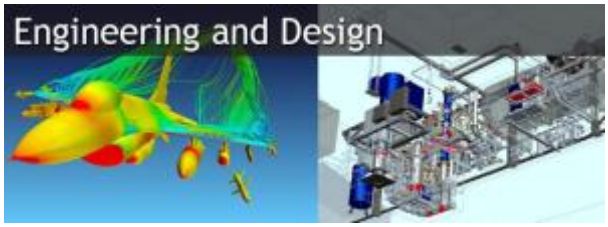
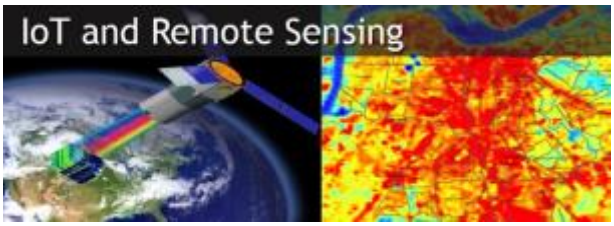
Desert Research Institute Applied Innovation Center

Quarterly Progress Report

Reporting Period: Oct 1st to Dec 31th, 2016

February, 2017





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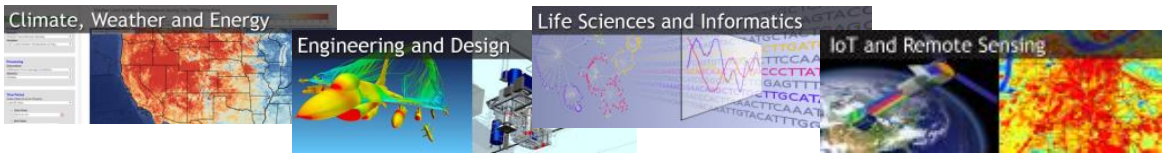


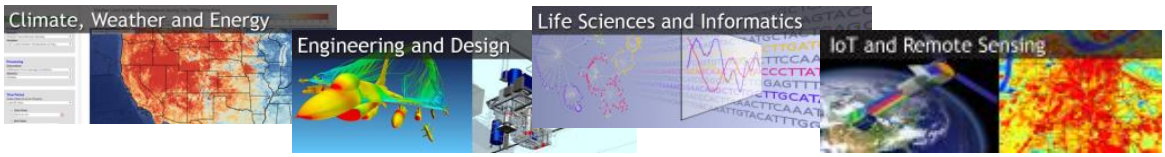
Project Purpose

The Applied Innovation Center at DRI is a Knowledge Fund sponsored start-up in the data and analytics space. We leverage the intellectual capital of more than 100 DRI faculty and 60 years of environmental science research to focus on four main areas of applied research: Climate, weather and energy nexus; Internet of things and remote sensing; Engineering and design, and; Life Sciences and informatics. From these 4 core areas we are able to: 1) Build platforms (hardware and software) for industry; 2) leverage these platforms for sponsored projects; 3) Create jobs; 4) write new and more competitive grants, and; 5) build or help build high tech companies in NV.

These activities encompass 6 of the 7 core KF Metrics and 3 of the 5 secondary KF Metrics. In Q4 2016, the AIC expanded on the largest community health project in the US in partnership with Renown Health and supported by the personal genetics company 23andMe. The success of the launch and the subsequent Q4 rollout was due to more than a year of work between the AIC and Renown Health: building the data security infrastructure, addressing HIPAA and other compliance needs and designing a study that has tremendous potential for NV in areas of data science, population health and biotech.

In Q4, the AIC was 15 FTE strong (7 FTE with KF support down from 8 in Q3). We are focusing intensively on leveraging work at DRI that we identified as having a need in industry and building a portfolio management approach to applied research development. We are building two new pieces of instrumentation and software for high throughput data collection in the climate/weather/energy nexus. In the IoT/Remote Sensing space we continue to develop technology and know-how in transportation data analytics, tracking and visualization. In the engineering and design space we are upgrading our technical capabilities around highly distributed file systems and database design and in machine learning.

In Q4 we expanded proof of concept work in our weather intelligence platform with two companies in the private sector. We began developing business relationships in the IoT space and in water monitoring – the latter in collaboration and guidance of KF's WaterStart.



Section I: Proposal Progress

During the reporting quarter, the AIC continues to make progress toward meeting proposed metrics. Major accomplishments for the current reporting period include:

1. **Urban weather intelligence for the energy industry**.
   The development of the WINDS platform continues with further development of our IP portfolio.
2. **Architecture improvements for data storage, parallel processing, analytics and visualization.**

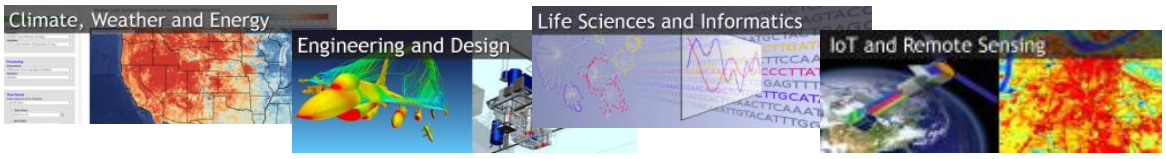
   The AIC is becoming a northern Nevada leader in building efficient and rapid back-end computer systems for the processing of large data sets and structures. We developed a Hadoop Distributed File System (HDFS) for data storage and parallel processing of weather data. We implemented a Mongo-DB non-relational database for data analytics and visualization. All of these technologies can be used in our development of weather related and health care related business opportunities. As well, this expertise will be important in developing further collaborations with other NSHE institutions and KF projects.
3. **Strategic development of an applied research institute in health data science with Renown Health.**

   One of the major objectives of Renown Health's strategic plan is to improve population health in Northern Nevada. In part, this requires access to top care and top medical facilities. Another part is modern health data science analytics and statistics. AIC is working to leverage our expertise in data analysis and programming to improve patient outcomes. In Q4, we worked on the following:

   - Recruited research participants in the study. The initial proposal was to recruit 5,000 people – we exceeded that target in 1 day and expanded the study to 10,000. In Q4 we recruited and completed the study enrollment and sample collection of 9700 Nevadans.
   - Began to build national level awareness around Northern Nevada's population health research including the submission of new NIH proposals, a $100m MacArthur Grant and conversations around research partnering around the US by speaking at international meetings such as the American Society of Human Genetics.

4. **Strategic development of IOT sensor networks for data assimilation and smart metering.**
   Sensor networks are a key component for weather forecasting – especially as predictions require more granularity and all overlaid on other data sets (such as energy meters). The AIC is working on sensor networks for live weather data assimilation into models that generate more accurate weather forecasts. As well, we are supporting the development of an IOT-enabled water meter-reading device to enable real-time water usage monitoring by consumers and utility providers

5. **Commercialization / Partnering**
   The AIC partnered and met with numerous companies in Q4 across the following sectors: mining, visualization, weather, energy, biotech and healthcare.
6. **Intellectual Property**



No new IP was disclosed in Q3.

Disclosures

The IP disclosure related to the WINDS platform

Applications

System for the controlled manipulation of single-celled organism physiology and bioproduct production	Grzymski and Staub	instrumentation and method	In revision Provisional patent
System and method for a specific military application	Decker and Grzymski	design and process	submitted 24 Oct 2016.

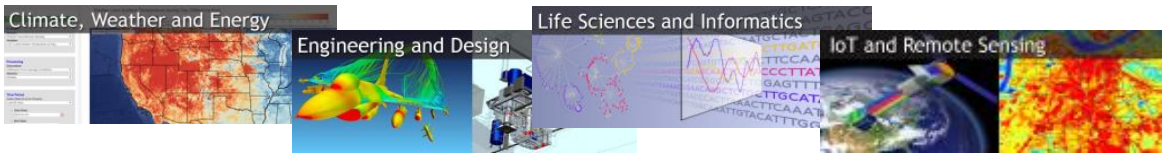
Issued

7. Programmatic & Project Changes

[Section is reserved and will be used only if needed. Summary of material changes to project scope and mission, e.g. addition or removal of job roles, any unforeseen needs, changes in budget, or other material changes in direction]

8. Looking Forward

We remain optimistic about the AIC and are growing and adding jobs to DRI and Nevada – consistent with the overall goals of the KF. We anticipate doubling the size of the AIC since it was first formed by June of 2017. We expect to meet the goals defined by Director Steve Hill to be no more than 30% reliant on state funds by the 5th year of our existence. We are accelerating our plans to implement a "Fraunhofer" style-funding model within the AIC as well as developing a new Applied Research Center with Renown Health – this new Institute will be legally codified in Q1 2017.



Section II: Performance

Table 2: Progress Toward Metrics

Knowledge Fund Report Metrics

Primary Categories	Q4 2016	Q4 2017	Q4 2018
Companies Moved to NV	N/A	0	1
Start-up companies	1	2	3
Jobs Created	3	10	20
IP Licenses	1	2	5
IP Revenue	0	$200,000	$330,000
Grants Received/Affiliated	0/0	$500,000	$1,000,000
Sponsored Research (Contracts/$)	3/$1,300,000	$1,250,000	$1,500,000
Secondary Categories			
Patents (Filed/Awarded)	1	2/0	2/1
Students placed with Companies	N/A	N/A	N/A
Impact Faculty Hired	0	2	2
Gifts/Donations to KF Projects	N/A	N/A	N/A
Student Internships	2	4	5

Notes: All Values are for booked amounts in Q3.

Start-up Companies:

Desert Research Corporation. In Q4 the DRC developed WINDS commercialization relationships. It also booked modest revenue with a company in the mining space.

Jobs Created:

Since AIC inception there have been 13 jobs created. In Q1 we will be increasing hiring again as the new Renown/DRI partnership is budgeted and implemented.

Intellectual Property Licenses:

Development of 2 new instruments are on-going which will lead to IP and revenue

Intellectual Property Revenue:

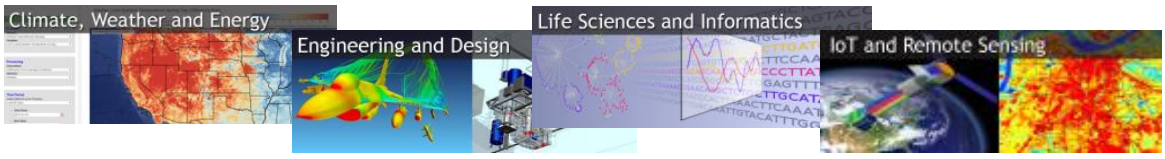
Revenue from the WINDS platform, from mining work and from health data science innovation is projected for Q1.

Grants received:

Since inception the AIC has received $442,996 worth of research grants directly and ~$750,000 as co-PIs or as SMEs. In Q4 we booked another $50k in grants. We submitted more than $104m in new grants in Q4 – the largest was a $100m MacArthur Foundation grant.

Sponsored research:

AIC and DRI did sponsored research with a NV mining company, EMS Genomics and Renown Health in Q4.



Impact Faculty hired:

We are searching for another faculty member.

Student Internships:

2 Student interns were working in Q4.

Section III: Budget

AIC General Salary in Q4 supported 8 FTE including the senior director, business development leader, 1 technical leads, 3 programmers, 2 post-docs and 1 faculty member. The Renown Health project supported approximately 4 FTE. In Q4 the expenditures will remain flat as we continue to work intensively on the Renown Health work.

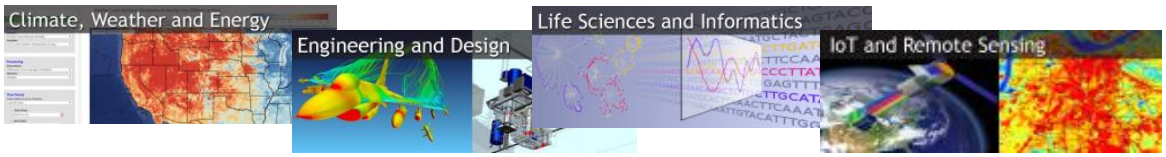
Asset and faculty development increased with the push to launch WINDS and develop some new capabilities. We expanded our expertise and assets in IOT, we sponsored the building of a new spectrometer which is in the final stages of proof of concept. We contributed to the development of new techniques for modeling pollution and water usage. We built out the infrastructure necessary to launch the commercial version of WINDS and are expanding our health and genetics data storage and analysis capacity.

AIC Expenditures

For Reporting Period

Sep 30 – Dec 31, 2016

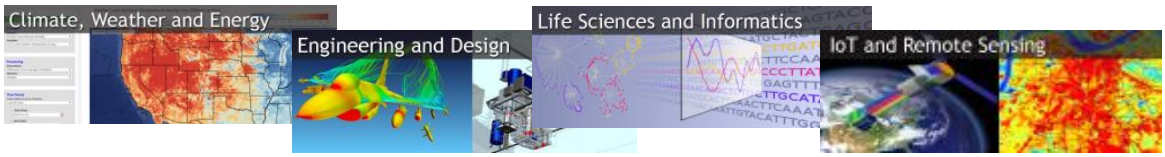
	Q4 actual Current period	To Date Phase II inception to date April 1, 2016 – Dec 31, 2016	Q1 estimate Jan 1-Mar 31, 2016
AIC General Salary	$285,772	$931,287	$300,000
AIC Operations	$30,733	$53,997	$15,000
Total	**$316,505**	$985,284	**$315,000**



AIC INCOME For Reporting Period Sep 30 – Dec 31, 2016			
	Q4 actual Current period	**To Date** Inception to Date April 1, 2016 – Dec 31, 2016	**Q1 estimate** Jan 1-Mar 31, 2016
Federal Grants / Contracts	$19,348	$439,344	$36,348
Private sector Contracts	$286,368	$434,020	$300,000
IP Revenue	$-	$-	$25,000
GIFTS	$-	$-	$-
Other Contributions	$-		
Knowledge Fund	$-	$-	$-
Total	**$305,716**	**$873,364**	**$361,348**

Section IV: Appendices

Monthly Reports
BD pipeline (by sector, company names removed)



AIC monthly report

October 2016
Business/project development General activity
Business/project development
Joe: Ordance passivation meeting Media Day Health Pop study ASHG Planning meeting AMG Genetics meeting Meet with Greg Massey NIH R21 proposal submission ASHG CME planning One River Grants-long term pop health funding
General Activity
Brian met with UAS cloud-seeding team to discuss commercialization and water enhancement summit
Brian :participated in the DRI Foundation meeting Finished the first WINDS executive summary slide deck for WINDS Forwarded the summary to 9 venture funds/investor houses Expanded operating model for a proposed weather forecasting business Constructed 2 page proposal for securing low-latency cloud framework on DRI campus Sent soil science starter program proposal to DRI scientists
Brian developed near-final draft of Work-Order for NexRF Met to discuss NexRF joint venture Discussed the integration of GIS layer(s) with Tim MInor and WINDS staff
Ming : WRF running smoothly on AIC cluster Disclosure of WINDS is done. HBASE ingestion is tested on Rajat's virtual machine. Submitted joint postdoc proposal Reviewed NexRF Context Aware Relevance Engine design document. Wrote and tested Python scripts for MySQL database setup for water meter project.
Ming: discussed proposal idea for NSF Partnerships for Innovation: Building Innovation Capacity - Smart Service Systems
Brian had meeting to discuss DRIVE theater function/reliability for mining education

AIC monthly report

Brian expanded WINDS summary slide deck to an investor deck
Brian had discussion about WINDS investor marketing
Brian began search for investor relations and PR support
Brian finalized collaborative agreement and awarded DRI a contract
Brian visited WWG to discuss DRI weather platform collaboration
Brian: update call with Ken Ladd to discuss business development Call with Henry Sun to discuss soil health science program Meeting to discuss term sheet strategy and elements Meeting discuss financial transaction support Call with NV State agricultural pathologist to discuss fungal issues in NV agriculture Teleconference to discuss fund-raising and corporate finance Discussed grant writing opportunity
Joe: Several meetings (including virtual reality meeting) with Pop Study health participants

AIC monthly report

November 2016

Business/project development
General activity

Business/project development

Joe: Health IHI work
a. Grant writing
b. Funder's forum
c. Legal/compliance work
d. Presentations to DRI and Renown Health boards

Spoke with consultant
AIC Conf call GOED
Call with logistics
Meetings

General Activity

Ming: Validated water meter software build on Raspberry Pi 3.
Decided the minimum viable product is to put the water meter gadget on utility truck.
Architected the software for this minimum viable product.
PFI-BIC proposal is not a go.
Raspberry Pi GUI development for automatic meter reading on utility truck.
Integrate TFT touch screen on Raspberry Pi.

Brian :Working on investigation of connecting DRI infrastructure to regional fiber networks
Several teleconferences conducted
Presented AIC projects to NCET visitors
Met with DRI soil science team to discuss building pilot program
Met with a legal team

Brian worked on the identification of weather forecast customers
Worked on development of commercialization content for weather business

Brian had 2 discussions on low latency compute business opportunity and weather modification business development

Brian had teleconference to discuss commercial posting of WINDS
Met to discuss weather forecasting
Met to discuss Knowledge Fund projects, development of an entrepreneurial partner ecosystem in northern NV, and emerging WINDS platform

AIC monthly report

Brian attended conference in San Francisco
Jim: Engaged on genetics software for SNP analysis Completed a list of clinical/researcher project candidates Traveled to Winnemucca to collect DNA samples Worked on delivering a proposal for women's health. Computed all numeric summaries for a cohort of 150,000 women. Procuring Nevada death certificate data in order to perform statistical survival analysis Continued interrogation of the healthcare data Investigating HIPAA rules as they relate to GIS mapping Working on a project analyzing Epi-pen utilization over time
Ming explored potential collaboration on geoinformatics with a geochemist
Ming: Building Tk GUI for automatic meter reader. Integrate TFT touch screen on Raspberry Pi. Weighing on whether to pursue MRI proposal
Jim: Discovered a similar genomics study in Michigan merging healthcare records with genomics. Helped host engineering team so they could see how the study actually collects data from participants. Geocoded all patients in the database. Continued immersion in Epic health care record system Getting Esri installed on the server for GIS mapping Working with pediatric clinician looking at lung, heart and prematurity issues
Brian teleconference with several members of a labs to discuss weather forecasting Teleconference to discuss cloud computing collaboration Teleconference with sales representative to discuss their wind and weather forecasting service Meeting to discuss deal structure options intended to underlie collaboration
Jim assessed air quality vs. prematurity of infants diagnoses Investigated asthma and air quality diagnoses in Truckee Meadows Learning about thunder asthma and how weather can trigger it

AIC monthly report

Ming released smart meter automatic reader hardware/software (AMR) to Shey for field testing. Had project meeting on 3, 6, and 12 month objectives. Engage WaterStart for smart meter field testing by Las Vegas water district
Jim worked on further analysis of air quality related to infant hospital admissions GIS mapping of patients 7 miles or less from EPA monitoring station and what ICD9/10 codes they present with. Delivered a dataset with sepsis patient information Met to discuss goals for the next three months Met to discuss in detail plans for assistance with our study.
Jim is constructing logistic regression models of air quality factors affecting health Constructing GIS maps of lung ailment distributions in the Truckee Meadows. Assessing EPA air quality data as causing patients with lung ailments to present at the hospital. Thorough examination of time series analysis to ensure cross-correlations of patient admissions and atmospheric gases are not contaminated by extraneous frequencies.

AIC monthly report

December 2016

Business/project development
General activity

Business/project development

Joe:

Legal, Compliance and strategy meetings for Renown IHI

Build out of Renown IHI operating agreements and associated legal docs.

Meeting with Renown and Dr. Schumer to introduce new statistics expertise

Meetings at UNR for collaborations.

Donor meetings and BD meetings for IHI funding.

General Activity

Ming: Decided to use Flask as web framework for in-home automatic meter reader.
DRI FireFly team has a conference call. The consensus is to pursue some kind of pilot project in response to the comment on the declined proposal. Lynn and Adam sent a note to the extended team to warn potential divergence in directions because almost all new ideas are not UAS related.
Still waiting to hear back to us on pilot testing of utility meter reading.
Developing web app
Did successful field test on automatic water meter reader.
Participated a portion of follow-up meeting of project.
Programmed another Raspberry Pi unit for in-home meter application.
Engage smart meter field testing by Las Vegas water district
Web development for in-home meter application.

Brian met with energy company to discuss collaboration
Met to discuss areas of potential collaboration in the soil sciences

Jim: Further analysis of air quality related to infant hospital admissions
GIS mapping of patients 7 miles or less from EPA monitoring station and what ICD9/10 codes they present with.
Delivered a dataset with sepsis patient information
Met to discuss goals for the next three months
Met to discuss in detail plans for her assistance with our study.

	Company Type	Opportunity Type	Notes (Progression and Next Step)
Leads - Awareness (346 - 432)			
	Entertainment	Predictive Analytics	Follow-up email to request continued discussion
	Aerospace	Engineering Visualization	Follow-up email to request continued discussion
	Software	TBD	No project at this time
	Software	Software	Follow-up email to request continued discussion
	Architecture Design	Predictive Analytics	Follow-up email to request continued discussion
	Energy	Predictive Analytics	No project at this time
	Software	Software	Follow-up email to request continued discussion
	Predictive Analytics	Software	Follow-up email to request continued discussion
	UAS	TBD	No project at this time
	UAS	Software	Follow-up email to request continued discussion
	Consulting	Predictive Analytics	No project at this time
	UAS	Weather Modification	Follow-up email to request continued discussion
	Design	Engineering Visualization	Follow-up email to request continued discussion
	PR	TBD	No project at this time
	Manufacture	TBD	No project at this time
	Energy	Predictive Analytics	Follow-up email to request continued discussion
	Predictive Analytics	Software	Follow-up email to request continued discussion
	Agriculture	Soil Science	Follow-up email to request continued discussion
	Energy	Predictive Analytics	Follow-up email to request continued discussion
	Water Energy	Predictive Analytics	Follow-up email to request continued discussion
	Agriculture	Soil Science	Follow-up email to request continued discussion
	Consulting	TBD	No project at this time
	Architecture Design	TBD	No project at this time
	Geology	Data Science	Follow-up email to request continued discussion
	Architecture Design	TBD	No project at this time
	Software	TBD	No project at this time
	Predictive Analytics	None	No project at this time
	Consulting	TBD	No project at this time
	Predictive Analytics	Software	Follow-up email to request continued discussion
	Software	Software	Follow-up email to request continued discussion
	IoT	IoT	Follow-up email to request continued discussion
	Governance	IoT	Follow-up email to request continued discussion
	Governance	IoT	Follow-up email to request continued discussion
	Governance	IoT	Follow-up email to request continued discussion
	Predictive Analytics	Software	Follow-up email to request continued discussion
	Predictive Analytics	Software	Follow-up email to request continued discussion
	Consulting	Predictive Analytics	Follow-up email to request continued discussion
	Software	TBD	No project at this time
	Supply Chain	None	No project at this time
	Entrepreneurship	None	No project at this time
	Predictive Analytics	TBD	No project at this time
	Data Science	TBD	No project at this time
	Predictive Analytics	Software	Follow-up email to request continued discussion
	Data Science	TBD	No project at this time
	Science Education	Education	Follow-up email to request continued discussion
	Agriculture	Soil Science	Follow-up email to request continued discussion
	Energy	Engineering	Follow-up email to request continued discussion
	UAS	UAS	No project at this time
	Marketing Brand Developmt	TBD	No project at this time
	Energy	Predictive Analytics	Follow-up email to request continued discussion
	Predictive Analytics	TBD	No project at this time
	Mining	Mining	Follow-up email to request continued discussion
	Sensors	TBD	No project at this time
	Mining	Mining	Follow-up email to request continued discussion
	Water Technology	TBD	Follow-up email to request continued discussion
	Virtual Reality	TBD	Follow-up email to request continued discussion
	Software	Software	No project at this time
	Software	Predictive Analytics	No project at this time
	Predictive Analytics	TBD	Follow-up email to request continued discussion
	Life Sciences	TBD	Follow-up email to request continued discussion
	Energy	Predictive Analytics	Follow-up email to request continued discussion
	Food Science	None	No project at this time

Predictive Analytics	TBD	No project at this time
Public Television	None	No project at this time
Global Industry	Software	Follow-up email to request continued discussion
Sensors	IoT	Follow-up email to request continued discussion
Energy	Predictive Analytics	Follow-up email to request continued discussion
Broadcasting	None	No project at this time
Software	None	No project at this time
Venture Capital	Software	Follow-up email to request continued discussion
Agriculture	IoT	Follow-up email to request continued discussion
Architecture Design	Engineering Visualization	Follow-up email to request continued discussion
Architecture Design	None	No project at this time
Life Sciences	TBD	No project at this time
Agriculture	Soil Science	Follow-up email to request continued discussion
Entrepreneurship	None	No project at this time
Architecture Design	Software	No project at this time
Energy	Predictive Analytics	Follow-up email to request continued discussion
Predictive Analytics	Software	Follow-up email to request continued discussion
Predictive Analytics	Software	Follow-up email to request continued discussion
Energy	Predictive Analytics	Follow-up email to request continued discussion
Global Industry	TBD	No project at this time
Consulting	None	No project at this time
Energy	Software	Follow-up email to request continued discussion
Energy	Predictive Analytics	Follow-up email to request continued discussion
Computing Services	Cloud Computing	Follow-up email to request continued discussion
Mining	TBD	Follow-up email to request continued discussion
Transportation	None	No project at this time
Healthcare	Software	Follow-up email to request continued discussion
Transportation	IoT	Follow-up email to request continued discussion
Energy	Predictive Analytics	Follow-up email to request continued discussion
Computing Services	Cloud Computing	Follow-up email to request continued discussion
Energy	Engineering	No project at this time
Data Science	Predictive Analytics	Follow-up email to request continued discussion
Healthcare	Predictive Analytics	Follow-up email to request continued discussion
Engineering	Predictive Analytics	Follow-up email to request continued discussion
UAS	UAS	Follow-up email to request continued discussion
Energy	Predictive Analytics	Follow-up email to request continued discussion
Energy	Predictive Analytics	No project at this time
Data Science	Predictive Analytics	Follow-up email to request continued discussion
Data Science	TBD	Follow-up email to request continued discussion
Software	Software	Follow-up email to request continued discussion
Manufacture	Manufacture	Follow-up email to request continued discussion
Manufacture	Engineering Visualization	Follow-up email to request continued discussion
Regional Planning	Predictive Analytics	Follow-up email to request continued discussion
Predictive Analytics	Predictive Analytics	Follow-up email to request continued discussion
Regional Planning	IoT	Follow-up email to request continued discussion
Venture Capital	Software	Follow-up email to request continued discussion
Energy	Predictive Analytics	Follow-up email to request continued discussion
Predictive Analytics	Software	Follow-up email to request continued discussion
Architecture Design	Engineering Visualization	Follow-up email to request continued discussion
Water Technology	Predictive Analytics	Follow-up email to request continued discussion
Architecture Design	IoT	No project at this time
Computing Services	Software	No project at this time
Architecture Design	Engineering Visualization	No project at this time
Energy	Predictive Analytics	No project at this time
Virtual Reality	Visualization	No project at this time
Consulting	Software	No project at this time

118 LEADS

Prospects - Interest (56 - 79)

Agriculture	Soil Science	Discussing scope of collaborative effort
Predictive Analytics	Software	Discussing scope of collaborative effort
Mining	Mining	Discussing scope of collaborative effort
Agriculture	Soil Science	Discussing scope of collaborative effort

Predictive Analytics	Software	Discussing scope of collaborative effort	
Energy	Predicitive Analytics	Discussing scope of collaborative effort	
			6 PROSPECTS

Qualified - Desire (19 - 26)

Predictive Analytics	Software	Collaborative agreement discussions ongoing	
Predictive Analytics	Software	WINDS Pilot Program discussion ongoing	
Predictive Analytics	Software	WINDS Pilot Program discussion ongoing	
Computing Services	Cloud Computing	Cloud Computing discssion ongoing	
Energy	Predicitive Analytics	Collaborative agreement discussions ongoing	
Predictive Analytics	Software	Collaborative agreement discussions ongoing	
			6 QUALIFIED

Negotiation - Action (7 - 5)

Predicitive Analytics	Software	Terms of collaboration ongoing	
Mining	Soil Science	Terms of collaboration ongoing (study 2)	**2 NEGOTIATION**

Won or Lost (2 - 4)

Mining	Mining	Work order sent for review, negotiated, signed. Work secured.	
Healthcare	Software	Phase 1 begun	**5 WON**
Logistics	Software	Route optimizer project initiated	
Mining	Soil Science	Work order sent for review, negotiated, signed. Work secured.	
Science Education	Education	Science Café Launched	