Statement of Need

1. Title:

Project Title: National Weather Service River Forecast System Reservoir Tools Enhancement

Project ID: SON-06-002

2. Description:

This section was copied from the Streamflow Regulation Accounting (SRA) Tools Umbrella SON (approved 11/2/2005):

The National Oceanic and Atmospheric Administration's (NOAA) National Weather Service (NWS) has a need to enhance the Joint Reservoir Regulation Operation (RES-J) model to improve stream-flow regulation accounting within the River Forecast Centers (RFCs). RFCs utilize the hydrologic model software package developed by the Office of Hydrologic Development (OHD) known as the NWS River Forecast System (NWSRFS). The software contains the RES-J model and handles a variety of scenarios encountered in daily forecasting operations. However, operational use and testing of the current version of RES-J model, in relation to stream-flow regulation accounting within the Missouri Basin River Forecast Center (MBRFC) area of responsibility, has revealed the need for several enhancements to the NWSRFS and the RES-J reservoir model. The completion of this work, and the delivery of these enhancements, is necessary for the MBRFC to move forward with the larger project of implementing Advanced Hydrologic Prediction Service (AHPS) in the South Platte River basin. This new capability will enable the MBRFC to characterize regulation and more accurately prepare long-range probabilistic forecasts of streamflow.

3. Justification:

3.1 Linkages:

This need directly addresses NOAA Goal 3, to "Serve Society's Needs for Weather and Water Information."

This project was identified by the "Software Infrastructure and Integration" AHPS Theme Team for Fiscal Year (FY05) and FY06.

3.2 Need Originator, Sponsor & Stakeholders

Originator: Mike Smith, OHD Hydrology Laboratory (HL)/Hydrologic Science and Modeling Branch (HSMB) Group Leader

Sponsors: Gregg Schalk or Tom Gurss at MBRFC

Stakeholders: All RFCs

4. Existing capabilities and limitations related to the need.

Because the RES-J reservoir model is limited in its ability to handle scenarios encountered in operational river and stream forecasting, specifically scenarios involving streamflow regulation and accounting, MBRFC has identified a need to increase the variety of hydrologic problems RES-J can model.

There are currently three major components to the NWSRFS: the Operational Forecast System (OFS) and Interactive Forecast Program (IFP); the Calibration System (CS) and Interactive Calibration Program (ICP); and Extended Streamflow Prediction (ESP). The RES-J model is fully integrated within NWSRFS. RES-J was developed as a network model, which could simulate a network of reservoirs, reaches, and nodes. RES-J includes a number of methods which simulate reservoir releases as a function of pool elevation and date. RES-J uses rules specified by the user to control which methods are activated based on conditions in the flow at a node, or dates. The design of RES-J considers the need to simulate reservoir releases for both short-term deterministic forecasts as well as long-term ensemble forecasts (Source: Memorandum Dated April 30, 2004, to Janice Sylvestre, from Mark Woodbury, Riverside Technology, incorporated. RTi, and titled "General Streamflow Regulation Modeling Strategies").

The enhancements to the RES-J Operation completed in the SRA Tools enhancement project (HOSIP Project H-05-051) included:

- Modification of the routines that manage carryover to allow RES-J to work properly in the ESP verification process ("Hindcasting capability").
- A new method added to RES-J to compute release as a function of additional system variables, states, or time series value, similar to the capability found in the LOOKUP3 Operation. ("Lookup3")
- Development of one or more methods to allow diversion from a node as a function of current flow at the node, consumptive use demand, or other model states. ("Diversion from a node")
- Modification the RES-J LAG-K method to include the same capability as the LAG-K operation. (i.e. variable Lag) ("Lag/K")

The updates of the SRA Tools enhancement project (HOSIP Project H-05-051) will be included in the OB8.1 release. Upon completion of that project, the Software Architecture Enhancement Theme Team for FY06 identified two additional deficiencies dealing with the Variable Table Lookup functionality in the LOOKUP3 operation and the handling of Rating Curves in the RES-J model. To address these deficiencies, RTi submitted a technical proposal to make the following enhancements:

- Modification of the LOOKUP3 operation to allow a component of a multi-value time series to be used as the input time series, so that the associated component could be used as a factor in regulation modeling.
- Modification of the RES-J model to allow the use of static rating curve definitions in the main NWSRFS files. The enhancements in RES-J will utilize single-valued

rating curves and handle logarithmic and linear interpolation, and offsets. This will allow a standardized use of rating curves rather than having "special" versions for Res-J.

Implementing these two enhancements is the focus of the current project.

5. Benefits and Performance Impact:

The NWSRFS Reservoir Tools initiative will also enhance RFC forecasters' ability to handle a variety of scenarios when issuing river and stream forecasts even beyond streamflow regulation accounting enhancements in the SRA Tools enhancement project (HOSIP Project H-05-051) .

- Lookup3 Operation: In some cases, the contents of the zones in the Sacramento model may provide a useful indicator of basin conditions that could be used to trigger some component of regulation modeling. This enhancement will allow the zone contents to be used as a factor in regulation modeling in those cases. For example, soil moisture conditions may be used to alter agricultural diversions.
- Integrated Rating Curves in the RES-J Operation: This enhancement will ensure the model always uses the most up-to-date and consistent rating curve data from NWSRFS database, thereby removing the need to redefine RES-J operations to recognized current rating table data. This enhancement is general in nature with benefit beyond streamflow regulation accounting.

6. Constraints

The proposed changes must be completed to meet the AWIPS schedule and for Operational Build 8.3 (OB8.3) delivery deadlines.

7. Attachments:

None.

8. Resource Proposal for Stage 2

Stage 2 will be conducted by RTi.

RTi has submitted a technical proposal that has been accepted by OHD.

RTi's proposal contains an estimate of 725 labor hours for the total project through Hydrologic Operations and Service Improvement Process (HOSIP) Gate 4. Resource estimates for Stage 2 are not identified explicitly.

RTi expects to complete Stage 2 – including preparation of all Gate 2 documents, reviews, submission of documents to HOSIP Administration, and Gate 2 itself in December, 2006.

9. Review and Analyses Statement

None

10. Expected Start Date

To be determined after the Gate 1 approval.

11. Appendices

Acronyms List

AHPS	Advanced Hydrologic Prediction Service
AWIPS	Advanced Weather Interactive Processing System
ESP	Ensemble Streamflow Prediction
FCEXEC	Forecast Execute
FCINIT	Forecast Component Initialization Program
FCST	Forecast Program
FY	Fiscal Year
IFP	Interactive Forecast Program
MBRFC	Missouri Basin River Forecast Center
MCP3	Manual Calibration Program
NWS	National Weather Service
NWSRFS	National Weather Service River Forecast System
OHD	Office of Hydrologic Development
OPT3	Automated Optimization Program
RES-J	Joint Reservoir Regulation operation
RFCs	River Forecast Centers
RTi	Riverside Technology, inc.
SON	Statement of Need
SOO	Statement of Objective
SRA	Streamflow Regulation Accounting

12. Approval Section

Proposed Service Theme Area			Small Basin Fast Responses Services		
Project Leader:	Kuang-Shen Hsu		**HOSIP Admin Analyst:**	Jose Soler	
Gate 1 Approval				**Date:**	**11/02/2005**
Office Name	**Project Area Lead**	**Group Leader**	**Branch Chief**	**OHD Architecture**	**OCWWS**
HSEB	Joe Gofus		Jon Roe		
Dependencies: *Please identify any dependencies (example: waiting completion of another project)*					
Funding Secured for Stage 2: (Yes/No). *If yes provide funding source and funding year*			Yes**,** This project was identified by the "Software Infrastructure and Integration" AHPS Theme Team for Fiscal Year (FY05) and FY06		
Stage 2 Expected Start Date:	**1/10/2007**		**Stage 2 Expected End Date:**	**2/07/2007**	