MRD 16- TAG Reconstruction

Data Product Overview
A reconstruction of the TAG event to determine the asteroid response to the spacecraft interaction with its surface including an assessment of the likelihood that sufficient material was mobilized to collect the baseline mass of material and an explanation of likely causes in the case that the first TAG event is not successful post-firing of a gas tank. The data product also includes a plan for long-term science derived from the TAG event including reconstruction of the geological setting of where the sample was collected, what the potential subsurface geology at the sample site, etc.

Nominally TAG Reconstruct does not levy requirements, rather it is a consumer and any and all data that is available. However, TAG Reconstruct could benefit from specific observations or strategies and we aim to express that in this document.

Overview
Data type (image, spectrum, data table, map format etc.). What does it measure at what scale?
The data will be a series of data tables that estimate the physical properties of the contacted surface area of the asteroid. The specific physical properties of the surface material that will be reported will depend on the results of the TAG event and also on those properties that have previously been shown to most directly affect sample collection as determined by the TAG Testbed efforts. These are currently known to be the particle size distribution, the presence of large rocks, the induration of the surface material and any cohesion between surface particles.

What observations are required to provide the input data needed to make the data product?
It will rely on post-TAG data products derived from the following: (1) TAGSAM telemetry Report (via the TAGFORCE product) from the TAG process that include data from TAGSAM, IMU, Telecom, GNC LIDAR, attitude measurements (2) Imagery/Movie from SamCam, (3) Trajectory Reconstruction based on the NavCam imagery and the Radio Tracking Data, (4) Sample Mass Measurement Report, (5) Post-TAG NavCam and GNC Lidar Imaging Report, (6) Any and all science data taken during and after TAG. This data will be used to reconstruct the specific behavior of the spacecraft during its interaction with the asteroid, as well as directly inspect the behavior of the TAG site on the asteroid.

It will also use a prepared atlas of modeling results, both numerical and laboratory TAG sampling tests. Numerical modeling will be calibrated to the TAGSAM Testbed Campaign, and then provide explorations of a larger parameter space, including significant tests in Bennu-gravity. Due to the short turnaround for this data product, these modeling tests will be done in advance so that a link can be made between spacecraft behavior and the most likely asteroid near-surface properties.

When in the DRM are the observations that make the data product scheduled to be taken?
The post-TAG data product timeline has all necessary data products produced within 120 hours following the TAG event. The TAG Reconstruction Report will be produced within 48 after all post-TAG data products have been submitted to the project. Much of the spacecraft telemetry is expected to be available within 24 hours of the TAG, and therefore some efforts will begin

earlier.

How long does it take to produce the data product?
The data product will be produced within 48 hours in order to meet the post-TAG timelines (7 days post-TAG). Much of the spacecraft telemetry is expected to be available withing 24 hours of the TAG, and therefore some efforts can begin earlier.

Is this product used for sample site selection, science value, or long-term science?
This product will be produced following a TAG event, and in the event that a second TAG event is needed this product will help understand the behavior of the asteroid and TAG after the the first TAG event. The information produced from the analysis of a failed TAG event will be used to re-assess map algorithms that were used to select the first sample site.

This product will also guide and assist long-term science resulting from data collected during the TAG events.

Data Product Structure and Organization
What is the structure of the data product (e.g. FITS file with 4 extensions)
The data product will be structured in a series of data ASCII files describing the estimated physical properties of the contacted asteroid surface, the total surface contacted, the total volume of near-surface material that interacted with the TAGSAM and an estimated mass collected.

How is the product organized (e.g. one data set per mission phase, one file per Earth Day, etc.)
There will be one product for each TAG attempt.

Data Format Descriptions
Header information (metadata) included with data product.
There is no expectation of necessary metadata to understand or interpret this product.

Detailed Description of data format.
The data format will be a series of tables in ASCII format numerical values.

Data Product Generation (desires for specific data...)
How and by whom is the product generated?
This product is generated by Walsh in the RDWG. It will be generated by comparison of the results in the following five input products and an atlas of modeling and laboratory experiment results.

What are the input products needed to produce the product?
It will rely on five post-TAG data products:
1. TAGSAM telemetry report (TAGSAM, IMU, Telecom)/STK Movie,
2. Video of TAG (MRD-380) (SamCam Imagery/Movie),
3. Trajectory Reconstruction/STK Movie,

4. Sample Mass Measurement (SMM) Report,
5. Post-TAG NavCam and GNC Lidar Imaging Report,
6. Any and all science data taken during and after TAG (OTES, SamCam Imagery)

More specifically, the desires for the imaging campaign during TAG are:

- Maximizing the SamCam imaging rate from 5m to post-TAG is crucial for capturing the properties of the actual spot that TAG happens. This is necessary to run the Sampleability Algorithm with this final data input.
- Extending imaging beyond TAG+10sec. +55sec would be great, and even longer timescales, if possible, holds value for glimpsing the post-TAG indent/crater

For other Science Data that could be taken during TAG:

- OTES data could provide a valuable ground truth on Thermal Inertia (TI) estimates at the TAG site and help us understand TI and grain size relationships.
- Any LIDAR could possibly "see through" a dust cloud and get some information on the shape scale of a crater/indent in the event that dust obscures the optical imaging.

What algorithms and/or calibration data is used to generate products?
The algorithm and plan are still being constructed by the TAG Reconstruct Tiger Team, with the major data product receivables listed above, and the major tools being numerical modeling results and capabilities, and also the TAGSAM capabilities testing results.

Has a specific Science Team Member been assigned to produce this product?
Kevin Walsh from RDWG.

Will multiple versions of the product be generated? How will they differ?
Multiple versions will only be produced in the event of multiple TAG events. Each product will be independent and rely on new versions of the input products produced at each TAG event.

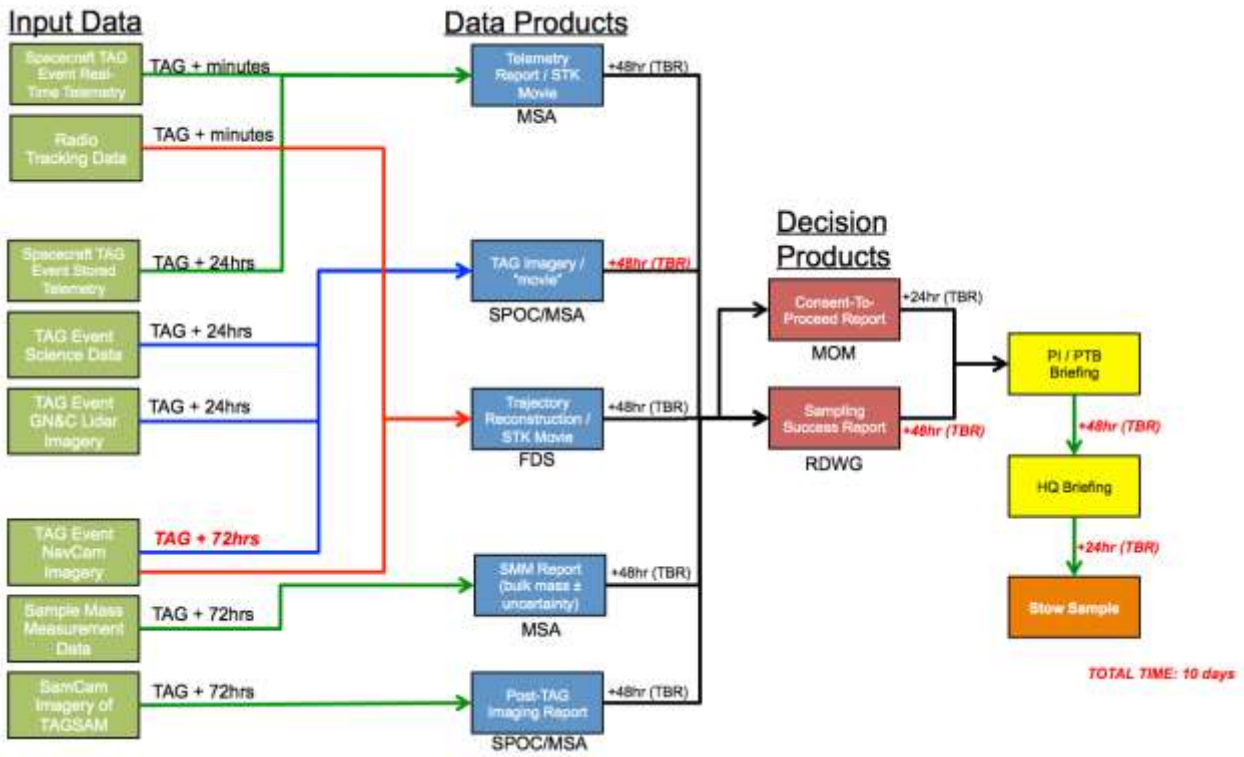
Data Product Validation
How will the product be vetted to ensure contents and format are correct?
The test data will come from the 5 data product receivables. This data product also relies on an atlas of computer simulation results and TAGSAM capability test results. These will be produced over the length of the mission and can be included in V&V tests as they are being produced.

Data Flow
Update Data flow diagrams with more detailed based on current processing configuration. Describe the sources, destinations, and transfer procedures for data products.

State the size of an individual data product and the total size of all the data products generated over the course of each mission phase.

State the time span covered by a product, if applicable, and the rate at which products are generated and delivered.

The input Data Products come via the SPOC, MSA and FDS, and all are produced within 72 hours post-TAG. The RDWG uses these to produce the TAG Reconstruct product which is delivered to the PI.



Standards used to generate data product

The output will be simple ASCII data files output in standard CGS units to describe various properties of the asteroid surface properties and estimated outcomes of the TAG event.

Observation Requirements

By definition, the TAG Reconstruction work is not levying observational requirements. This product is a consumer of data already produced.