NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Ames Research Center
Intelligent Systems Division
Moffett Field, California 94035-1000

By: Third Evolution, Inc.

We will be a Prime Contractor

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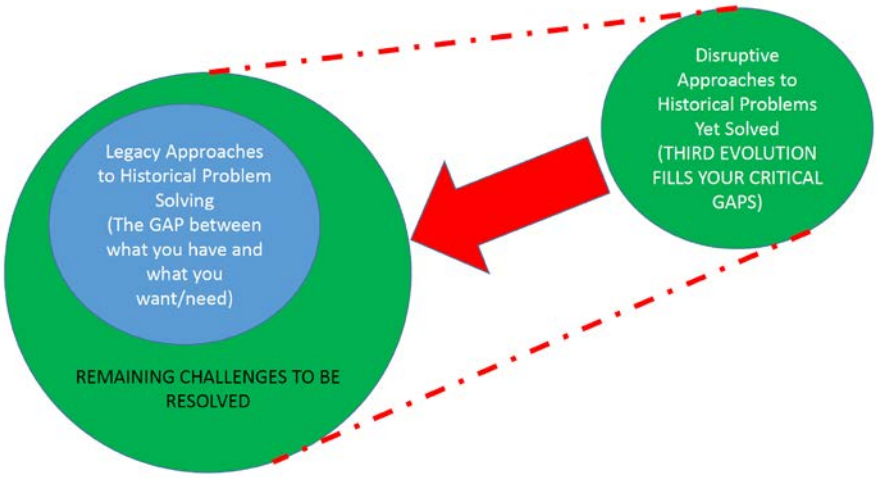
SCOPE OF WORK

The Contractor shall provide research support in the following domains: artificial intelligence (AI), knowledge-based systems, knowledge discovery and data mining, information processing and sensors, signal analysis and feature extraction, model-based diagnostic reasoning, system fault diagnostics, prognostics, decision making, automated software methodologies, software verification, validation and safety assurance, fault-tolerant computing hardware and networking, tele-presence and tele-control of remote, mobile platforms, autonomous and adaptive control, human-centered computing, collaborative system design, distribution of research information in various formats and forums.

Third Evolution, Inc. has a tremendous amount of capability and experience in all the above Scope of Work domains. Please see the detailed explanations below for these capabilities and software approaches & tools we use.



We make it very clear: <u>our approach completely breaks the classical approach to problem solving</u>. It is why we can resolve complex, seemingly irrational challenges by being able to extract correlations, dimensions of influence and magnitudes of those influences on otherwise unreachable conclusions to complex, interactive systems; and with that unique capability, when can then transition to human-based constructs steeped in advanced, conventional mathematical and scientific constructs/systems. We needed to develop these skills due to the preponderance of otherwise unsolvable technical challenges our clients have presented to us over the past 17 years. Our approaches would fall into the realm of, "Meta-Engineering," which we are proud of and anxious to share with leading scientific institutions like NASA.

Scope Capability Requirements

<u>Artificial intelligence (AI) and knowledge-based systems:</u> Third Evolution, Inc. has been in the AI business for our entire existence of 17 years. Our ownership and management has been in it for over 30 years, including the first AI system applied in the mining industry. Our experience with "canned" AI software has given our firm tremendous insight into why so many AI efforts fall well short of the objectives.

The reason: to get all you can out of AI, one cannot think like the trained humans we are. We are all taught the same math, regardless of the depth of mathematical complexity, and that needs to be overcome to reach and "see" the infinite other ways complex, technical challenges can be resolved. The same goes for our collective "training" we get on Newtonian physics in our technical education. Both of these areas are areas of critical need for AI, but they are only the first 2 hurdles; most leaders in this field wrongly stay within these domains, which is absolutely short-sighted and becomes the death spiral of failing to reach the complete potential of an AI application as applied to an optimized outcome. We certainly know how to use mathematics and physics, where and when they are applicable, but so much of the data that is used does not follow or need those concepts, and to get out of the shadows and into the light of absolute discovery. We need to be able to recognize the open space of problem-solving opportunity and be able to look back and accept that current worldviews are truly in a confined space of our own making. Actually, those concepts become an impediment to all of the possible solutions that have other behavioral characteristics and relationships untethered to that confined space of modern math and Newtonian physics. If this concept is uncomfortable to NASA/AMES, then no further reading is needed and we should be rejected at this point.

This is what our engines excel at, well beyond the otherwise confusing and base AI modeling programs others try to utilize and apply; because of that they will NEVER get to the optimized outcomes under consideration. Essentially, we cannot shoehorn processes that have no aspect of Newtonian physics or common math into those constructs and expect to get the absolutely accurate characterizations of those otherwise abstract, seemingly dimensionless concepts.

Third Evolution, Inc. has developed and implemented our Knowledge Molecule™ approach to accommodate all other meta-concepts and meta-constructs, as well as conventional math/physics based models. Therefore, with our time-tested approach to the most accurate system and multi-system outputs, we begin with all known relevant information but our Self-Tuning module takes us the rest of the way as it reveals any other R^2 elements that otherwise appear to have no correlation (R^2) to the elements of emphasis on any system we apply. With the number of large companies who advertise expertise in this space talking to us about utilizing our engines and methodologies as OEM components, we feel justified to declare no other firm can achieve what we can because they only see a fraction of the potential solutions available to them, and the chances of the best optimization of the outcomes being within that narrow, myopic space is so slim that if that were the best path, it would have been discovered already. Those optimized solutions await our teams assignment to resolve.

Our fundamental differences from all other known AI engines/solutions:

1. **Ours actually works to the point of closed loop control, not some Rorschach-looking chart that becomes more challenging to deconstruct to the value elements than the original problem.**
2. **We use our proven methods from Process Engineering to**
    a. **Understand or design the base process**
        i. **We account for every single molecule in physical processes**
        ii. **We do this through a mass/material balance**
        iii. **This establishes what 100% of potential is**
        iv. **Measure actuals with instrumentation**
        v. **Arrive at all KPI's deviation/%error from potential**

vi. Use our engine(s) to grasp the holistic best-possible optimization
vii. Generate the control outputs to meet the best-case outcomes
viii. Auto Identify the greatest to least influences keeping the process from optimal
ix. Determine the value of defeating/overcoming each bottleneck
x. Overcome each bottleneck until diminishing returns help us arrive at the ultimate optimal solution
xi. Continue same approach automatically with our self-tuning because most processes tend to "drift," and we need to stay locked on the process, including as it drifts

b. Once we have the base process and satellite processes characterized at a base level
   i. We decompose all processes to identify the root influences
   ii. We recompose all processes with a model that allows us to measure all influences
   iii. We add controls and algorithms wherever possible to be the master of all influences
   iv. We turn the model into logic, building self-tuning into the automation
   v. We then optimize the automation
   vi. Our systems are always designed to be unmanned and automatic, with automated alerting whenever the system needs maintenance attention or is heading out of design parameters
   vii. If a manual step or human intervention is required, we implement it with mechanisms to keep any parametric changes within required settings and track any changes by user
c. We build up all process components as molecules, arriving ultimately with a "Super Molecule" of logic
d. We construct the HMI (Human Machine Interface) as required based on the various user classes and operational perspectives
e. We create all required reports
f. We attach to/design & create the IT infrastructure and all needed security

Knowledge discovery and data mining: Utilizing our SCADA experience, once we have the target outcomes and the data sources identified, we connect our applications to the IP addresses of all possible data sources (as well as open source data if allowed), writing any API's not in existence.

At this point, we establish the various ways we can currently identify ideal outcomes. This can be through performance requirements, edges of safe pressures, temperatures, speeds, amperages, etc., and is therefore part of the V&V discussed later since any elements that contribute to ideal outcomes or impediments to it must also be available to us in the process design/decomposition during and after the material balance. Now we have all available known best and worst case outcomes, and can begin to search for first, second and third order relationships that resolve to the requirements of the target objective function/outcome.

CRITICAL NOTE: Our system has further uniqueness in that we can utilize the characterized ideal outcome variations (there are usually multiple ways to arrive at ideal or close to ideal outcomes) and as combinations of process circumstances develop in a direction towards or

away from ideal, we can establish numerous value derivatives for developing "better" outcomes.

Value Derivatives from Data Mining:

1. **We will discover the knowledge with our applications including all possible value elements and the various magnitudes of influence on the target outcomes**
2. **We will discover the negative and positive influences on the process/target outcome, so that we can expose the holistic framework with associated logic to gravitate towards the ideal AS WELL AS being aware and in control of the negative influences to establish and implement vie self-tuning an ever-increasing optimization of outcomes (We will get better faster, and more accurately over time)**
3. **With ideal outcomes characterized, we will track and historize developing partial outcomes of value with an indicator and automatic alert as the data in question becomes convergent or divergent to our objectives so that we can begin to formulate and characterize predictors of outcomes for any and all outcomes of value. We will capture these elements with magnitudes of value and completeness, such that over time (frequency, really) we will have our own predictive capabilities of time (T), contributing influences to ideal outcomes, magnitudes of influence for each parameter and magnitudes of value of each magnitude of influence distributed across any system-auto-identified (or team-identified) parameters.**
4. **With frequency of 3 above, for time-critical outcomes to be avoided (safety, danger, etc.) our solutions will provide greater and greater predictive outputs with greater accuracy faster and faster for disaster avoidance scenarios, for example. Equally, as we self-tune and learn deeper and deeper influences and combined influences with 2nd and 3rd order mining, we will approach the fastest, most efficient way to the ideal outcomes of our given objective functions.**
5. **As indicated above, networked sharing of authorized users of the data will be automatically distributed to any IP address or mobile devices so that the immediacy of the value can be known instantly for greatest use-benefit. We are IOS, Android and Microsoft developers, so these functions are standard fare for us.**
6. **Additionally, for any reporting requirements we will generate and distribute the reports as required by the contract.**

Information processing and sensors, signal analysis and feature extraction:

As previously covered, with 17 years as a company working primarily in the industrial sector we have extensive capabilities coming from an analog to digital signal for processing in modern computing systems like our Knowledge Molecule ™. We have likely worked with almost any type of signal and sensor devised, and probably worked with each one hundreds if not thousands of time. This would include the photon-generators that exist at the HLSTF laser facility in White Sands, NM. And, to the need of signal analysis and feature extraction, if it can be digitally characterized, we can do any kind of analytics you can dream up provided the subject data complies with being analyzed. For example, if we are asked to generate the analysis of weight for a transient voltage frequency, that would fall under non-compliant with the request. Otherwise, we are very, very comfortable in this domain.

Model-based diagnostic reasoning, system fault diagnostics, prognostics, and decision making:

Since we come from optimized, automated real-time and predictive control environments and have previously indicated that our fundamental approach to our work is to characterize ideal, or 0% error outcomes, diagnostic reasoning and system fault diagnostics are inherent in our designs. This applies as well to decision-making (that is real-time control, after all), which MUST also inherently include prognostication as well since you must be predictive to keep a power plant, refinery, gas plant or any other reactor-based process up and operating. In other words, to be real-time in our world requires inherent predictive logic otherwise we would always be "chasing" the process falling further and further behind with each second. (We have been approached by multiple larger firms – gigantic firms, actually – and have seen their demonstrations of basic AI. Their engines cannot "keep up," and tend to sit there cycling for long periods of time trying to resolve whatever functions are embedded in their AI logic. This has given us great confidence about our approaches, which do not suffer the same inefficient design flaws of some very famous solutions currently being advertised globally.

Automated software methodologies, software verification, validation and safety assurance: At the risk of sounding like a broken record, the items listed immediately above are part of an accepted/required analysis process created in the industrial space, and is called a HAZOP.

This frequently misunderstood process has extreme value for the NASA applications discussed herein and is directly applicable to the verification, validations and safety assurances aspect of this section. A HAZOP process begins with the designed holistic solution/system being implemented, and accounts for every possible path of action, including all circuits, logic paths, equipment failures, process upsets, outside influences, etc. As each possible path is traversed in the meeting, all involved parties with detailed knowledge of the process or parts of the process review all possible failures and failure outcomes; then we confirm that all possible failures have been defeated with the balance of the project design. This process covers all safety issues to failures that can occur once in 10,000 years and the resulting effects of all identified conditions of interest. We capture all project aspects heretofore not addressed or defeated by the design and implement changes to satisfy the project objectives.

At this point in the project process, any parties involved will have participated in the meeting; however, any participant that has ownership of an area deemed in need of further controls will be responsible for implementing those changes and distribution the modified design documents that reflect the desired outcome and any new points of interaction with other subsystems.

At this point, and this is critical, the Sequence of Operations/Process Narrative can be finalized at the design stage. The SOO is a written narrative of the entire process with detailed identification of all interacting elements by their system identified vernacular. All alarm points, limits of maximum tolerances and any interlocking combinations are also defined and detailed operationally in this document. Ultimately, the SOO becomes the script by which the process is codified and implemented, which is needed to get to the Validation and Verification of the system.

To validate the systems, the project database, SOO and HMI/Graphical User Interface are used to verify simulated inputs (at first) with datasets that will/should give known outputs. This is the phase where we will force inputs and outputs to their high and low limits to exercise all alerts and alarms, as well as to make sure the graphical user interface matches what the process is doing. Without being connected to live systems, the software validation steps and

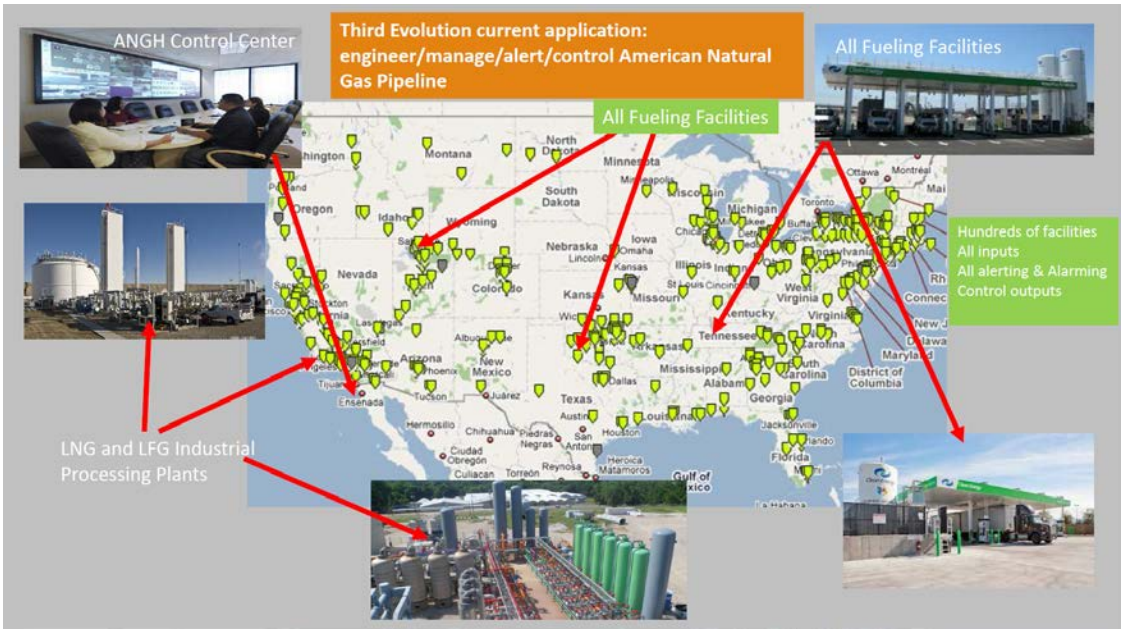
procedures will find the inconsistencies, typos and software exchanges/communications issues for remediation. Once the soft V&V has been done, hard connections to physical devices and networked devices can be made for checkout and commissioning of the actual systems. If a previous system is in place (a legacy system we might be replacing) we can run our system concurrently with outputs being sent to a database instead of the actual devices to get to the next level of verification, which would verify the graphics, system navigation, system networking and communication, alerting and alarming.

Once this step has been signed off, the final cutover of hardwired outputs or communication paths for outputs can be connected and checked out. This is an important step as wiring with reversed polarity can be found, any communications issues will be realized and general tuning of the process can begin. During this phase, "COMMISSIONING," we will force any operating elements to their allowable limits so that we can see, for example, that a valve is opening when it is supposed to be opening, and not reversed in its action.

CRITICAL NOTE: The most important phase of project execution is the tuning phase, which appears to have been left out of your requirements. At this point in the project we must carefully exercise the live application, cautiously aware of operational impacts by prodigious use of historical data and significant trend and deviation analysis of expected operation of the application. As the system is energized or initiated, it will be done following a well-documented plan derived from the checkout experience, layered in with the more advanced, coordinated control actions that require multiple systems to harmonize with each other. A punchlist will be generated, just as in the prior steps, until the entire process has been verified functional to the design standards, accepted and signed off.

Fault-tolerant computing hardware and networking, tele-presence and tele-control of remote, mobile platforms:

As the recurring theme continues, fault tolerant computing and redundancy considerations for uptime percentages is a common and mundane aspect of system architecture design. We have implemented many redundant systems, including many triple redundant systems for turbine control applications. SIL requirements also can come into play, with which we are also very familiar with, up to SIL-3. The user requirements dictate if any and which of these would be required for NASA's intended use. Regarding tele-presence and tele-control of remote mobile platforms, this is again a fundamental part of 95% of our project work. See our 700 plus system (and growing) fully designed from IT down to each IO point of each of the 700 sites, fully integrated, with 1 large command center along with regional command capability and, for authorized users mobile device capability for any authorized control commands. Although we generally do not recommend it, we have controlled sites for our clients while on a commercial jet as they had more confidence in us doing that instead of themselves on the ground at the site. We have 100% confidence of any aspect of these work scope capabilities.



700 plus site nationally designed and deployed coordinated control network

Autonomous and adaptive control & human-centered computing:

As a process engineering and controls automation firm for 17 years, autonomous and adaptive control is part of our base DNA. As we have indicated numerous times above, our designs and implementations are inherently adaptive based on the self-tuning nature of all of our implementations. Autonomous control is a microcosm of all controls, such that with our approach we MUST begin at the root level of ideal outcomes. Hence, for a project that has a thermal reactor of some kind, it will be made up of a series of autonomous controls loops designed for maximum efficiency that are then "ganged" together for a tiny coordinated control loop (perhaps feedwater to a boiler) that then gets ganged again to a larger coordinated control solution (say 3 element feedwater control) that relies on feedforward and feedback loops plus demand signals from dispatch.

Relative to human-centered computing, this can take a few directions, all of which we are comfortable with. For sentiment-analysis AI approaches, we can create reactive/adaptive AI solutions that spoon-feed the operators the best next decision paths based on the current circumstance and the objective outcome. This approach, although more complex, can have dramatic feedback value for operational improvements on the staff side as well as process side at it pertains to critical system training based on simulated failure analysis and optimized paths to recovery from said failures.

Equally, for any manually controlled operations, we have extensive experience utilizing simplistic graphical tools that optimize the human-centric control guidance since the greatest risks of failure on 95% of all projects is directly tied to human errors. Keeping the system in AUTO is always preferred.

Collaborative system design, distribution of research information in various formats and forums:

As a system integrator for 17 years, and as we have indicated above with the Americas Natural Gas Highway System Design and Integration of over 700 unique sites, each with handfuls of vendors, drawing packages, communication strategies, control strategies, training needs and predictive requirements, we feel exceptionally justified in our ability to work within a team structure, particularly since we pride ourselves and helping elevate other subcontractors that struggle with some of the advanced concepts so critical to the overall success of a project. We take great pride in our collaborative approaches that allow for painless handoffs of data and signals in the most efficient way possible. Additionally, when hierarchical solutions depend heavily on the subordinate functions being optimized for the superordinate functions to have a chance at being optimized at all, we feel our ability to communicate and convey these concepts at the applied level adds yet another level of our contribution value for the overall project outcomes.

As it pertains to formats of shared data, forum-based or otherwise, since we are an integrator of multitudes of dissimilar systems and protocols, we have no issues complying with any format types and sharing platforms.

2 AREAS with qualifying commentary:
quantum computing – Third Evolution, Inc. is in a unique position relative to quantum computing, as we have an excellent personal and professional relationship with Ambature and specifically its CEO, Ron Kelly. Ron holds numerous and exclusive patents needed for quantum computing; specifically the Josephson Junction based technology required for super-conducting whereby the J-J is the necessary element, analogous to the transistor of current computing technologies, as well as a host of other like-needed technologies to allow for super computing. However, Third Evolution, Inc. has its own developed technologies that beg the comment, "If you can't figure out the HOW to all of the domains for this scope of work, no amount of speed will get you to the right answer." We have the right answer, so super computing will help but only because we know HOW, with the speed of processing at near-photonic speeds a big plus.

unmanned aero and terrestrial based vehicle technologies – Third Evolution, Inc. has a 17-year track record in real-time and predictive control in all the industrial verticals; however direct experience with vehicle control would need the IO table of actions and the associated control theory for each singular and collective outcomes. We recognize this is not a trivial aspect, but since our firm is at its roots a process engineering, process control and advanced, automated optimization firm we have exceptional skill in this particular area so the need does not affect us.

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The Contractor shall be responsible for providing flexible, responsive, coordinated, and comprehensive research workforce that are within the framework of the core requirements. The Government will provide specific requirements for the core research at time of award. The Contractor shall administer all work to be performed under the core, and assure the availability of qualified personnel and resources.

Third Evolution, Inc. works in this manner on all our Industrial projects, given most of our contracts begin because larger, renowned engineering firms have failed to perform, hence our first engagements with new clients tend to require great flexibility since the challenges we face tend to be research oriented by nature.

2.1.3 Core Operational Support

Specific duties to be performed include -
System architecture design
System configuration definition and implementation
Security plan development
Integration of server systems
Support of user systems

Third Evolution: Again, as a bona-fide systems integrator in all industrial verticals, meaning Newtonian physics-based large facilities are standard fare for our firm – please see the section which diagrams our design, implementation and continued support for T. Boone Pickens America's Natural Gas Highway SCADA system. With that, having to connect to the vehicles referenced in this RFI is actually a significant drop in complexity since the America's Natural Gas Highway has over 700 industrial facilities that we must use predictive analytics and advanced controls schemes for real time maximum uptime, and each site could have thousands of signals being collected at 10-100 times a second for predictive optimization. **Everything in 2.1.3 is therefore part of our base skill-sets for 17 years as a company.**

2.2 Core Technology Research Areas

The Intelligent Systems Division performs research in four main technology areas. As the research matures or as projects require, work from multiple areas can be matrixed to support a single task, project or program.

Technology Area 1: Autonomous Systems and Robotics (ASR)

The Contractor shall perform and/or support research, development, and deployment in areas of expertise including artificial intelligence, robotics, computer vision, aeronautics, theoretical computer science, operations research, software engineering, electrical engineering, and discrete and continuous control.

Third Evolution: Perhaps unique today, Third Evolution, Inc. has teamed up with the #1 college for innovation in the US: Arizona State University. To that end, we have a commitment of access to any and all resources that are needed for any scopes that develop beyond currently known scopes.

Artificial intelligence – 100% (See 2.0 details above)
Theoretical computer science – 100% (We did the review for the JOINT MIT/WATERLOO SUPERCONDUCTOR PROJECT, for conversion from Theoretical to Applied fecundity)
Operations research – 100% Every day function for us.
Software engineering – 100% Every day function for us.
Electrical engineering – 100% Every day function for us.
Discrete and continuous control – We are the BEST firm for this work in the US. 1000%
We have seen so many advanced control applications that when it comes to the discovery phase of any project, which becomes the moving-constraint defined objective functions, as sub-objective functions to super-objective functions, we are very comfortable adding value to creating the highest resolution process model and, if needed, the highest fidelity simulators for the same application.

Robotics – 85% Need clarification on needs, but to us robotics are just a very small industrial plant.
Computer vision – 100% + **We believe we can produce information that NASA and others can only dream of having**, specifically when it comes to planetary analytics. As an optimized AI application, IF THE DATA IS DIGITALLY CHARACTERIZED, we CAN DO MAGIC with our technology. We feel VERY STRONGLY about applying our technology to any image-based analytics. We are so confident that we feel strongly we can prove to NASA/AMES that are ability to discern and predict planetary & near and deep space anomalies, particularly with inferential and heretofore out-of-reach analytics regarding 1st, 2nd and 3rd order deep search & correlation analytics. This would be of great value for surface area analytics, atmospheric analytics, and most importantly the larger influences of orbital, interorbital, solar system derivative influences (huge potential) as well as inferential extractions of heretofore unknown interstellar relationships at the predictive level.
Aeronautics – 100% with ASU relationship commitment

THIS IS THE KEY TO OUR CAPABILITIES FOR THIS SECTION: THIRD EVOLUTION IS ABLE TO CONTINUOUSLY IMPROVE THE ABSTRACT, DIMENSIONLESS DATA OBJECTS WITH AS MANY MAGNITUDES AND DIRECTIONS OF INFLUENCE BECAUSE WE CAN QUANTIFY THOSE MAGNITUDES AND DIRECTIONS IN OUR PURELY RELATIVISTIC ENGINES, AND THEN COUPLE THOSE TOGETHER FOR HOLISTIC CAPTURE OF ALL OF THOSE INFLUENCES IN A QUANTIFIED, RELATIVE SENSE WE CAN USE CLASSIC CONTROL THEORY ON OUR NEWLY FOUND MATHEMATICAL MODEL OF INFLUENCES TO GAIN INSIGHT INTO THE GREATEST TO LEAST INFLUENTIAL CONTRIBUTORS TO THE IDEAL, OPTIMIZED OUTCOME WE REQUIRE.

Additionally, the "Building Block" engine can be implemented singularly or combined with itself configured for

A. **Cognitive Computing**
B. **Associative Computing**
C. **Predictive Computing**
D. **All of the above, as a larger molecule and further to expanded "Super Molecules."**

The PSG research – Our engines will take the complex, temporal constraints, with limited resources, uncertainty and control and generate, by existing design, the guaranteed best path to achieving the

goals. Equally, and again by design, our solution would inherently produce a what-if analysis engine for simulation use to help future development optimization.

The IRG research – Our engines are well suited to large, seemingly disparate volumes of data and identify all deviations; and with those identified deviations our engines can then go into an identification mode with highest probabilities of the deviation analysis, serving up to researchers the most relevant data packaged in the most digestible manner for R&D to begin their efforts at precisely the right point given available data and current circumstances.

BEST USE CASES for IRG: computer vision (navigation, planetary mapping, automated science support), interactive 3D user interfaces (E.G. for situational awareness, sensor data integration, path planning and navigation), and planetary rover optimization, preventative and predictive maintenance.

The Contractor shall employ a broad range of Artificial Intelligence (AI) methods to the missions and tasks such as:
Model-based reasoning and simulation: **Core strength of our AI solutions.**
Planning and scheduling: **in 17 years, we have 100% mission success, including on time and in budget outcomes. Relative to more advanced planning and scheduling optimization, Third Evolution, Inc. has an app we call an "Assignment App." This app has use cases in many industries, optimizing the greatest value resources to the tasks at hand; while giving predictive analysis of the greatest needs and greatest asset identification for enhanced optimization and debottlenecking**.
Constraint-based reasoning: **Core strength of any integration firm specializing in automated, adaptive, real-time advanced control solutions.**
Local and global optimization: **See America's Natural Gas Highway for proof of this capability**.
Decision theory: **Fundamental to our core business**.
Machine learning: **Fundamental to our core business**.
Intelligent synthesis: **Fundamental to our core business**.
Multi-agent coordination: **Fundamental to our core business and covered in detail above**.

Technology Area 3: Discovery and Systems Health (DaSH)
The Contractor shall support research to understand physical phenomena and mechanisms in design tradeoff studies and integrated vehicle environments, including root causes of system failure as well as risk identification, assessment, and mitigation, and in an interdisciplinary way, combining laboratory and field experimental tests, physics-based modeling and analysis, and technologies for data analysis and statistical model and state inference. The Contractor shall support research into quantum computing algorithms and hardware; quantum annealing for combinatorial optimization; understanding the role of noise and decoherence in quantum computing devices; Specific support will be in the development and deployment of advanced algorithms, such as model-based diagnosis, prognostic life estimation models, physics based models, traditional machine learning, learning from partial or incomplete models, stochastic nonlinear model identification, Bayesian and other statistical and model-based learning methods, and decision support.

Third Evolution, Inc. appreciates the inevitable value of super conductors and quantum computing; however, our experiences with very large, world-renown companies claiming AI/predictive analytics capabilities fall into 1 category and we fall into another. And, as previously stated, we are closely aligned with the CEO that holds ALL of the relevant patents

for super-conducting (Ron Kelly of Ambature) so any paths to quantum computing will ultimately go through him. But we currently stand behind the notion that all of the big data analytics firms have 1 glaring issue: they don't have something that works. We know this because the largest data firms are talking to us about partnering.

Them: No matter how fast the computational system can go, if you don't have the right approach you will not get to the desired result. All the large tech/big data firms talking with us about acquisition of our engines come down to the same issue: they recognize they do not really have a true predictive analytics engine, let alone one that can take non-parameterized, abstract data and do 1st, 2nd and 3rd order correlations with magnitudes of emphasis revealed.

Us: Harvey Gillis, a consulting partner in our firm, who holds numerous advanced degrees in classic advanced analytics from Stanford and was the first person in the world to identify and resolve with the US government the heretofore unheard of notion of interest rates going north of 10% (in the Carter Administration), Mr. Gillis singlehandedly saved the financial world of the US from going inverted and bankrupting the entire US/world economies. Mr. Gillis was the 1st choice of Jeff Bezos for CFO of AMAZON; Mr. Gillis had to decline that offer due to other commitments, but his vision and skills with classic predictive control and advanced analytics heroics have become part of Silicon Valley lore. Combining his skills with our iconoclastic AI engines, coupled with our deep adaptive, multi-dimensional constraint control and data mining solutions we feel we have the pedigree to meet and exceed most of the objectives in this RFI.

Johnson Space Center **Mission Operations Directorate (MOD)** Projects:
Third Evolution, Inc. has the pedigree in thermal optimization, a subset of our total process optimization skills, to handle and excel at the scopes required for this work effort.

To achieve any semblance of true optimized decision making – automated or not - we must be able to decompose the process(es) at hand to all roots. Then, from the decomposed root structure of the entire process(es) we must be able to recognize and understand how the re-composition of the process with full optimization can be achieved. And this is only possible through a holistic understanding of the entire super-process from a material-balance perspective. This is a process engineering approach absolutely required for any industrial process that needs to be optimized. It has complete transferability to data-only realms, if one can transition mentally to a relativistic perspective. Hence, our mantra for these types of applications require us to, "Decompose the process, absolutely understand what can be understood, optimize and recompose the process from the root up, automate the process, and then optimize the automation, and then tune the outcomes empirically (against known historically accurate facts), lock down the logic and release for use." Self-tuning remains as an integral part of the locked-down solution. The outcome of this work effort results in (from process engineering accepted best practices) a set of detailed documents that capture the nature of the process in English, symbology and other in-house mechanisms that allow for a complete structural capture of the entire process ready for conversion to our logic engines.

We at Third Evolution postulate that one of the greatest limits of the art of optimization is the absolute failure of today's industries participants to grasp the critical value of a holistic material balance, coupled with all phase transitions of entropy to achieve the ideal outcome. This can only be achieved applying advanced process engineering skills coupled with a powerful correlating engine to envelop all of the noisy data and extract all process influences and their associated magnitudes for all relevant systems. We ARE DIFFERENT, and we are proud of it. We would appreciate the opportunity to discuss our value propositions.

CASE STUDY 1; Kelowna, Canada Biogas Plant Resurrection ONGOING

ARC systems, out of Pittsburgh, PA, had sold 6+ sites of a technology designed for landfill gas upgrading to pipeline quality natural gas. The designer/inventor had never been able to make any of the sites operate to the performance requirements. Fortis, Canada's largest utility, had invested in 1 of these systems in Kelowna, located in the Canadian Rockies. For years, the site never operated and we were contacted as a last-ditch effort to salvage a very expensive and embarrassing site. Third Evolution, Inc, had to grasp the existing system in its entirety and establish if and how we could get the system functioning when the inventing engineer could never get it to work.

We did this work in Phases, splitting the existing, dysfunctional site initially into 2 halves. The front end of the process up to and including the critical primary technology of molecular refinement and total potential relative to starting process circumstances and the ultimate objective function. If we could not explicitly demonstrate a certain significant improvement of outcome performance/potential, we would kill the project at that point – which was the 2nd most likely outcome, if we could not get the performance we had calculated was achievable.

Like any project we do, the holistic understanding of the desired outcome is always crucial for our ability to know IF we can get there, based on the starting point which in this case was a dead site, no documentation whatsoever and zero opportunity to have any discussions with the engineering firm and inventor of the process. To avoid any legal issues for the client, we completely removed all existing logic, controls, data acquisition and processing power so that our starting point was an existing electro-mechanical configuration of vessels, piping, wiring, a landfill we had no control over the production of feedstock and a utility that needed to hit certain performance requirements.

The only way to achieve an acceptable level of knowledge for a clear launch point of efforts with physical installations is to establish every single aspect of capability for each pipe, each pump, each motor, each gas chromatograph, each mass spectrometer, each safety relief valve setting, each physical limit of any chemical interactions, the influence of time on each successive stage of the processing, the multitudes of combinations of interactions of shared equipment which created circumstances of processing exclusivity (one vessel can only be doing 1 thing at a time, in a key sequence, with numerous variable influences pulling and pushing the process in and out of ideal), and then capturing the various models and ferreting out the beginning point of how Third Evolution would set the baseline system so we could operate the site and utilize the existing transmitters, analytical devices and other processing to verify what we thought was correct.

We proved enough to our team and our client that we should move to Phase 2, to then do the same with the balance of the process as step 2a, and then run the site entirely as step 2b. Once we got to operating at step 2b, we would know with greater insight the entire process given there was enough instrumentation to reveal enough information between all process points of effect so that we could match our mass balance ideal capabilities against current operating efficiencies. We were able to successfully prove we could produce the outcomes our client was hoping to achieve. We did so in such a fashion that the site that never ran was now running for weeks at a time UNMANNED. And with how we configure systems, when the site needed human intervention we would send the alerts to the appropriate staff to give the client the opportunity to decide when to dispatch someone to site to maintain optimal uptime. Further, we were able to consult to our client that we could likely DOUBLE their performance expectations with a simple advanced control approach that had otherwise escaped them.

Since we have 17 years of 100% mission success, we know that if we say we can do something, we will succeed. 1 year later, the site now operates per specifications, UNMANNED. The grasp of physics, chemical engineering, optimization, electrical engineering, integration, networking and project execution and project management all played key roles in succeeding where no one else could.

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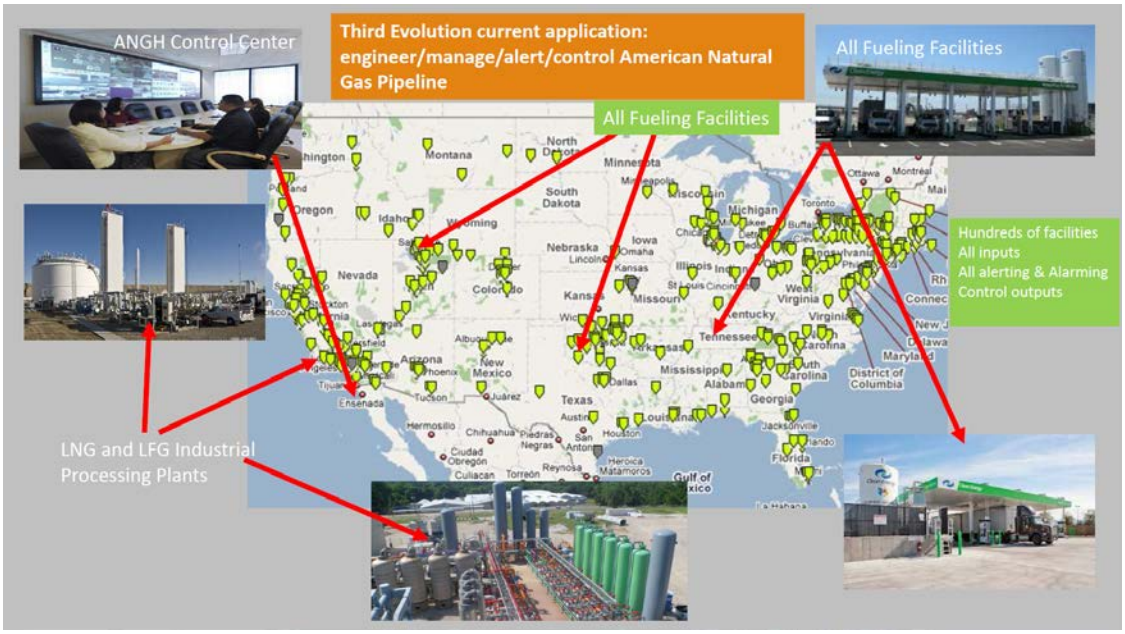
Project cost: Approx $1 million Canadian

CASE STUDY 2: Americas Natural Gas Highway ONGOING 7 years



This massive, nationally deployed 700 site predictive control system demonstrates exclusively all the requirements of this RFI with the exception of Rovers and Extraterrestrial environments. **This project had 4 years of many engineering firms trying and failing to get 1 site up on the display. 1 site. And after 4 years and millions of dollars spent, they had nothing to show. Then they called us, and after 3 weeks we had 6 sites up!** That got us the entire project, which is now in its 7th year of roll out and completely designed and implemented by Third Evolution. This project demonstrates how our firm, not yet a nationally recognized name, has once again overcome the challenges that large, nationally known entities could not overcome.

This project has so many iterations of 90% of the SCOPE OF WORK for NASA/AMES that it is challenging to single out a definitive aspect of similarity. With over 700 unique, real time sites with a thousand IO points at each one and our scope going from designing and building the IT infrastructure all the way down to the design, implementation and on-going support at DART (Dallas Area Rapid Transit) which encompasses all equipment automation inclusive of the field IO. Multiplying that by 700 sites, plus the overlaying NOC (national operations center) SCADA system with alarming and alerting and predictive algorithms we believe this accomplishment highlights the overwhelming amount of interfacing and interaction with various vendors, engineers, network variations, protocol

variations, network infrastructure variations, security variations coupled with a Single-Sign-On (SSO) requirement to prove our capabilities worth of additional consideration for your ongoing work.

Clean Energy Natural Gas Highway SCADA system contact:
Project cost: millions and ongoing

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We strongly feel that we have an extremely unique insight into the “solution of things” that is peerless in its capabilities. And that insight has allowed us to develop those tools, needed by NASA, to be able to handle the base needs of your work as well as the critical mining and correlating of vast amounts of digitized, characterized data. When we combine our expertise in Systems Integration as well as stellar automated, adaptive/self-tuning distributed control systems with all IT layering included, we feel there is a compelling reason for our organizations to get together and solve some of NASA’s targets faster and with more resolution than ever before in history.