CALIFORNIA INSTITUTE OF TECHNOLOGY
JET PROPULSION LABORATORY

Software Reporting Form

The following is a new software application: **NTR Number:** **50965**

Title: CODEX: The COmplex Data EXplorer **Docket Date:** **None**

Funding Disclosure

Funding Source: NASA

Other-Specify: Contact: Jay E Wyatt

Funding Project:* 106409 AMMOS TECH Task: 05.01.13.A

*Project/Task used for tracking purposes only, the number will be checked against existing and past account codes within the NBS financial system

Task Order: NNN13D821T

Development Costs: 600
(Please estimate within 50K)

Additional Development Dollars Anticipated: 2000

Software Description

This software accomplishes the following:

Imagine the world before Excel. Working with large tables of numbers was painful, slow, and often done by writing custom computer scripts. This is the state of machine learning today; expert knowledge is required of both machine learning and computer coding in order to just explore data from a data-driven perspective. CODEX permits users from novice to expert understanding a fast, beautiful interface to load in their dataset and immediately begin building intuition about their data. What looks normal or odd? Are there troublesome values? Do these numbers usefully predict these other numbers, and if so how? CODEX, when complete, will be a transformative product that lets everyone "play" with their data using machine learning, reducing analysis that previously took weeks to a matter of hours.

What are the unique features of the software:

CODEX is built in a browser so that it can run anywhere, anytime, either fully on your personal computer or using a powerful server back-end. It is designed ground-up to maximize interactivity, so you spend as little time waiting for your results as possible (very rare in ML). It has full guidance at every step as to WHY you would take an action, HOW it can be done, WHAT the experts say about the choices, and SUGGESTIONS on how to answer any questions it must ask.

What improvements have been made over existing similar software application:

There aren't any programs like CODEX out there, though we've needed them for years. Excel's ability to fit lines to graphs is a tiny fraction of CODEX, and it's the closest example.

Software Release Version: not yet released, demo only

What problems are you trying to solve in the software:

Rapid assessment of problems in data. Rapid building of intuition (what's really in this data?) Rapid falsification of hypothesis (are these numbers related? No... they aren't, or yes, they are, and here's how). Suggestions of subtle relationships not easily found in simple graphing. Fluid, interactive graphing and highly responsive views.

Please cut and paste the abstract describing the program (this abstract should focus on the programmatic and/or utilization aspects of the software):

The Advanced Multi-Mission Operations System (AMMOS) provides most of the ground data system functions needed to design, implement, and operate a Mission Operations System

(MOS).
AMMOS consists of a core set of products that can be readily customized to accommodate the specific needs of individual missions. It is based on a simple idea: build the elements of an MOS that are common to multiple missions once rather than individual missions duplicate development and maintenance effort.
Using AMMOS lowers mission cost and risk by providing a mature base for mission operations systems at significantly reduced development time. AMMOS enables Principal Investigators by providing direct, immediate, flexible, and seamless interaction with their instruments and data from almost any location without requiring expertise in mission operations or the AMMOS.
High quality and cost effectiveness of our products is why NASA has chosen the AMMOS to support NASA Deep Space and Astrophysics missions.

Does your work relate to current or future NASA (include reimbursable) work that has value to the conduct of aeronautical and space activities? If so, please explain:

This product directly supports all mission Ops concepts (hence AMMOS support), supports end-users exploring data and building intuition, and accelerates machine learning practitioners compare approaches in real-time to select the one matching their data best.

JPL Contributors

Who should be included as contributors on the New Technology Report? Those who have made a direct, unique, and significant contribution to the conception and/or implementation of the innovation.

Badge #	Name	Lab Ext	Section Number	Main Contact	Specific Inventive Contribution
118356	MANDRAKE, DR. LUKAS	4-1705	398J		Vision Keeper, Chief Architect, PI
147065	LIGHTHOLDER, JACK A	0-3246	398J		
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Non-JPL Contributors

A badge number is not required for Non-JPL contributors. If the contributor has a JPL badge number, please enter it; otherwise, fill in all information as appropriate.

Badge #	Name	Phone	Email	US Citizen/ Perm. Res.	Company	Contract #

Name	Contribution

Outside Interest

What advantages does this software have over existing software?

Currently, to engage ML understanding of your data and scan data for problems, you must use Python, Matlab, or similar scripting system to build your own custom code. Only the questions you can think of asking can be answered, and it takes a lot of time to debug each new capability. CODEX automates all of this in a pleasing, intuitive, graphical manner. CODEX doesn't replace custom scripts for deep analysis; instead, it lets you rapidly build intuition and perform quick analysis so that later deep analysis proceeds in an informed, reasoned manner without the hidden "gotchas" often experienced in data analysis work. The interactivity aspects of CODEX are of the greatest interest, as you can quickly "play" to learn about your data rather than ponder, code for an hour, then see a single graph to answer a single question.

Are there any known commercial applications? What are they? What else is currently on the market that is similar?

We intend to produce this software as open source.

Is anyone interested in the software? Who? Please list organization names and contact information.

Several mission ops teams have expressed interest, but we have not formalized any agreements. Luke Dahl of the JPL AMMOS team is spearheading this reaching out effort.

What are the current hardware and operating system requirements to run the software? (Platform, RAM requirement, special equipment, etc.)

Standard desktop system, any OS.

Software Status

What is the status of the software? BETA

How has the software performed in tests? Describe further testing if planned.

Even in its very preliminary demo state currently, users are already wildly excited by its promise and react with "wow!" once they realize what this could do for their workflow.

Awards

Do you want this information published in NASA Tech Brief magazine (www.nasatech.com)? Y

If you want the innovation to be considered for publication in Tech Briefs, you will need to provide a Technical Support Package (TSP). Your technology must specifically relate to NASA work that has value to the conduct of NASA aeronautical and space activities, then publication alone is still possible if you wish. If this is the case, please contact your evaluator.

Software Available for Public Release Award

This award is a cash award of $500 for programs with multiple contributors and $1000 for programs with a single contributor. The software does not have to be available to the general public. In order for your software to be eligible to receive this award, it must be of commercial quality i.e. fully documented either electronically or in hard copy format, have completed all alpha and beta testing, be nearly bug-free, perform the purpose for which it was intended on the intended platform(s) without harm to the host computer's operating system or data, and be distributed to customers and sponsors in the final commercial grade form. It must also be of mature status (see software status questions) and relate to current or future NASA (include reimbursable) work that has value to the conduct of aeronautical and space activities.

Do you believe your software is eligible? N

If so, please identify the customer(s) and sponsors(s) outside of your section that requested and are using your software.

Software Dissemination

Third Party Contributions

Was this software built upon previously existing code/software? N

If yes, then was the previously existing code/software developed at JPL and/or Campus?

If the previously existing code was not developed at JPL or Campus, please answer the following:

Name and description of the previously existing code/software:

Contact information for the code/software (web site, name/email, name/phone number):

Did you accept any license terms for the previously existing code/software?

Website (URL) for license to previously existing code/software (if applicable):

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Software Reporting Form

Has the software been disclosed (e.g. presented as an enabling flowcharge) or distributed to others external to JPL or Campus? N

If so, please identify to whom the disclosure was made and provide date, place, and manner of distribution:

Do you need to disseminate your software? N

Run Date: 28-AUG-18