Canada and into Alaska consisted of the following:
June 10th, Edmonton, BC
June 11th, Fort Nelson, BC
June 12th, Whitehorse, Yukon

June 13th, Haines Junction, YT, and on
June 14th, Anchorage, AK

When we knew we would not be in Homer in time to ship by barge, BRI had made arrangements with Desert Air Alaska to fly the Cyclo-Turbine system to Igiugig. So, after Dave and John's arrival in Anchorage, they coordinated with Desert Air for payload storage and transport to Igiugig. During the next two days, the truck crew was busy: paying for previously ordered electrical components from Brown's Electrical Supply (needed to complete the wiring for the 20-foot CONEX Ground Control System in Igiugig for our system); picking up the compressed Nitrogen bottle required for our system from Air Liquide, (prepped for air transport); and picking up the array of broadband equipment from GCI, Inc., as well as the two GCI 'Arctic-Hard' cell phones for use at Igiugig. All items were delivered to Desert Air for transport to Igiugig.

Then Dave and John returned the truck and trailer to U-Haul.

Task 6. Set-up and Deployment

Other members of the team, Mike Ryder (Team Leader), Rob Hines and Andrew Ross, had reservations on a United Airlines flight from Huntsville to Anchorage that was canceled on Sunday, June 15th. So, they had to change their reservations, and they arrived in Anchorage late Monday night, June 16th.

The team managed to complete several additional tasks in Anchorage, including the procurement of required personal safety equipment, before flying to Igiugig on Tuesday afternoon, June 17th, on Lake Clark Air. The five of them settled in at Igiugig and waited for the arrival of the DC-3s. Most of their suitcases were on the DC-3s because of limited luggage space on Lake Clark Air.

The 1st DC-3 did not arrive at Igiugig until Friday, June 20th, due to bad weather. The 2nd DC-3 flight arrived on Saturday, June 21st. The planes were unloaded by our crew with assistance from Iliamna Lake Contractors using their heavy equipment and operators.

Components were removed from packing boxes and the primary frame was assembled on the steep beach area near the boat ramp. Aluminum panels that had been sized to fit inside the DC-3 transport aircraft were unpacked, and then fitted to their place to form the Venturi system. As problems were identified with the task of putting the Cyclo-Turbine system together, solutions were found. The assembly of the system was complicated at times by rainy weather and swarms of mosquitoes.

Assembly of the BRI Cyclo-Turbine™ on the beach at Igiugig

The Debris/Fish Guard was installed forward of the Venturi inlet. Several days were committed to outfitting the Debris Guard with more than 180 tines that are ½" apart. The Debris Guard system is approximately 5 feet high, and each tine had to be adjusted to required tension.

After the Debris Guard was completed and attached to the Venturi, BRI personnel assisted LGL scientist Matt Nemeth in the installation of a required light (positioned as far forward as possible), and cameras on the Debris Guard to record fish activity on and around the system.

Once fully assembled, the Cyclo-Turbine will be tested in the calm water area near the run-out of Lake Iliamna into the Kvichak River. Once deemed ready, the Cyclo-Turbine will be moved down river and installed in a relatively level area within Site 6 after an 11,000 pound concrete anchor is installed, which will secure the Cyclo-Turbine to the river bottom at the end of the anchor cable.

Ground Control Station (GCS)

The Ground Control Station is located in a 20-foot CONEX container. Once on site and leveled using 6x6 beams, it was populated with necessary hardware and communications links. A dedicated Data Acquisition and Control (DAC) system was installed. Hardware, such as controllers, inverters, dump loads, and emergency circuit breakers, was installed. Turbine speed is controlled from the GCS via a data link originating and monitored in the GCS.

The GCS was set up on a bluff above the river. An underwater power cable will be installed between the Cyclo-Turbine and the GCS. A Shark Meter was installed in the CONEX and was interfaced to the local electric power grid. This CONEX/GCS will offer shelter to the members of the BRI crew during the 24/7 monitoring the system.

The photo shows Andrew Ross, electrician, installing three inverters which will change DC current to grid-ready 480 VAC current. (The primary power cables will run from the Cyclo-Turbine resting on the river bottom approximately 35 yards offshore to the GCS.)

Trenching was required for the electric cable from the Powerhouse to the GCS.

University of Alaska-Fairbanks support is being provided by Rorik Petersen, Associate Professor of Mechanical Engineering, and Phil Evans, Graduate Student. Rorik will be making trips to Igiugig to monitor and evaluate the Cyclo-Turbine system. Phil will remain with members of the BRI team at Igiugig to assist with the deployment and daily monitoring of the system.

Jim Boschma was at Igiugig on June 24th and 25th to check on progress being made to prepare the system for deployment.

On Saturday, June 28th, after the Cyclo-Turbine was fully assembled and waiting to be deployed, two members of the BRI crew, David Ross and Rob Hines, flew home. They left Igiugig by Lake Clark Air to Anchorage then got on a United Airlines flight to Huntsville arriving on Sunday, June 29th.

Next Reporting Period:

In July, BRI will continue working to deploy the Cyclo-Turbine system in the Kvichak River.

5) Complete the installation of the anchor at Site #6
6) Complete the installation and outfitting of the CONEX-based GCS
7) Complete installation of power and telemetry cables
8) Complete deployment of the BRI Cyclo-Turbine™ at Site #6

Attachments

BRI Team – Anchorage Details, 2 pages

BRI Firearms Control Plan, 1 page

'BRI … Deployment/Retrieval Plan' 23 June 2014, 18 pages

BRI TEAM – ANCHORAGE DETAILS

NITROGEN
Air Liquide America LP
6415 Arctic Blvd
Anchorage, AK 99518
POC: Scott 907.564.9736
Has Mike Ryder's name and cell phone number
Will have Nitrogen ready for Monday pickup
Need to have an open vehicle to transport it
It should be airplane-ready including HazMat documents. If not, DesertAir will direct you to a company across the street from them that will do prep & HazMat Certification.

ANTENNNA & GEAR
GCI
POC: Joan 907.770.3082
To pick up antenna and other equipment:
GCI Warehouse
4900 Fairbanks Street
Anchorage, AK 99503

PURCHASE 2 PHONES FOR IGIUGIG USE
GCI Store
3120 Denali Street, Suite 5
Anchorage, AK 99503
(Located between Northern Lights and 36th Avenue)
Phones are $69 or $99, basic ruggedized phones (not smart phones)
Month-to-month service: 1200 plan $59.99; 2nd phone $9.99 or
2000 plan $79.99; 2nd phone $9.99;
Unlimited texting is an additional charge, but you should get it.
Choose the phone and the service for Igiugig…

Check on MCMC Order delivered to Desert Air

DESERT AIR ALASKA
POC: Joey 907.243.4700
4001 Old Int'l Airport Road, Unit #9
Anchorage, AK 99502

POCs:

Jamie Boschma	**205.310.0124**	
Bill Price	**907.903.3377 (cell)**	**907.336.1503**
Alan Baldivieso	**907.771.3027**	
Helene Herndon	**907.235.6260 Iliamna Lake Contractors, Homer**	
Jocko, welder	**Iliamna Lake Contractors, Igiugig**	

AlexAnna Salmon 907.533.3211 907.444.5530 (cell)
Christiana Salmon 907.533.3211
(temporarily taking AlexAnna's place while she's on maternity leave)

DesertAir (Joey) 907.243.4700
Lake Clark Air 800.662.7661

LAKE CLARK AIR 800.662.7661
2425 Merrill Field Drive
Anchorage, AK 99502

TUESDAY: Noon Flight; be at Lake Clark Air by 11:30
One-way reservations paid with the BRI credit card
Mike Ryder (they have your phone number)
Rob Hines
John Horton
Andy Ross

WEDNESDAY: Afternoon Flight (1:00 or 2:00 p.m.) check in with them
One-way reservations paid with the BRI credit card
David Ross (they have your phone number)

If you need to change these reservations, call and discuss with them.

BOSCHMA RESEARCH, INC.
Hydrokinetic Energy Development

138 Lawler Drive
Brownsboro, AL 35741
Phone 256.417.6048
Fax 256.417.6037
www.BoschmaResearch.Com
Service Disabled Veteran Owned Small Business

23 June 2014

Firearms Control Plan

Boschma Research, Inc. (BRI) has 2 firearms, and three 3 cans of Bear Spray onsite in Igiugig, Alaska, during our deployment.

The weapons are:

(1) 12-gauge Shotgun with slug ammunition

(1) .44 Magnum Pistol

POC concerning these weapons is Michael Ryder, cell phone number in Igiugig is 907-538-5893.

Michael has been a Reserve Deputy Sheriff with the Madison County Sheriff's Department in Huntsville, Alabama, for the past 5 years. He is an expert in the handling, and use, of firearms.

For the two (2) other people who will be manning the CONEX for BRI, Michael will train them in the use of the shotgun as a last resort against a bear attack.

- (1) 12-gauge shotgun with slug ammunition is in a locked long-gun case. It will be inside the CONEX, which will be manned 24/7.
- The Bear Spray is the 1st line of defense against bear attacks. One (1) can will be available inside the CONEX at all times. The other two (2) cans will be available for people in transit between the CONEX and ManCamp. The 12-gauge is to be used as a last resort against bear attacks.
- The .44 Magnum Pistol will be carried by Michael Ryder as a side arm.

Regards,

James H. Boschma, CEO
Boschma Research, Inc.
Cell phone: 256.694.1483
AEA Grant # 7310058, "BRI Cyclo-Turbine™ Energy Production"

23 June 2014

‘BRI Cyclo-Turbine™ Energy Production’ Deployment/Retrieval Plan

This document describes the Boschma Research, Inc. (BRI) deployment/retrieval plans for the BRI Cyclo-Turbine™ system.

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CYCLO-TURBINE SYSTEM ASSEMBLY PROCEDURES

1. Transport parts from airfield to assembly location
2. Unload and organize parts
3. Lay out main I-beam and attach the red foot pads
4. Install the 10 cross-member I-beams, and install wheels and red foot pads
5. Once frame is loosely put together, square and level system and tighten all bolts
6. Lay out bottom panels with ½ inch shims in place and tighten to base I-beam frame
7. Assemble turbine parts into Turbine Box
8. Install Turbine Box assembly and square up
9. Install Venturi and diffuser side panels
10. Install Venturi and diffuser top panels
11. Inspect all waterproof connectors on Dry Box for damage or signs of leakage
    a. Install generator coolant pump
    b. Check Dry Box sump pump mount and wiring hookup
    c. Install Dry Box (containing generator, gear box, control electronics, telemetry and power cable interface) to Turbine Box side
    d. Verify generator and gear box freedom of motion by rotating the turbine through at least six (6) revolutions
    e. Install all transducers. Double check each transducer mounting bracket for security
    f. Verify clearance for Strain Relief on wire and cables
    g. Check strain relief setups
    h. Exercise emergency shutdown function

12. Install pontoons with all bracing
13. Check for square and level, and tighten all panels
14. Install main bridle to front of system
15. Assemble Debris Guard and attach to Venturi
16. Install all buoys to handling lines and main bridle
17. Install air lift system to pontoons with depth marker lines on four corners
18. Install flow meter instruments
19. Install Debris Guard wire tines and rolling bumpers
20. Check fit of all parts for square, and tighten all hardware
21. Place safety caps on pontoon lift system
22. READY FOR PRE-LAUNCH INSPECTION

GROUND CONTROL STATION (GCS) SETUP

The Ground Control Station will be installed in a shelter, (i.e., a CONEX). Surface-mounted breaker boxes, the disconnect box, controller, inverters, transformers, and dump load will be secured on one side. Two monitors (with Graphic User Interface) will be pedestal-mounted. (In remote sites, electric power can be provided using a gasoline powered generator.) In Igiugig, electric power will be provided through the grid.

1) Install 480 Volt power line into rigid conduit between the GCS terminal box and the shore-mounted breakaway box.

2) Bundle and Install 115VAC and telemetry wires into rigid conduit between the GCS and the shore-mounted breakaway box.

3) Install surface mounted power conversion hardware.

4) Install Primary Power cable interfaced to four pole equipment disconnect.

5) Install 115VAC "shore" power and surface mounted breaker box.

6) Verify 115V power at all receptacles.

7) Power up computers and monitors and verify graphic displays.

8) Hookup Primary Power Cable (480VAC) to GCB-20K Converter in GCS.

9) Ensure that all cables and wires are firmly seated in their receptacle.

Install 'HighVoltage' warning signs at 480VAC access points.

10) Route and install the Primary Power cable, telemetry wires, and 115VAC wires from the GCS to the NEMA break-away box at the river's edge.

11) Double check all receptacles for plug security and strain relief, where appropriate.

12) Verify functionality of "to be demonstrated" software.

13) Verify that all telemetry channels are functioning.

14) Verify blade angle travel, and response to command.

OPERATOR SAFETY START-UP SEQUENCE

1) Ensure all connections are secure and correct
2) Turn on AC circuit breaker to generator
3) AC console and Dry Box power turned 'ON'
4) Load software, and verify that it is operational
5) Open operator interface
6) Adjust pitch angle until RPM are observed
7) System state – click START and verify state is OPERATING
8) Adjust pitch angle until desired RPM are achieved
9) Turn on AC grid power circuit breaker
10) Turn on DC power disconnect
11) Ensure grid tie inverters start up

SAFETY GEAR FOR BOAT AND MAN OVERBOARD PROCEDURES

-Safety Gear: BRI safety gear will include Life Jackets to be worn at all times while on the boats, and ring or horseshoe-shaped Personal Floatation Devices (PFD), with safety lines. Each skiff will have a Long Boat Hook on board.

BRI has 3 Motorola 20-Mile Walkie Talkies, to facilitate communications between personnel.

-Man Overboard Procedures:

We anticipate two skiffs and a tow boat in the water with us during the deployment.

If an individual falls in the water, the following procedures will be followed:

- The person observing this event should **immediately** shout, **'MAN OVERBOARD'**, and *keeping his eye on the victim* in the water, pointing toward the victim's location.

- The Ring or Horseshoe-shaped PFD should be thrown to the victim in the water.

- One of the skiffs should immediately respond by moving toward the victim, slowing the boat as it approaches the victim.

- If the victim is able to pull himself on board the skiff, they will then proceed to shore.

- If the individual is not able to pull himself on board the skiff, then the 2nd skiff will come to their aid. Once the victim is out of the water and on board the skiff, they will proceed to shore for further evaluation of the victim.

SET THE ANCHOR

For the training/deployment exercise in Langston, Alabama, we utilized two (2) 22-pound PLOW anchors for the Cyclo-Turbine. We set these plow anchors in accordance with the manufactures recommendations using our 115hp powered pontoon boat. The anchors were rigged with leads equipped with PEAR loops.

One result of the Langston, AL, training/deployment exercise was a revision of the auger locations. Prior to shipping, we will install an auger on each side of the diffuser. In Igiugig, we will then be able to screw the auger in from one of the support skiffs without leaving the boat.

ANCHOR/MOORING DEPLOYMENT PLAN FOR BRI IN IGIUGIG, AK

The anchoring process for deployment of the concrete anchor used on the BRI Cyclo-Turbine™ at Igiugig, AK, requires the interface of mooring cables in fast current. A reference book entitled, "Chapman Piloting, Seamanship & Small Boat Handling" was suggested to BRI by a member of the US Coast Guard Auxiliary located in Guntersville, AL. This has proven to be an excellent safety resource for line handling and mooring of our system.

The mooring anchor at Igiugig is a large slab of concrete weighing approximately 11,000 pounds with dimensions of 20' in length, 4' width and 10" thick. It has been fitted with two (2) 1" diameter eyebolts on one end of the slab fitted through pre-lined, heavy wall tubing prior to the final concrete pour. Each eyebolt will be shackled to a bridal that will distribute the load to the first 100' feet of stainless steel single anchor line leading to another 100' stainless steel cable attached to the device on the down-river side. (200' of cable total from anchor to device.) The up-river side of the concrete slab has been fitted with similar eyebolts that are also used to attach a 1" steel "L" type plate. One side of this plate is bolted to the concrete slab and the other side of the "L" extends down into the river bottom 16". In the unlikely event that the slab would begin to slide along the bottom of the river in a fast-moving current, the "L" plate will dig in and arrest the movement immediately.

The concrete slab was originally designed and fitted with side lifting hooks and cables. There are four (4) of these side-lifting devices on the slab located 5' from each end. A bridal system will be used to lift the concrete slab off of the flex-float with an excavator. The slab will be lowered into the flow of the water. Once the slab has been lowered to the bottom of the river, a buoy will be attached to the lifting bridle for slab removal upon completion of the project. A second buoy will be attached to the down-river end of the 100' cable to facilitate the attachment of the device.

The device will be towed to the deployment destination by a 100' mooring cable with a bridle attachment between the towing vessel and the device. Once in position, the load will be transferred from the towing bridle to the mooring bridle. The responsibility of the load transfer will be determined after Mike Ryder (BRI Lead) and the Vessel Master have discussed this procedure. One option is to transfer the load from the towing vessel and another option is to do the transfer from a skiff.

Each of the BRI contractors is equipped with US Coast Guard Approved floatation safety vests, and reflective vests, hard hats, safety glasses and safety toed boots.

A detailed briefing to all personnel involved will be conducted prior to the anchor deployment.

TOW TO DEPLOYMENT SITE

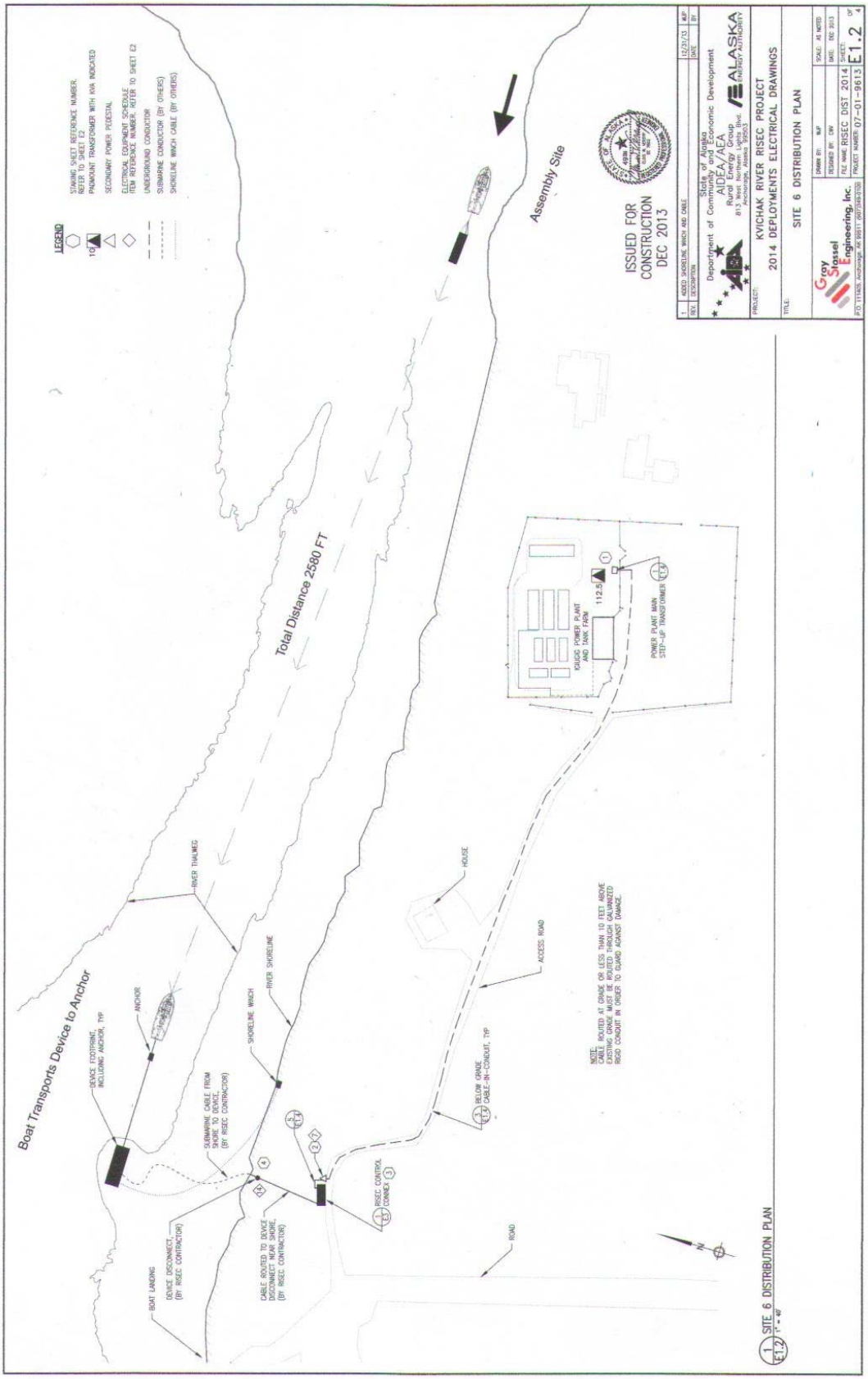
In Igiugig, a 32' fishing boat and crew will conduct tow and support hookup to anchor the system.

1) Coordinate towing plans. The towing plan will be coordinated with all participating BRI team members and with the tow vessel captain/crew prior to execution of the plan. Line handling during the transfer from the tow boat to the anchor will be conducted in accordance with the book, 'CHAPMAN PILOTING, Seamanship & Small Boat Handling'.
2) Safety is paramount when making the connection between the PEAR-shaped cable end coming from the Anchor and the PEAR coming from the Cyclo-Turbine. The team will be trained to use the Coast Guard recommended procedures to hookup hardware, and the hardware will be inspected for condition and function, prior to implementation.
3) Orient the tow-ready Cyclo-Turbine with bridle cable pointed at an angle of about 15-30 degrees toward the oncoming flow. This will allow the tow boat operator to avoid slack lines as the Cyclo-Turbine enters the water.
4) The tow boat will proceed in an up-stream direction until established in the Thalweg, then maintain steerage while navigating stern-first down the Thalweg to a site from which the tow boat can maneuver to the pre-set anchor (see Map 1 for proposed Igiugig Deployment, page 11).
5) Once the Cyclo-Turbine is down-river of the mooring site (about 2600 feet from the assembly point), the tow boat will power up and maneuver the Cyclo-Turbine so that the Bridle cables' PEAR Loop is held over the Anchors' PEAR loop (see photo).

6) The tow vehicle crew will install clevis pins to lock the anchor cable and Cyclo-Turbine Bridle cable.
7) The tow vehicle will then slowly back out until all the load is transferred to the Anchor.
8) The tow boat crew will then release the tow cable from the tow boat and place a marker buoy on the cable. The tow boat will then be released by the BRI team.
9) Once the interface is verified, the skiff(s) will recover any tools or residual materials and then withdraw.

STAY CLEAR OF THE TOW BOAT AND SKIFF(S) WORKING ON SITE!

10) Install flank augers using the auger tool. Attach and ensure buoys are visible
11) Using the underwater camera, inspect augers and straps for condition and proper tension.


LEGEND
STAKING SHEET REFERENCE NUMBER. REFER TO SHEET E2
PADMOUNT TRANSFORMER WITH KVA INDICATED
SECONDARY POWER PEDESTAL
ELECTRICAL EQUIPMENT SCHEDULE ITEM REFERENCE NUMBER. REFER TO SHEET E2
UNDERGROUND CONDUCTOR
SUBMARINE CONDUCTOR (BY OTHERS)
SHORELINE WINCH CABLE (BY OTHERS)
Assembly Site
Total Distance 2580 FT
Boat Transports Device to Anchor
DEVICE FOOTPRINT, INCLUDING ANCHOR, TYP
ANCHOR
RIVER THALWEG
SHORELINE WINCH
RIVER SHORELINE
SUBMARINE CABLE FROM SHORE TO DEVICE, (BY RISEC CONTRACTOR)
BOAT LANDING
DEVICE DISCONNECT, (BY RISEC CONTRACTOR)
CABLE ROUTED TO DEVICE DISCONNECT NEAR SHORE, (BY RISEC CONTRACTOR)
RISEC CONTROL CONNEX
ROAD
BELOW GRADE CABLE-IN-CONDUIT, TYP
ACCESS ROAD
HOUSE
IGUGIG POWER PLANT AND TANK FARM
POWER PLANT MAIN STEP-UP TRANSFORMER
NOTE: CABLE ROUTED AT GRADE OR LESS THAN 10 FEET ABOVE EXISTING GRADE MUST BE ROUTED THROUGH GALVANIZED RIGID CONDUIT IN ORDER TO GUARD AGAINST DAMAGE.
SITE 6 DISTRIBUTION PLAN
ISSUED FOR CONSTRUCTION DEC 2013
State of Alaska Department of Community and Economic Development
AIDEA/AEA Rural Energy Group
ALASKA ENERGY AUTHORITY
KVICHAK RIVER RISEC PROJECT
2014 DEPLOYMENTS ELECTRICAL DRAWINGS
SITE 6 DISTRIBUTION PLAN
Gray Stassel Engineering, Inc.
PROJECT NUMBER: 07-01-9613
E1.2

WIRE INSTALLATION

Wiring from the Cyclo-Turbine to the Ground Control Station (GCS) includes a primary power cable (480VAC) and a shielded telemetry run bundled with an 115VAC cable.

The 480VAC line will be weighted to the river bottom and routed into a Rigid Conduit near shore, then into a shore-located NEMA box with emergency breakaway capability.

The telemetry and house power lines will be weighted and routed from the CYCLO-TURBINE to a separate conduit and then into the NEMA box onshore. All lines are potted; thus, lines must be unreeled from the Cyclo-Turbine to the shore. Once in shallow water, all the lines must be installed into Rigid Conduit and terminated in the NEMA box onshore.

The primary power line must be the sole conductor in one conduit. The other lines will be bundled in a separate conduit that also terminates in the NEMA box.

Use Caution: HIGH VOLTAGE!

1) Make sure that 'Strain Reliefs' are installed and cables are clear of obstacles. Wires must be weighted with 10-inch REBAR segments every 6 feet.
   a. Reel out the Primary Power marine cable and the telemetry and housekeeping power lines. Install rebar weights and at each 6 foot interval. As the cable reaches shallow water, it must be installed in rigid conduit for a distance (TBD) before it reaches shore. The rigid conduit and cable will terminate in a pole-mounted NEMA break-away box placed on the shore. The team electrician will make the connections.
   b. The second cable for prime power, telemetry and housekeeping functions will be also be installed in a rigid conduit and routed from the NEMA box to the GCS. The team electrician will make all connections and verify conductivity between the GCS and the Cyclo-Turbine.

CAUTION: Ensure that the Turbine is not rotating during installation or removal of the primary power line!

DRY BOX ACTIVATION

1) Power up Graphic User Interface monitor.
2) Power up Data Collection monitor.
3) Check Nitrogen pressure.
4) Purge Dry Box, and return Nitrogen to selected pressure.
5) Check for pressure leaks using soap spray.
6) Using checklist below verify that all transducers are reporting:
    a. Turbine blade angle
    b. Port load cell - online
    c. Starboard load - online
    d. Turbine RPM
    e. Flow velocity (Ambient)
    f. Flow velocity Inlet
    g. Flow velocity Turbine box
    h. Flow velocity Diffuser
    i. Nitrogen (N2) volume
    j. N2 pressure
    k. N2 added
    l. External water pressure
    m. Current – Amps
    n. Voltage – Volts
    o. Power – Watts
    p. Generator temp – C
    q. Gear box temp – C
    r. Ambient temp - C
    s. Ambient flow – Meters/sec
7) Demonstrate telemetry functions and housekeeping displays.
8) Demonstrate blade angle of attack (AoA) change.
9) Demonstrate emergency stop function.
10) Demonstrate power conversion from generator output to Grid Ready 3-phase AC power.

SUBMERGED OPERATIONS

1) Install **Danger High Voltage** warning marker buoys.
2) Flood pontoons.
3) Adjust red foot pads to level system.
4) Set foot pad augers using gas powered auger driver from surface.

NOTE: The system will be launched from shore or a ramp and towed to an anchor point located in 8-10 feet of water. The Venturi will be oriented into the ambient flow, the ballast will be expelled and the turbine will settle onto the bottom.

The bridle loop will then be mated to the primary anchor lead by the skiff's crew. The system will be secured from cross-flow movement with straps and augers. (A skiff will be used during the Milestone 1 Demo to support the anchoring of the Cyclo-Turbine.)

FUEL BARGE AVOIDANCE - IGIUGIG

The Cyclo-Turbine may be required to relocate from its mooring site to avoid propeller strike on mooring cables from the Fuel Barge arriving at Igiugig.

GPS data show a history of barge maneuvering in the vicinity of the Kvichak River at Site 6 (depicted on RISEC Distribution Overview, #07-01-9613). Occasionally, a Fuel Barge must dock at unprepared sites northwest of the community's fuel tanks. These barges often drag bottom, and incur propeller strikes on the bottom, as they maneuver to a position near the tank farm.

Site 6 is a prime site for operating a HydroKinetic power generation system, such at the Cyclo-Turbine. However, the Cyclo-Turbine provides power through a 3-phase marine cable that is weighted so that the cable hugs the bottom. It may therefore be vulnerable to a barge propeller strike.

The mooring line used to secure the Cyclo-Turbine is a high strength AMSTEEL line that extends 300 feet from the anchor's PEAR loop to the Cyclo-Turbine's PEAR loop.

If a Fuel Barge approaches, BRI will first **SHUT DOWN THE GENERATOR.** Skiff and crew are deployed to remove the screw anchors located on the leading edge of the Venturi section. We will pump air into the Cyclo-Tubine's pontoon buoyancy tanks to make the system slightly buoyant. We will then hook an AMSTEEL line from our on-shore winch into the Cyclo-Turbine's PEAR loop and pull the Cyclo-Turbine toward shore. The PEAR loop will allow the Cyclo-Turbine to maintain an orientation into the ambient flow.

Additionally, we will have our crew members in two skiffs to maneuver the power lines to avoid problems during the relocation. When the Cyclo-Turbine reaches shallow water near the shore, we will put augers in to secure the Cyclo-Turbine's position until the Fuel Barge 'danger' has passed. We will then relocate the Cyclo-Turbine to the original mooring site. During the survey in 2013, the riverbed at Site 6 was surveyed and found to be relatively flat with few obstructions in the area where we plan to moor.

The sequence of events to achieve relocation and temporary off-site mooring is described here:

1) Shut down the Turbine by commanding all blades to zero AoA
2) Inspect mooring cable and flank augers for damage
3) Hook up the BRI AMSTEEL winch line (350 feet length) to the PEAR ring on the Cyclo-Turbine.
4) Remove flank augers using auger tool.
5) Make the system slightly buoyant.
6) Pull the Cyclo-Turbine at a low velocity to shallow water near shore.
7) To relocate to original site:
    a. Make the Cyclo-Turbine buoyant.
    b. Slowly out-reel AMSTEEL lines allowing the Cyclo-Turbine to align itself over the original site.
    c. Once over original site, dump buoyancy and settle onto the riverbed.
    d. Install augers and lines.
8) The above procedure will be used for maintenance also.

RECOVER THE CYCLO-TURBINE SYSTEM

Recovery after the Cyclo-Turbine Igiugig deployment will be conducted in a similar manner to Fuel Barge Avoidance procedures.

We intend to tow the system to either the new Barge Landing Ramp or to a site nearby. We will then disassemble the system, and load structural components into a CONEX container. The Turbine and other key parts will be further dismantled and examined for wear and tear. The system will either stay in Igiugig or BRI will arrange transport.

A Final Report of findings will be provided per the Grant Agreement.

BRI DEPLOYMENT PERSONNEL

This team has worked together on numerous successful developmental projects of similar complexity over the past 10 years.

JIM BOSCHMA, CEO
MIKE RYDER, Sr. Technician/Operations Director – Igiugig Deployment
ANDY ROSS, Technician (Electrical)
ROB HINES, Sr. Welder and Technician

DAVID ROSS, Technician/Fabrication Supervisor
JOHN HORTON, Technician (Mechanical) (Engine)

David Ross and John Horton will drive a 26-foot U-Haul truck and 5'x8' trailer to transport the BRI Cyclo-Turbine™ system to Anchorage, Alaska. The system will be delivered to Igiugig by DC-3 from Anchorage to Igiugig.

Mike Ryder, Andy Ross and Rob Hines will fly to ANC and the five of them will fly to Igiugig to be there when the system arrives to unpack, assemble and deploy it.

Mike Ryder and Andy Ross will stay in Igiugig during the deployment. Phillip Evans, a graduate student from University of Alaska–Fairbanks will also stay on-site during the deployment. Rorik Petersen, an Assistant Professor at University of Alaska-Fairbanks, is providing support to BRI and will be in Igiugig periodically to assist the team, as will Jim Boschma.

Igiugig will also provide an individual for general maintenance support as part of the In-Kind Matching.