QUARTERLY PROGRESS REPORT

July, 1 2011 to September, 30 2011

In this reporting period the task order to enhance the FHWA-FST2DH model for simulating two-dimensional depth-averaged flow and sediment transport (see below) was submitted to the contracting office (HAAM). HAAM will negotiate the task order between TFHRC Hydraulics Laboratory Support Services contractor and FHWA. The task order was not awarded in this reporting period.

Contract No: DTFH61-11-D-00010 "Hydraulics Laboratory Support Services Contract".
Title: Enhancements to the FHWA-FST2DH Model for Simulating Two-dimensional Depth-averaged Flow and Sediment Transport – Phase I.

The FHWA has a requirement for a new task order under DTFH61-11-D-00010 Contract in support of the statement of work provided below. The proposal submittals by the contractor shall be to the Contracting Officer (CO) and the Contracting Officer's Technical Representative (COTR) at:

Samantha.Reizes@dot.gov, CO
Kornel.Kerenyi@dot.gov, COTR

All questions should be forwarded to the CO and the COTR.

RESEARCH OBJECTIVES

The contractor shall work with federal personnel from the Hazard Mitigation team at the Turner Fairbank Highway Research Center (TFHRC) to update the FHWA-FST2DH model for simulating two-dimensional depth-averaged flow and sediment transport. The current version FST2DH is not suitable for modern computer standards and has to be improved. FST2DH is used by many sate DOT's to perform hydraulic modeling for bridge scour calculations.

STATEMENT OF WORK (SOW)

FST2DH is FHWA's Two – Dimensional Hydraulic Model for modeling flows in floodplains and through complex bridge openings. The model was developed more than ten years ago and since that time many improvements have been made in computational capability. The program needs to be modified to take full advantage of these capabilities. Additionally, much advancement has been made to the computer hardware that is needed to solve the complex series of equations used by the program. Numeric algorithms for solving simultaneous series of equations have continued to evolve and computers with multiple cores that can speed up the solution times by a factor of ten are now the norm. From an engineering perspective, we are more frequently being asked to solve complex problems involving multiple bridge openings, different types of structures, multiple embankments that alter natural flow patterns, unsteady flows, sediment transport, and scour

countermeasure design. Because of the increasingly more difficult types of problems that are routinely being encountered, the state-of–practice needs to continue to improve to keep pace.

RESEARCH TASKS

Considering the above, the work shall be performed in accordance to the following tasks (All Tasks and Subtasks are subject to availability of funds):

Task 1: Task Order Monitoring: Assemble a technical advisory committee (TAC) comprised of members of the FHWA National Hydraulics Team that will provide oversight and guidance on all aspects of the project. Organize quarterly conference calls/webinars with TAC members during the project to discuss the progress of the study.

Task 2: Improve Equation Solution Schemes.

Allow much faster computation times thus increasing productivity and the application of more complicated solutions to complex surface water flows.

Task 2.1 Investigate the ability to utilize a multi-core processor version of the FST2DH software.

Task 2.2 Implement the ability to utilize a multi-core processor version of the FST2DH software. This includes revising the solution scheme for the iterative methods used by the existing version of the software to take advantage of the multi-core processors.

Software Requirements

Task 2 will use software code written in a standard, available software language and having compilers readily available to the Government (i.e., FORTRAN, BASIC, C++, etc). All software development tools used in producing the product shall produce non-proprietary executable programs and should the need occur, the Government would be able to readily obtain these development tools and re-produce the software product. The contractor shall provide a written description of all language and tools for the Government's approval before beginning any coding.

Deliverables

Document all the work conducted in task 2. The work considered under Task 2 is to be considered as an interim deliverable. The deliverable will contain a compiled executable, source code, and complete documentation of the computational methods employed by the program.

Task 3: Update of Bridge Pier Local Scour Calculations

Update the bridge pier local scour calculations to include the most recent HEC-18 procedures, as well as other optional local scour calculation methods not currently coded in the model.

Conduct QA/QC to validate that results are consistent with HEC-18 and other approaches.

Software Requirements

Task 3 will use the same software language and source code used in Task 2. All software development tools used in producing the product shall produce non-proprietary executable programs and should the need occur, the Government would be able to readily obtain these development tools and re-produce the software product. The contractor shall provide a written description of all language and tools for the Government's approval before beginning any coding.

Deliverables

Document all the work conducted in task 3. The work considered under Task 3 is to be considered as an interim deliverable. The deliverable will contain a compiled executable, source code, and complete documentation of the computational methods employed by the program.

Task 4: FST2DH Manual Update

Update the FST2DH manual to include the following: (1) An added appendix or incorporated discussion that describes the use and advantages of the new equation solution schemes, and, (2) An added appendix or incorporated discussion that describes the bridge pier scour calculations, and (3) Conversion of current WordPerfect electronic format to Microsoft Word electronic format. The work considered under Task 4 is to be considered as a final deliverable and will contain a compiled executable, source code, and complete documentation of the computational methods incorporated under Tasks 2 & 3. These enhancements to the computer program and manual will be considered ready for release to the general engineering public.

DELIVERABLES

The project timeline and expected deliverables are outlined in Table I below.

Table I - Project Time frame and expected deliverables

Main Research Tasks	Time period (beginning month to ending month) (All times are based from the effective date of the contract)			
	0 → 1	1 → 5	6 →7	8 → 12
TASK 1	Task Order Monitoring	Task Order Monitoring	Task Order Monitoring	Task Order Monitoring
TASK 2		Improve Equation Solution Schemes (Deliverables includes source code, a compiled executable and documentation)		
TASK 3			Update of Bridge Pier Local Scour Calculations (Deliverable includes source code, a compiled executable and documentation)	
TASK4				FST2DH Manual Update (Deliverable includes source code, a compiled executable and documentation)