

## Phase C/D Charter: Dynamical Evolution (DEWG) – Lead: Bottke

The DEWG is tasked with the reconstruction of the dynamical timeline of Bennu from main-belt asteroid to near-Earth object. The primary objective of the DEWG is to develop geologic and dynamical hypotheses that are testable with future ground-based observations, the asteroid encounter, or analysis of the returned sample. In support of this activity they will contribute to the Sample Analysis Science Report.

The DEWG will seek to investigate whether or not Bennu is related to any known asteroid family or the "background" asteroid population. If such a link is established this group will explore the collisional history and dynamical lifetime of the Bennu main-belt family. In addition it is important to understand if there are siblings of Bennu in the NEO or main-belt populations that are following a similar dynamical path.

This group will also focus on the short-term dynamical evolution of Bennu. They will constrain the timeline for Bennu-Earth close approaches in the past and future and address whether any of these are likely to have resurfaced Bennu. This group will also address the impact hazard and define measurement requirements to refine the probability of impact.

The DEWG is responsible for producing the following dynamical data products: Yarkovsky acceleration (MRD-150); YORP effect (MRD-193); prediction of orbital evolution and evaluation of the impact hazard (MRD-195b). For products that support sample-site selection or other mission-critical elements, the DEWG must coordinate with the SPOC to develop the plan for delivering these products on a timeline defined in the ground system development schedule.

The DEWG is responsible for the following Deliverables in Phase C/D:

- Dynamical Evolution Product Descriptions
- Yarkovsky acceleration
- YORP
- Prediction of orbital evolution
- Evaluation of impact hazard
- Dynamical model

The DEWG will receive the following Receivables in Phase C/D:

- Science Implementation Plan for review and concurrence – from PI Office
- Science Software Phase C/D Development Schedule – from PI Office
- Data Products Menu – from SPOC