

## Phase II Project Summary

**Firm:** Tech-X Corporation

**Contract Number:** NASA SBIR # NNX11CB05C

**Project Title:** Fortran Testing and Refactoring Infrastructure

### **Identification and Significance of Innovation:**

Tech-X proposes to develop a comprehensive Fortran testing and refactoring infrastructure that allows developers and scientists to leverage the benefits of comprehensive Integrated Developer Environment (IDE) tools. An intriguing aspect of the infrastructure is the integration of performance measurement, unit testing, and refactoring tools with the many other features of an IDE, which will allow developers to get immediate feedback about the overall application and reduce their development cycle time. The infrastructure will facilitate refactoring newly developed and legacy codes correctly and accurately for single and multi-processor applications. Major benefits to refactoring include creating robust codes that are more easily ported to different hardware and software platforms, promoting extensibility, facilitating better collaboration, and encouraging best software engineering practices. For example, refactoring code to remove common blocks allows porting to multi-core architectures with increased thread safety.

### **Technical Objectives and Work Plan:**

The objectives of Phase II: (1) Design a portable and extensible testing toolsuite for Fortran that supports generating tests for legacy codes; (2) Integrate pFUnit into the Eclipse environment and combine it with Photran and PTP to form a complete- cycle tool; (3) Design and Implement a set of feature rich refactorings for Fortran with focus on parallelization; and (4) Use the resulting FTRI tools with GISS-ModelE and NCAR-CESM/CAM in order to improve testing functionality and overall utilization; were accomplished. The work plan included steps to complete Fortran testing and refactoring infrastructure to accomplish the key components of the technical objectives.

### **Technical Accomplishments:**

During the Phase 2 performance period we implemented a plugin within the Parallel Application Developers Eclipse integrated development environment that allows a user to generate pFUnit tests (i.e. parsing Fortran source code files for subprograms and individual modules in order to generate new unit test code with appropriate build files to test the original Fortran source). This plugin provides graphical user interfaces to interact with pFUnit, showing the progress and test results. We also provide step-by-step instructions for how to use the functionality and extend its refactoring capability. The other major technical accomplishment was to add refactoring capability to the Eclipse environment while greatly improving its performance as requested by users. These Phase 2 results show that we have met the technical objects.

### **NASA Application(s):**

While process study missions are critical to improve underlying climate model physics, future mission observations are critical to determine the impact of those climate model improvements on the accuracy of predicting future climate change. Since the proposed tools will make it easier for NASA scientists to develop and optimize climate modeling codes, the proposed project in a sense supports all climate-related current and future missions.

### **Non-NASA Commercial Application(s):**

Commercial applications are directed at all developers/maintainers of Fortran codes. As new computing architectures become available, the portability, maintainability, and scalability of legacy codes can negatively impact the productivity of users. Serial codes moving to multicore architectures and serial or parallel codes moving to hybrid architectures are targeted as benefiting from the proposed tools.

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