



August 24, 2015

Ms. Karlene Fine
Executive Director
North Dakota Industrial Commission
600 E. Boulevard Avenue
State Capital, 14th Floor
Bismarck ND, 58505-0310

Dear Ms. Fine:

Subject: Hell Creek Environmental Proposal No. 2015-001, "Collection and Development of Actionable Reclamation Data Using Aerial Remote Sensing"

Hell Creek Environmental (HCE) is pleased to propose research into improving reclamation activity on North Dakota lands. A qualified team, including representatives from the service industry, producers, and experts in the fields of remote sensing and aerial surveying, have been assembled to target inefficiencies in the reclamation process. The project objective is to deliver imagery which verifies that the current state of the art in aerial remote sensing can effectively and efficiently assess the eligibility of well sites for their satisfaction with NDIC and other agency requirements for post-closure reclamation.

Enclosed please find an original and one copy of the subject proposed along with a check for \$100. HCE is an LLC registered with the State of North Dakota and is a taxable entity. HCE has no tax liability with the State of North Dakota nor does HCE have any other projects open with the NDOGRC.

As a native of North Dakota I am pleased to be the lead investigator in this effort to improve the reclamation process on North Dakota Lands.

This transmittal letter represents a binding commitment by my company HCE to complete the project described in the proposal. If you have any questions, please contact me by phone at (701) 500-9825, or by email at mark.hellcreek@gmail.com

Sincerely,

Mark Jackson, VP of Business Development

Enclosures

Application

Oil and Gas Research Program

North Dakota

Industrial Commission

Project Title:

Collection and Development of Actionable Reclamation Data Using Aerial Remote Sensing

Applicant:

Hell Creek Environmental Services

Principal Investigator:

Mark Jackson, Hell Creek Environmental

Date of Application:

July, 2015

Amount of Request:

\$137,321

Total Amount of Proposed Project:

\$274,642

Duration of Project:

Remainder of 2015

Point of Contact (POC):

Mark Jackson, HCE

POC Telephone:

701.500.9825

POC E-Mail Address:

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POC Address:

15399 Cranes Mill Road Canyon Lake, TX 78133

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ABSTRACT

Objective:

This proposal is for funding to conduct proof of concept research and development into the use of remote sensing technology, via manned aircraft, to assess and validate the quality of land reclamation at plugged or otherwise closed oil and gas well sites subject to NDIC well closure requirements.

The project objective is to deliver imagery which verifies that the current state of the art in aerial remote sensing can effectively and efficiently assess the eligibility of well sites for their satisfaction with NDIC and other agency requirements for post-closure reclamation. The current system is unduly expensive, consuming excessive resources of both the mineral lessees and the NDIC reclamation staff.

This initiative involves research and development of a remote sensing capability, and the development of a GIS platform, enabling managers to easily view different data sets covering specific locations. The selection of sensors, and associated data sets, were selected based on efficiency and effectiveness metrics developed during current, robust commercial research in the agriculture sector.

The proponents understand that the technologies being deployed may also be applied to the inspection of pipelines; identification of right of way encroachments; measurement of erosion and soil movement; emissions, contamination and spill detection; and a variety of other matters achieved through the combination of imagery and change analytic software. Alternative sensors such as hyper-spectral and LiDAR can be deployed if additional qualitative and quantitative resolution is desired.

If the data collection and presentation is satisfactory, we would expect a high level of adoption by the industry considering the efficiencies accruing to both public and private interests. Our intention over time is that this initiative transitions from research to an economic and commercial development opportunity within North Dakota.

Expected Results:

Proponents expect the following results:

- Determination of whether high resolution imagery, taken at various AGL (distance above ground level) can effectively validate that the site has been revegetated, re-contoured, and otherwise cleaned up to the specifications of the NDIC.
- Through cooperation with NDIC reclamation specialists, develop a level of confidence at NDIC that the data collection and quality can support site clearance decisions.
- The development of a new GIS-based data visualization system, enabling NDIC and company managers an efficient way to view and store different data sets relative to a location.
- That this level of confidence at NDIC will result in a significantly more efficient deployment of staff to the field to conduct site clearance inspections.
- Expedited site closure and release of performance bonds with greater efficiency and reduced cost.
- Measureable reduction of data latency, providing managers with useful imagery within one or two days of collection.

Duration:

The project proposes two cycles of aerial collection within months of each other, enabling the comparison of imagery in different seasons. The project will be closely coordinated with NDIC to assure consistency with NDIC best practices; the NDIC reclamation site evaluation process targets a late spring and fall inspection for comparison of site conditions. The project will begin in the fall of 2015 and completed in 2016.

Total Project Cost: \$280,000

\$140,000	Requested from North Dakota Industrial Commission, Oil and Gas Research Program
<u>\$140,000</u>	Cost share provided from the HESS Corporation
\$280,000	Total Project Cost

Participants:

Hess Corporation

Kevin McGlaughlin, Base Production, EHS Supervisor

North Dakota Industrial Commission (NDIC)

Cody VanderBusch, Reclamation Specialist

Hell Creek Environmental Services (HCE)

Mark Jackson, VP Business Development, Geologist

Paradigm isr (PISR)

Josh Brungardt, Executive Vice President

Analytical Graphics, Inc.(AGI)

Todd Smith, Cesium, Director of Geospatial Technology

PROJECT DESCRIPTION

Industry Challenges:

- The current NDIC reclamation approval process routinely requires multiple field visits in coordination with the industry partner to achieve success.
- This requires significant time and personnel resources for the NDIC and industry partner due to the remote locations and variability of the locations readiness for review.
- Current reclamation inspection schedule, on 1 June 2015 Hess alone had over 200 sites in North Dakota at some point in the reclamation process.

Objectives:

The participants have the following objectives in pursuing this project:

- This initiative is to develop a system of drill site data collection, analysis, and presentation, enabling lessees and public agencies to determine the quality of reclamation at far-flung, inaccessible locations.
- The proposal moves NDIC and Hess toward the elimination of repetitive site visits, and reduces the need to verify site reclamation performance by evaluating site conditions remotely.
- The removal of closed/abandoned facilities from rolls reduces or eliminates the need for additional \$150K bonds, resulting in a reduced “net gain” of disturbed sites.
- The project will provide baseline cost data for both manned and unmanned programs to perform data collection and analysis on a continuing basis for both the NDIC & Hess.
- The project creates, evaluates and refines initial data capture, analysis, distribution and IT infrastructure requirements necessary for a Hess/NDIC collaborative effort without leveraging Hess IT assets or personnel, and utilizing an open source solution.

Relationship to OGRC Mission Objectives

Improve the overall suitability of the oil and gas energy industry in North Dakota through the development of new environmental practices that will help to reduce the footprint of oil and gas activities:

- The clearance of existing sites on the reclamation schedule restores the best possible net acreage affected by industry.

- Aerial data collection is a non-invasive investigation method which eliminates the impacts and disturbance of motor vehicles once road and access features are removed.
- The next generation of aerial remote sensing carries the prospect of identifying industrial product and byproduct releases early, delineating them immediately, and shifting resources directly to the response instead of the currently inefficient methods of investigation.

Maximize the market potential for oil, natural gas, and the associated byproducts produced therewith.

- By providing a faster, more efficient method of clearing plugged sites, this system will facilitate expansion of oil and gas activity by reallocation of existing bond money to new lease activity.

Develop baseline information that will lead to other projects, processes, ideas, and activities.

- This project will serve as the basis for a new business enterprise built around the intellectual property gained from this research and development effort, employing pilots; UAS operators; system / sensor integrators; and GIS and image analysts.
- The collaboration between industry and regulators as the system and eventual enterprise are built will provide a service which utilizes a more convenient, open, and common operating picture between industry and regulators.

Methodology:

In collaboration with NDIC and Hell Creek Environmental, we propose utilizing a high definition, electro-optical (HD EO) camera at various altitudes in conjunction with post flight analysis and processing, enabling NDIC and Hess personnel to determine reclamation status at their desktop.

The proposal is to perform aerial collection in conjunction with ground analysis to validate whether aerial data can be relied upon to accurately characterize a site's compliance with North Dakota's post closure requirements. A successful outcome depends on both properly identifying compliant site conditions as well as non-compliant site conditions. The most difficult data challenge will involve differentiating between acceptable grasses and shrubs, and unacceptable weeds and invasive species.

The key elements of NDIC approval for reclamation are:

- Surface contouring
- Successful establishment of native vegetation, and absence of invasive, non-desirable weeds
- Removal of industry infrastructure

The proposal is to study plugged and closed well sites in each of the following categories:

- Sites which are successfully reclaimed and released;
- Sites at which reclamation success has not been certified, but which are judged likely candidates for release;
- Sites which are judged troublesome, and where deficiencies in re-vegetation and other issues can be documented.

This project proposes two seasonal flight programs (fall 2015, spring 2016). Each series of flights will utilize a high resolution electro optical imager capable of ground sampling distances of less than 10cm in resolution. The study will include the following components:

- Pre- and post-flight field data collection:
 - A team including Hell Creek Environmental, NDIC and possibly Hess personnel will survey selected sites (total number TBD) pre-flight and again based on imagery captured during each flight series.
 - Ground team will mark problem areas for later validation via aerial imagery. Problem areas may include qualitative and quantitative issues with vegetation coverage, erosional and drainage features, and site specific attributes.
 - Process is iterative; as problems are identified, ground inspections and aerial collections will be conducted appropriately.

Analysis of the three key reclamation parameters and site attributes will consist of both field investigation and remotely collected data and imagery, including Digital Elevation Models (DEMs), and reflectance in the spectral band. This program will measure the sensor and systems sensitivity and target the appropriate resolution to determine the level of detail needed for a standard data collection via manned or unmanned vehicles.

Surface contour analysis will use DEM imagery and “nearest neighbor” comparison with surrounding landscape during site visits. A comparison between the elevation models and the site visit by NDIC staff will provide feedback on the level of resolution being used. Historical imagery, CAD, and contour maps will be used if available for reference.

Analysis of vegetation during either pre-flight and/or post flight ground inspection will include; mark and document problem areas; identify and delineate broad leaf and grasses; characterize soil type and survey for electrical conductivity in the top 12 inches of soil. Soil and vegetation samples may be taken and will be evaluated on a site by site basis.

Analysis and processing of vegetation data will include both reflectance indices and pattern recognition. The use of proprietary algorithms to separate points of interest from background may be evaluated. The appropriate resolution for site vegetation attributes will be generated in a feedback loop between NDIC reclamation specialists, researchers, and industry personnel.

Infrastructure removal is expected to be obvious from HD imagery and verified in select cases by the ground truth/field inspection described above.

Flight methodology:

- Sorties flown via Cessna aircraft mounted with high resolution sensor. Aircraft is based in Sioux Falls, SD and will fly two series of sorties to ND to complete data capture.
- The camera will capture temporal, HD EO imagery of the target locations over the course of the study (**Example Aircraft and Sensor are shown in Appendix 1**).
- Each series of flights will take approximately five days.
- Flight results will be used to validate actual requirements, future UAS requirements, precision, cost and risk.
- Flights will include multiple passes at multiple altitudes over time; goal is to identify the highest possible altitude enabling collection of qualified data at the most efficient cost and at the lowest risk to flight operations.
- Flights will cover three reclaimed sites, and eleven sites still in the reclamation process.
- Flight data will be supported by ground verification.

Ultimately, the project intends to provide decision makers with desktop level, clear identification of issues relative to reclamation success. Toward that outcome, this project includes developing the following data capture, technical analysis, post processing, and display:

The ability to detect appropriately remediated sites includes;

- Display of ongoing status/progress/change of a site during the reclamation process.
- Data captured will be verified back in the office with the full team using pictures and sampling data (as required).
- Proof of concept and demonstration of a hosted Cesium terrain and imagery server
 - Cesium is an open source JavaScript library for creating 3D geospatial visualizations and enables a web hosted multi-user/agency interface and cloud storage of data;
 - Hypothesis is that Cesium will provide a “next generation” data organization, storage, and visualization capability, resulting in a major gain in efficiency to the regulatory agencies and regulated industries by establishing a “common operating picture”.
 - Enables visualization of survey grade GPS and HD imagery capabilities

Anticipated Results:

- A capability to provide NDIC and other agencies with well site imagery and data in which there is a high level of confidence that the site is qualified or not qualified to be released from closure requirements.
- Development of a draft policy, procedural guidance, and cost estimate to accomplish the determination of reclamation status by remote sensing.
- Development, testing, and demonstration of the Cesium platform in which to store and view detailed data sets pertinent to specific locations.
- Initial rough order of magnitude for fixed implementation, potential personnel requirements, contracts and recurring expenses.

Facilities:

Collected data will be analyzed and presented through the existing facilities at Paradigm isr in Bend, OR, where similar research and implementation programs are being conducted for other industry sectors. The Cesium development will continue to take place at AGI in Exton, PA. If site specific attributes warrant further characterization of soil or vegetation the HCE lab in Canyon Lake, TX will be utilized. Each of these facilities is capable of delivering the required data and imagery within the expected project timeframe.

Resources:

The primary resources deployed to this project are the Paradigm aircraft and sensor suite, and vehicle and equipment supporting the parallel ground truthing and data collection.

Techniques to Be Used, Their Availability and Capability:

This program may require up to three phases if efficiencies can be identified; the number of phases will be driven by the availability of study sites in the proper stage of reclamation for the determination of finalized imagery requirements.

The initial research phase will utilize a high resolution imager mounted on a manned aircraft. The imagery will be integrated into the Cesium platform (but at a 15X greater resolution than current data sets), please follow the link for a sample of this capability.

<http://apps.agi.com/fodar/>

Environmental and Economic Impacts while Project is Underway:

This project involves aerial data collection and ground inspection where necessary. Each inspection will collect ground based photographs and video in an effort to eliminate any repeat visits during the course of the research. The project will not affect existing economic activities.

Ultimate Technological and Economic Impacts:

- We expect this project to provide a way forward to the use of both manned and unmanned aerial systems (UAS) to collect data that is critical to the efficient, effective protection of North Dakota natural resources. The potential elimination of data latency – the ability to receive actionable data within hours or days of its collection – could result in more effective responses to environmental releases, and more efficient decisions on regulatory matters. (Proponents' Original intent was to accomplish remote sensing utilizing some form of unmanned aerial system (UAS). Due to the short timeline and current regulatory environment this is unachievable for a 2015 project. Commercial UAS work for the tasks described in this proposal requires specific FAA approval and require a minimum of 120 days after submission to run the federal approval process.)

- We think it possible that the Cesium platform could provide a significantly more efficient system of data organization, storage, and most importantly – access. The project provides funding to develop a “proof of concept” Cesium demonstration covering a few sites, and does not obligate Hess or the State to any adoption in the future. If the outcome is positive, however, it presents an opportunity for significant cost savings to the public and to the industry.

Why the Project is needed:

The current NDIC reclamation approval process routinely requires multiple field visits in coordination with the industry partner to achieve success. According to NDIC (letter attached), “the process of reclaiming, inspecting, and clearing plugged well sites is not working as well as it could. NDIC makes far too many site visits with intent to release, only to find that reclamation was insufficient in some way. The industry spends untold sums on repeated site visits, and re-deployment of crews in an effort to correct deficiencies. The process needs improvement.”

The site clearing process requires significant time and personnel resources for the NDIC and industry lessees due to the remote locations and variability of a locations readiness for review. Today Hess has more than 200 sites in North Dakota at some point in the reclamation process. A system enabling the efficient movement of sites off of the reclamation lists would result in public savings due to the efficient deployment of staff; the timely release of reclamation bonding and industry relief under the restrictions to develop new leases if too many sites are not cleared or not reclaimed.

STANDARDS OF SUCCESS

Measurable deliverables:

- The ability to discern and resolve reclamation criteria via high resolution imagery.
- The organization of data within a user friendly geographically precise platform.
- Once effective temporal data is established, the intent is to determine and approve a well site’s readiness for release from state bond through desktop analysis prior to a final field visit.

Measurement of success:

This project is designed to find the least cost solution to determining whether reclamation requirements can be validated through remote sensing. If high resolution imagery is not a viable solution, the next step would be to use LiDAR and/or spectral sensing to achieve the required certainty.

The project is predicated on building a solution that NDIC can adopt as a standard operating procedure; in that eventuality, the project is a measurable success.

Value to North Dakota:

This project bears directly on North Dakota’s dual goal of enabling economic expansion while requiring the strongest possible protection of natural resources. The clearance of existing sites on the reclamation schedule restores the best possible net acreage affected by industry. The next generation of

aerial remote sensing carries the prospect of identifying industrial releases early, delineating them immediately, and shifting resources directly to the response instead of the currently inefficient methods of investigation.

As the Oil and Gas Industry in North Dakota matures and resource recovery infrastructure is improved through advances in technology the task of removing and minimizing the artifact infrastructure and associated environmental impacts during the “boom” phases of the industry will begin. Providing actionable imagery and data collection today will make those efforts, for both the NDIC and Operators, more manageable, comprehensive, and effective when considering the volume of disturbed sites which will need to be reclaimed across the North Dakota landscape.

Public and Private utilization of Results:

Competition in the oil and gas industry relates to the acquisition of production and the efficient transport of the resource to the market. It does not relate to environmental protection and compliance with applicable rules and laws: the industry has a stake in having all operators performing to high standards; one bad actor can result in new regulatory requirements, foisting new costs to all.

If the outcomes are as expected, we expect to pursue additional remote sensing missions relative to the oil and gas industry.

Commercial Use:

This project will serve as the basis for a new business enterprise built around intellectual property gained from this and other research and development efforts. Because of this initiative the community of remote sensing technicians will better understand the needs of the oil and gas industry as a whole and begin to draft and implement the appropriate use of a variety of sensors, resolutions, and frequency to provide qualitative and quantitative analysis of the most common industry products and by-products present in the operating environment. The commercial viability and industrial utility of the data will only be understood through collaborating initiatives such as the reclamation program described herein. The technologies to be used in this initiative have provided commercial viability in the agricultural, mining, surveying, and infrastructure sectors, and continue to do so.

Enhancement of education, research, development and marketing of North Dakota’s oil and natural gas resources:

This research project demonstrates the strongest possible partnership between industry and regulators as it applies to environmental stewardship. The collaborative nature of this project in developing and implementing a more effective and efficient system to restore North Dakota Lands can be used as a reference to how shared challenges provide opportunity to shared solutions.

This initiative also fits into the state’s theme of continually improving the best practices associated with industrial activity in the state. By providing a faster, more efficient method of clearing plugged and closed sites, this system will facilitate expansion of oil and gas activity, by alleviating the bottleneck caused when too many sites are not cleared.

Jobs:

With successful research and development, a new business enterprise will form, employing pilots; UAS operators; system / sensor integrators; and GIS and image analysts. As opportunities for these skills increase commercially the academic programs and students in the State associated with the development and advancement of remote sensing, and manned and unmanned aerial vehicle (UAV) technologies will also benefit.

Please see:

<http://www.ndsu.edu/pubweb/~oduor/RemoteSensing/index.html>

<http://www.uasresearch.com/home.aspx>

Success reporting:

When successful, we will have built the execution framework with the NDIC for reclamation evaluation based on imagery rather than fieldwork, which we expect to set a new standard operating procedure for the industry in North Dakota.

The data would be compiled into geographically precise formats, with clear display of the particular data or imagery of interest. Data would be analyzed and presented within days of collection. Over time, the system would collect multiple data sets simultaneously for each site - and from multiple sites - in a single flight path. Such a capability would result in a much more efficient deployment of agency time and resources, with concomitant budget and natural resource benefits.

The key deliverable is determination of the actual sensor requirements necessary to determine site viability for clearance, including:

- The type and accuracy of imagery required;
- The quantitative/qualitative analysis necessary to achieve the objectives;
- Evaluation of the potential for additional remote sensing applications;

BACKGROUND/QUALIFICATIONS**Hell Creek Environmental/Mark Jackson:**

HCE is engaged in the development and deployment of remediation, reclamation, and geophysical investigation technologies related to the energy sector. HCE personnel utilize 30 years of partnerships with Federal and State Agencies to implement Remedial Design initiatives for postindustrial site closure. Under our Master Service Contracts HCE also provides industrial waste management services to major producers in the Bakken. HCE is a member of the ISNetwork Industrial Safety program.

Mr. Jackson is the business development VP and a geologist. Responsibilities relevant to this initiative include the generating and managing of contractual, regulatory, and personnel components to meet operational forecasts and budgetary targets.

Professional Experience:

Geologist (Geophysical and Hydrologic investigations), Current Environmental Solutions (CES);
CES Drilling Manager, EPA Region 9 Superfund (EPA #: CAD071530380);
Project Manager/ Process Plant Construction and Drilling Programs Lead in US and Europe, Global Engineering Solutions (GES);
Operations Manager, Hell Creek Environmental (HCE);
Vice President of Business Development and Managing Member, HCE

Education and Training

BS, Geology, North Dakota State University
(NDSU Geoscience department required advanced Geographic Information Systems and Remote Sensing accreditation)

Paradigm isr/Josh Brungardt:

Paradigm is engaged in advanced data analytics relative to aerial data collection. Paradigm team members have advanced experience and training in unmanned aircraft operations, integration of aircraft sensor payloads, hyper- and multi-spectral analytics, LiDAR, and GIS.

Mr. Brungardt is widely considered one of the nation's academic experts in the development and management of unmanned aircraft systems.

Professional Experience:

Director, Unmanned Aircraft Systems Program (UAS), Kansas State University;
Chief Pilot, High Performance Aircraft Training, Electronic Flight Instrument Systems Training, and Lancair Aircraft;
Unmanned Systems Subcommittee Chair, Governor's Aviation Advisory Council, Kansas;
Senior Officer training, Predator UAS, Creech Air Force Base, 11th Reconnaissance SQ;
Author, Introduction to Unmanned Aircraft Systems;
ATP & CFII ratings with over 4000 hours;
Competitor, Reno National Air Races;
Completed more than 75 first flights on experimental aircraft;
Instructor pilot, U.S. Air Force;
Specialized in Electronic Flight Information Systems (EFIS) and avionics integration;
Board of Directors, Association for Unmanned Vehicle Systems International (AUVSI), Cascades Chapter;
Founded EFIS Training, private company training pilots in EFIS and transition to glass cockpits;
Director, Unmanned Systems, *n*-Link Corporation

Education and Training

BS, Airway Science, Kansas State University AS, Professional Pilot, Kansas State University/Salina

Analytical Graphics, Inc. (AGI) / Todd Smith:

Todd A. Smith serves as director of geospatial technology at AGI. In this role, Todd develops strategy to integrate and apply AGI's analysis and visualization capability into broad market areas. Todd serves as the product manager for Cesium to direct open source and product development. This also includes product marketing and evangelism to potential users. With Todd's deep knowledge and experience in the enterprise geospatial tradecraft, he also positions AGI technology within subscription, federated, enterprise and service-oriented architectures. Before joining Business Development, Todd was AGI's product manager for enterprise integration.

Prior to joining AGI in 2006, Todd served as a technical project manager of military solutions at GeoDecisions.

Education and Training

B.S. in geography and GIS from Penn State University

MANAGEMENT

Management of the project resources including time and milestones tracking, budgetary reporting, fund accounting, and contract services will be done in collaboration between Hess Corporation and HCE. The minimum requirement is quarterly reports, with the understanding that Hess internal reporting requirements may generate additional progress evaluation periods. The deliverables of this proposal will be incorporated into a contractual agreement ensuring timely delivery of milestones and fund management accountability.

TIMETABLE

KEY MILESTONES					
Date	Status	Program Phase	Action	POC	Notes
21-Aug-15	√	Planning	LOI Approved	Behounek	By providing brief LOI is approved and signed by the appropriate party authorizing use of Hess funds on the project. This authorization will allow Hess to submit OGRP Grant request. Grant request will be completed by Hell Creek and amended based on results of the LOI discussion. If additional approvals are required, they will be attained prior to grant submittal.
24-Aug-15	√	Planning	OGRP Grant Request Submitted	Hess Project Owner	Jackson
1-Sep-15	√	Planning	Hess Finance Procedures	Hess Project Owner	These must be in place before any grant funding is accepted or expenditures made
30-Sep-15		Planning	Technical Memorandum Complete	Hess Project Owner	Jackson, Brungardt, McGlaughlin
TBD		Planning	OGRP Grant Approved (Grant round for approval starts 1 Sep with submission deadline of 18 Aug)	NDIC/OGRC	Recommendation is that if funding is not approved at 50% level Hell Creek will find additional sponsors or reduce the scope
Sept - Oct 15		Ops	1st Flight Event	Paradigm	Lewis
		Ops	1st Ground Truth Data Capture	Hess/NDIC/Hell Creek	TBD/TBD/Jackson
		Ops	Data processing	Paradigm/AGI	Brungardt/Smith
		Ops	Data imported to Hess ARC GIS	Hess/AGI	Sandstrom/Smith
		Ops	1st OGRP report	Hess Project Owner	Jackson
May - June 16		Ops	2nd Flight	Paradigm	Lewis
		Ops	2nd Ground Truth data capture	Hess/NDIC/Hell Creek	TBD/TBD/Jackson
		Ops	Data Processing	Paradigm/AGI	Brungardt/Smith
		Ops	Data imported to Hess ARC GIS	Hess/AGI	Sandstrom/Smith
		Ops	2nd OGRP report	Hess Project Owner	Jackson
15-Jul-16		Closure	Meet with NDIC to finalize Phase 1 progress, determine way forward & wrap up	NDIC/Hess/Hell Creek	This would define accomplishments and determine necessary follow-on work necessary to fully achieve the goals. Review of Phase 2 Hyperspectral, LiDAR, and IR data collection program and evaluate suitability of information for capturing of fugitive emissions/by-products, DOT pipeline

BUDGET

Project Associated Expense	NDIC's Share	Applicant's Share (Cash)	Applicant's Share (In-Kind)	Other Project Sponsor's Share
Hell Creek Project Management / field work	15,384	15,384		
Paradigm Project Management / Pilot	15,384	15,384		
Paradigm Sensor	7,692	7,692		
Paradigm data processing	3,606	3,606		

and analysis				
Hell Creek policy review, reporting/documentation	2,884	2,884		
Paradigm GIS	2,884	2,884		
Travel expense	10,734	10,734		
Manned aircraft	44,000	44,000		
AGI Data delivery	25,000	25,000		
Ground Truth equip	2,466	2,466		
Data processing and storage	10,000	10,000		

CONFIDENTIAL INFORMATION

Confidential information is included in Appendix 1 and is exempt from FOIA requests.

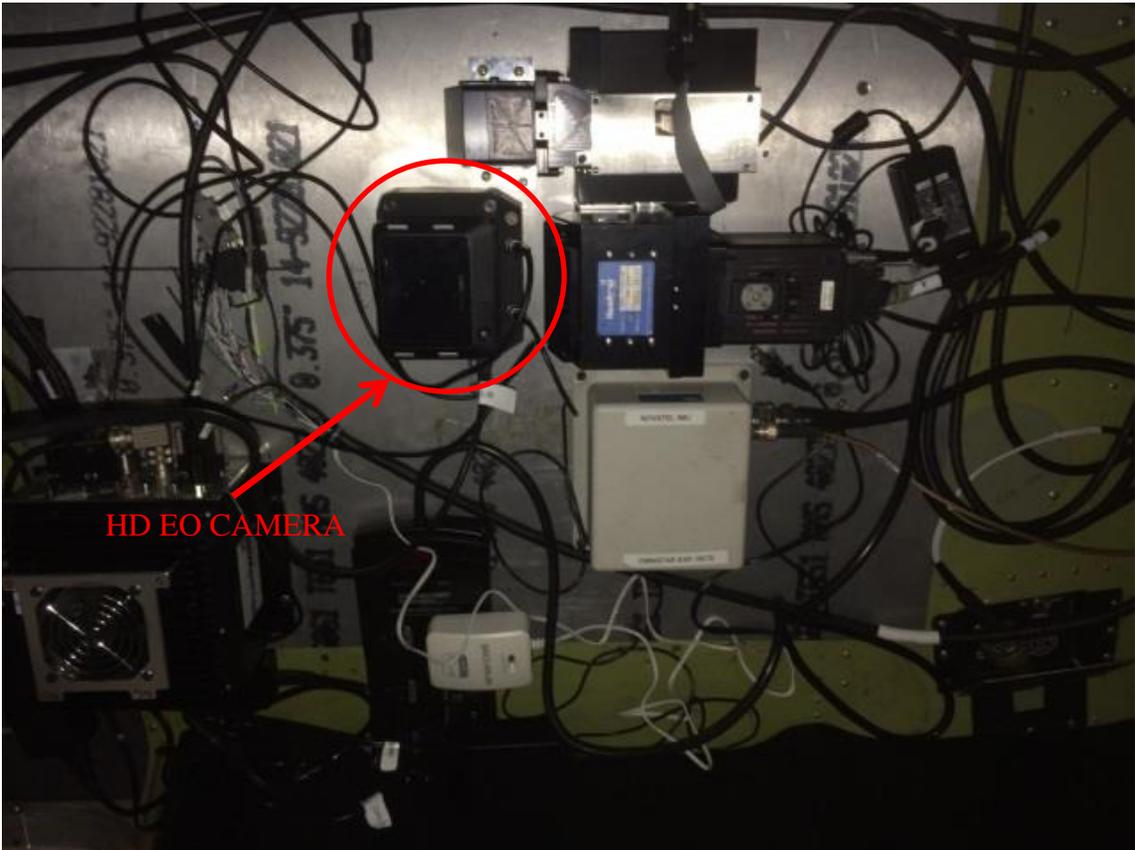
PATENTS/RIGHTS TO TECHNICAL DATA

The development of a new GIS-based data visualization system, enabling NDIC and company managers an efficient way to view and store different data sets relative to a location is a partner development project component, the rights to technical data from these software delivery systems will be proprietary.

STATUS OF ONGOING PROJECTS

HCE has no other projects open with the NDOGRC.

Appendix 1: Aircraft and Sensor Integration Panel (Proprietary and Confidential)



Appendix 2: Generalized Data Collection and Process Flow Diagram

