

Summary of Draft EXPORTS Implementation Plan Reviews & Steps Forward

September 26, 2016

The draft EXPORTS Implementation Plan was released for public comment by the EXPORTS Science Definition Team (SDT) on July 18, 2016. Both the draft plan and supporting documentation were provided at the NASA Ocean Biology and Biogeochemistry webpage (http://cce.nasa.gov/ocean_biology_biogeochemistry/exports). Comments were requested on the suitability of the plans presented, but the EXPORTS SDT was especially interested in comments regarding: 1) Alternative descoping options, 2) Costing of the Goal Plan and the descoping options, 3) Proposed timeline and phasing of the Goal Plan program and the cruises, 4) Input on potential national and international partnerships and their interactions with the suggested timeline 5) Project and data management and 6) Capacities not reflected in the plan that could make important contributions to the measurement suite and/or modeling. The review period was open until September 6, 2016.

A total of 48 comments were submitted to the obb_comments@cce.nasa.gov for consideration by the SDT. Reviewers ranged from graduate students to emeriti professors and an approximate assessment of the academic standings of the reviewers is presented in Table 1. More than one-half of the respondents were graduate students, postdocs or early career scientists. Further, fourteen reviewers were at non-U.S. institutions and expressed interests in helping to build collaborations between their nation's programs and EXPORTS. The reviewers were not told that their comments would be made public. Hence, the SDT decided that neither the identity of the reviewers nor their complete comments would be made public.

Table 1: Reviewer Demographics

Category	Number
Graduate Student	10
Postdoc	4
Early Career Scientist	13
Senior Scientist	19
Emeriti Scientist	2

The reviewers had near unanimity in their enthusiasm for the EXPORTS program as described in the draft Implementation Plan. Many respondents commented that implementation of a comprehensive field / modeling / synthesis program addressing the functioning of the biological pump is long overdue. This enthusiasm was particularly apparent in the comments from beginning / early career scientists where several stressed the importance of comprehensive, highly interdisciplinary research programs for laying collaborative foundations for students and early career scientists. Many reviewer comments stressed the importance of frequent team meetings and data workshops to help foster these collaborations.

The need for integrating synthesis throughout the field campaign was raised by most of the commenters. Without exception all thought that Phase 1 (SQ1 & SQ2) should **not** be decoupled from Phase 2 (SQ3) and that descoping options that suggested this were unacceptable. The reviewers stressed that EXPORTS must integrate synthesis throughout

the program’s duration. Several commented that the synthesis plans were not as well comprehensive as plans for the field operations. In the revised Implementation Plan, sections 4.4 and 4.5 have been updated to demonstrate the path which NASA supported EXPORTS field observations, mined and collaborating international data would all be synthesized to answer the EXPORTS science questions. Further several reviewer comments stressed the importance of frequent team meetings and data workshops run by a Project Office to help foster this synthesis.

The SDT designed and costed the Goal Plan (plan A in Table 5) that would provide a high degree of certainty that all of the EXPORTS science questions would be answered. The SDT also created and costed a set of reduced resource options (or descopes) to be considered if there are inadequate resources to conduct the Goal Plan. The SDT needed feedback from the community with regard to which descoping option would still enable the EXPORTS science questions to be answered. There were many ways that answers to this question were given in the commenters’ written responses and clearly synthesizing them into a quantitative framework is challenging.

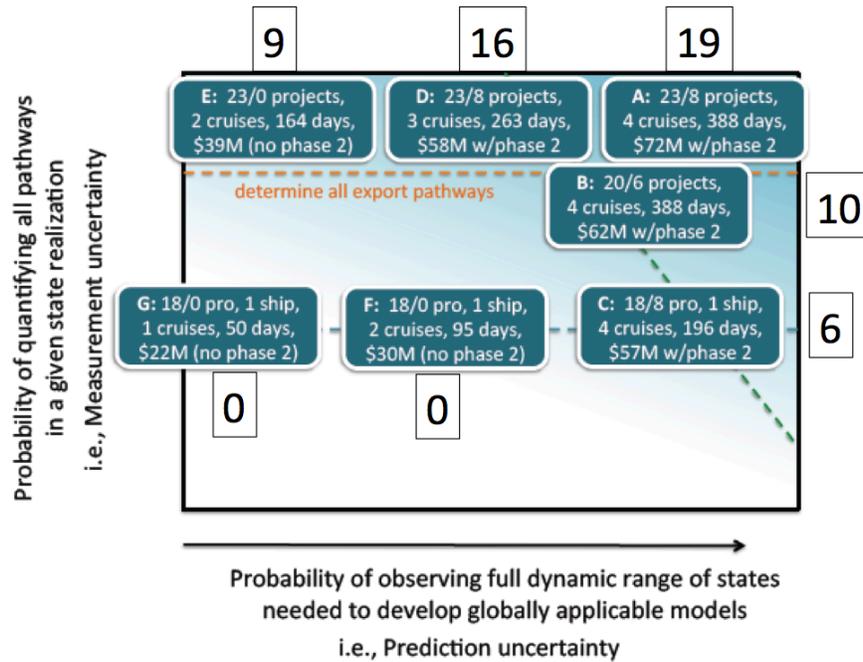


Figure 1: Trade-space diagram for probability of quantifying all pathways vs. observing full dynamic range with numbers of community responses for which descoping option would still be acceptable to answer the EXPORTS science questions.

From the comment narratives, the SDT determined the number of comments for which an option was selected as an acceptable minimum for EXPORTS (Figure 1). Nineteen respondents said that only the Goal Plan (Plan A) would adequately answer the EXPORTS science questions. Sixteen said that the three cruise option (Plan D) would be adequate while 10 reviewers thought that the Goal Plan “lite” version (Plan B) would work. Other proposed descoping options (Plans C, E, F & G) had fewer comments about their acceptability. The SDT recognizes that this determination of preference from the written comments is inexact at best. However the community preferences appears to be for two

ship options that would determine all export pathways (at least near the horizontal dashed orange line in Figure 1) over single ship options. Several participants commented that the development of robust international partnerships would help expand the number ecosystem / carbon cycling states that would be available for answering the EXPORTS science questions. It should also be mentioned that no respondents stated that the Goal Plan would be inadequate. This analysis of community comments along with recent discussion among the SDT is used in section 5.2 to make the final recommendation for the minimum acceptable configuration for the EXPORTS field campaign.

As requested, there were many specific comments regarding activities that individual reviewers felt were missing from the draft plan or were simply not well explained. A comment theme of the comments was that the SDT placed too much emphasis on particulars that were buried in the appendices (and the footnotes of the appendices) or were discussed in the previously vetted Science Plan. In response, we have edited the draft plan to better explain the range of planned activities. For example, we have carefully defined what the SDT means by an “ecosystem / carbon cycling state”, “program element”, “plankton composition”, “-omics” and similar phrases used throughout. Further table 2 seemed to be a source of confusion as it contained only those measurements needed to answer SQ1C. In an effort to avoid this confusion, we have replaced Table 2 with a redacted version of the Complete Measurement Table. We hope these changes will make it easier to understand the implementation plan.

There were many instances where the community comments brought light to omissions in the draft implementation plan. These included but were not limited to near-real time data assimilation modeling focused on informing cruise operations, modeling of source funnels for sediment trap collections, net traps for collecting large amounts of sinking particulate materials, developing contingency plans for rare biological events (like salp blooms), characterization of the enzymatic activity of the microbial community, etc. These changes have been included in the final implementation plan draft.

Several reviewers did raise concerns about the effects of iron limitation on programmatic goals, particularly for the NE Pacific cruises. Early on during the drafting of the Science Plan, it was decided that EXPORTS would not focus on the controls on NPP, but rather its fates. Hence, both the Science Plan writing team and the SDT decided that a trace metal sampling and analysis program was not needed to understand carbon export pathways. We have made it clearer that the sampling and incubation for phytoplankton rate determinations needs to be done under trace-metal clean conditions. We also suggest that for the NE Pacific cruises in particular it would be useful to have some measurements of dissolved iron concentrations as well as proxies for phytoplankton condition (cf., Fv/Fm) as iron limitation likely impacts community structure at this site.

Finally while the SDT has tried not to be overly prescriptive, it was essential to focus on realistic scenarios so that robust cost estimates could be made. The suggestions made by the community reviewers have improved the draft plan. The exact implementation of EXPORTS, if it is to occur, will be worked out through the proposal competition process.