To: D. Meekins, TJNAF

From: H. L. Nigg, SRNL
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Date: 11-10-2014

(U) FY15/16 TJNAF-SRTE Tritium Target Structure Evaluation

Statement of Work and Funding Estimates

The following is a Statement of Work (SOW) and Cost Estimate requested for FY15 and FY16 activities to be led and/or performed by SRNL (Savannah River National Laboratory) and TP (Tritium Programs), also collectively called SRTE (Savannah River Tritium Enterprise) at SRS (Savannah River Site), in collaboration with and in support of TJNAF (Thomas Jefferson National Accelerator Facility). The funding mechanism is an ICO from TJNAF with a period-of-performance (POP) 10/1/2014 through 09/30/2016.

TJNAF will use a tritium filled target in a fundamental physics experiment. The aluminum alloy target has not previously been used in tritium service. TJNAF is interested in understanding the safe application and handling of the target before, during and after their experiment. SRTE will design and implement a program to expose alloy samples to relevant conditions, test specified properties and evaluate results to assist TJNAF with this understanding.

The experiment (beam time) is expected to occur October 2015 – December 2015 and January 2016 – June 2016. SRTE will need to have some samples exposed to tritium about 4-6 months before beam time in order to produce potentially relevant information. The following activities will be performed by SRTE:

1) Task Technical Plan and Task Quality Assurance Plan
2) Understanding Beam Conditions; Material Properties
3) Identifying Relevant Experiment Parameters and Property Tests
4) Design of Experiment
5) Loading/Storing Samples with Tritium
6) Performing Property Tests
7) Evaluation and Reporting
8) Disposal of Samples/Materials

Relevant scope/activity detail is provided throughout this document. The Principal Investigators (PI) are also listed. High resolution details for each activity will be provided in the Task

Technical Plan (TTP). Approved additions, deletions and modifications will be documented in subsequent revisions.

Activity 1) Task Technical and Quality Assurance Plans

TJNAF PI – Dave Meekins

TP PI – Joseph Novajosky

SRNL PI – H. Lee Nigg

SRTE will produce both a Task Technical Plan and Task Quality Assurance Plan for TJNAF input, review and approval. The TTP will detail tasks, responsibilities, schedule, requirements and specifications for the agreed scope. The TQAP will define Quality Assurance requirements.

Activity 2) Understanding Beam Conditions; Material Properties

TJNAF PI – Dave Meekins

SRNL co-PIs – Mike Morgan, Ashley D. Elizondo

SRNL personnel will document beam conditions and known material properties which may be useful in the design of experiments. Project expectations and early design-of-experiment will also be proposed and discussed. Three SRNL personnel will travel to TJNAF.

Activity 3) Identifying Relevant Experiment Parameters and Property Tests

TJNAF PI – Dave Meekins

SRNL co-PIs – Mike Morgan, Ashley D. Elizondo

SRNL personnel will identify relevant experimental parameters, given beam conditions, and property tests that provide specified information and propose to TJNAF for approval. Some of this scope may also occur in Activity #2. Some possible parameters and property tests may include:

Parameters:
- sample (coupon) dimensions
- notched samples
- un-notched samples
- up to 5k psi tritium gas
- up to 200 °C
- age for helium build-in: 0 to 1 year

Property Tests:
- bending strength
- tensile strength
- microstructural analysis (SEM, TEM, etc.)
- tests at elevated and/or low temperature

Property tests are designed to determine any microstructure changes and, if so, their effect on material properties/performance.

Activity 4) Design of Experiment

TJNAF PI – Dave Meekins

TP PI – Joseph Novajosky

SRNL co-PIs – Mike Morgan, Ashley D. Elizondo

SRTE will build a design of experiment for this program. SRNL will also propose to TJNAF for approval. SRTE will also create relevant procedures and acquire necessary hardware. At this time anticipated parameters may include the following. These will be more formalized in the TTP.

- up to 12 coupons
- some notched
- some un-notched
- half of notched → bending strength
- half of un-notched → tensile strength
- selected coupons → microstructure analysis
- sampling and testing → ~ every 4-8 weeks (TBD)

Activity 5) Loading/Storing Samples with Tritium

TJNAF PI – Dave Meekins

TP co-PIs – T. Scott McGee, Joseph Novajosky

SRNL co-PIs – H. Lee Nigg, Mike Morgan

SRTE will load and store samples at specified conditions/parameters. SRTE will provide procedures and necessary hardware. The storage vessels are anticipated available (assuming coupons fit). There is an assumption that loading and storage procedures can be created with slight modification of existing procedures.

Activity 6) Performing Property Tests

TJNAF PI – Dave Meekins

TP co-PIs – T. Scott McGee, Joseph Novajosky

SRNL co-PIs – Mike Morgan, Ashley D. Elizondo

SRNL will property test samples. SRTE will provide procedures and necessary hardware. The property testing equipment is assumed available. Tests will likely occur each of the first 3 months followed by every other month (TBD).

Activity 7) Evaluation and Reporting

TJNAF PI – Dave Meekins

SRNL co-PIs – Mike Morgan, Ashley D. Elizondo

SRNL will report the details and data of all activities including assessments and evaluations of property performance.

Activity 8) Disposal of Samples/Materials

TP PI – Joseph Novajosky

SRNL PI – Mike Morgan

SRTE personnel will dispose of samples per procedure. Procedures and hardware are assumed available.

Post-Beam Structure Analysis

TJNAF will ship the used target for unloading to the SRS Tritium Facility. This scope is funded by a different ICO.

Afterwards, SRNL may perform a burst test followed by microstructure analysis. If this is performed, SRNL will create procedures and provide all hardware. This is noted for information purposes. It is not funded at this time. Funding may be negotiated at a later date.

Proposed Schedule and Budget Tables

The tables below show proposed schedule and fully burdened costs for the listed scope split into TP and SRNL portions as well as FY15 vs. FY16 activities. Labor rates and overheads can and do change over the course of any FY and between each FY. Labor, materials and travel are included in the budget numbers.

Meetings and activities where personnel may travel to one location or another are indicated. The anticipated experiment (beam time) is also shown. Note that schedule changes will be addressed in a revised Statement of Work and ICO Request.

The total cost is ~ $80k split: ~$60K in FY15 and ~$20k in FY16.

CY/FY	14/15			15/15									15/16			16/16								
Scope Schedule	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1) Task Technical Plan and Task Quality Assurance Plan																								
2) Understanding Beam Conditions; Material Properties			travel to TJNAF																					
3) Identifying Relevant Experiment Parameters and Property Tests																								
4) Design of Experiment																								
5) Loading/Storing Samples with Tritium							actual load																	
6) Performing Property Tests																								
Beam Time																								
7) Evaluation and Reporting																								
8) Disposal of Samples/Materials																								

Scope Budget	FY15	FY16	TOTAL
1) Task Technical Plan and Task Quality Assurance Plan	2623	0	2623
2) Understanding Beam Conditions; Material Properties	31401	0	31401
3) Identifying Relevant Experiment Parameters and Property Tests	848	0	848
4) Design of Experiment	6172	0	6172
5) Loading/Storing Samples with Tritium	15625	0	15625
6) Performing Property Tests	2645	12754	15399
7) Evaluation and Reporting	799	4680	5479
8) Disposal of Samples/Materials	0	2363	2363
TOTAL	**60112**	**19798**	**79910**