

10 September 2014

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### **American Geosciences Institute Response to draft *Dynamic Earth: GEO Priorities & Frontiers 2015—2020***

The American Geosciences Institute (AGI) appreciates the opportunity to comment on the recently released draft document, *Dynamic Earth: GEO Priorities and Frontiers 2015–2020*. We commend the NSF Advisory Committee for Geosciences (AC GEO), NSF staff, and all who were involved in developing the document.

The American Geosciences Institute (AGI) is the global leader in geosciences information. Founded in 1948, AGI is a nonprofit federation of geoscientific and professional associations representing more than 250,000 geologists, geophysicists, and other earth scientists. AGI provides information services, acts as a voice of shared interests in the profession, plays a major role in strengthening geosciences education, and strives to increase public awareness of the vital role geosciences play in our society.

The draft five-year plan outlining priorities for the National Science Foundation (NSF) Geosciences Directorate (GEO) is highly important for the geoscience community and it also has broader societal impacts—NSF’s choice of focus areas will affect the flow of information that is available to decision makers at all levels and will frame discussions on earth-related policy making.

Our comments are informed, in part, by AGI interactions with audiences outside the mainstream academic environment, including industry, members of Congress, the administration, and their staff, and the general public. In this challenging funding environment, it is important to be cognizant of the multiple audiences that this document may reach. Ideally, the document should articulate a strong rationale for supporting the GEO Directorate, its purpose, and its investment choices.

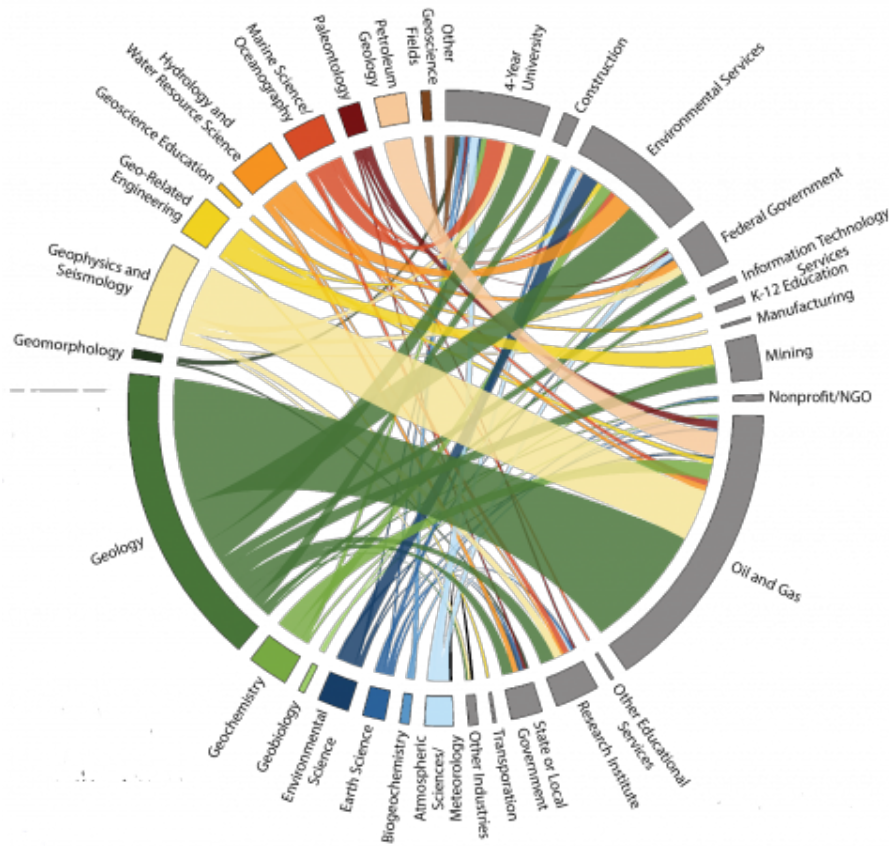
The choice of research imperatives—core research, hazards and disasters, water cycle, ocean observatories initiative, facilities, operations in polar regions, sun-earth-community models, cyberinfrastructure, using computational infrastructure, observing systems and arrays, workforce, community-based science, use of community resources—shows the breadth and challenges that GEO faces in supporting its Divisions and wide-ranging strategic priority areas. Faced with the immense demands on the research, resources, data and cyberinfrastructure, and education and diversity components of GEO, it is difficult to prioritize individual elements and AGI recognizes the hard choices faced by AC GEO.

We respectfully suggest that it would be helpful to include a statement outlining a vision of what GEO is striving to achieve when selecting its priorities for 2015–2020. Perhaps the AC GEO could use “The GEO Vision” outlined in the 2009 GEO Vision Report (<http://www.nsf.gov/geo/acgeo/geovision/start.jsp>) as a starting point for explaining the purpose behind the choices. A GEO vision would help stakeholders to assess the relative merits of the strategic priority areas, imperatives, and research frontiers, and to relate them to national and other priorities.

This revision of GEO priorities offers an opportunity to emphasize the importance of the second criterion in NSF merit review: broader impacts. Intellectual merit is a fundamental tenet of NSF’s philosophy but broader impacts, “the potential to benefit society and contribute to the achievement of specific, desired societal outcomes,” are where many stakeholders engage with the outputs and outcomes of research. Basic research, free of market or other constraints, must always be a core function of NSF but information on the broader impacts of NSF investment decisions could be incorporated as a specific element in GEO strategic choices.

Broader impacts are inherent in many of the topics outlined in the document and in some cases, such as funding for facilities, the broader impacts are the main purpose for the investment. It would be helpful to the geoscience community and others if AC GEO were to validate and articulate the importance of both intellectual merit and broader impacts in GEO priority areas, imperatives, and research frontiers. It would also be helpful to explain the role of both criteria in your choice of priorities as an example of implementing dual-criterion decision making within NSF.

We note your statement that “GEO is interested in connecting GEO research with the marketplace.” This is an approach that may offer some metrics to support investment choices based on a fuller investigation of the needs of the marketplace. Some marketplace indicators that could be incorporated in GEO strategic decision making are already available. In the area of education, for instance, a recent AGI publication identifies those sectors that employ the greatest numbers of new geoscience graduates (Fig. 1). How does NSF investment in education respond to data on the employment prospects of geoscience graduates, which are now mainly in the oil and gas, environmental services, and 4-year university sectors?



**Fig. 1.** The industries of geoscience graduates’ first jobs by field. (Based on data from AGI Geoscience Student Exit Surveys 2013 and 2014). (AGI Currents #90, July 24, 2014, <http://www.americangeosciences.org/workforce/currents/industries-geoscience-graduates-first-jobs-degree-field>.)

The research frontiers chosen by AC GEO—Land/Ocean Interface; Ocean Oscillation, Ocean-Atmosphere Interactions, Ice Sheet Dynamics and Related Interactions; Atmosphere and Ocean Processes in the Southern Ocean; Urban Geosystem Science; and Early Earth—are all worthy and important issues. We note, however, that there appears to be a dearth of solid-earth geosciences in the research frontiers and we would urge a balanced approach to filling gaps in knowledge.

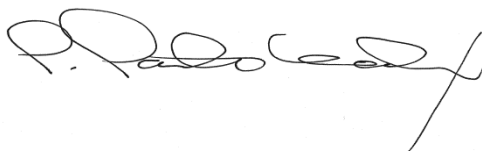
Within the Education and Diversity strategic priority area, AGI sees many benefits in strengthening GEO's presence in the K-12 sector and we urge you to consider this as a priority. Developing geoscience capabilities at the K-12 level would help in addressing the workforce pipeline, improve public geoscience literacy, and could readily be linked to community-based science that leverages community resources, all of which are Education and Diversity imperatives. GEO could develop a dynamic K-12 geoscience initiative in collaboration with other NSF Directorates and with other federal and non-federal partners.

At a finer level of detail, in the GEO-Research Imperative on hazards and disasters, we suggest adding earthquakes, landslides, and sinkholes to the list of hazards and disasters on p. 5. We would also suggest that risk quantification may be a more appropriate immediate goal than forecasting or predicting disasters. We commend the initiative to develop a GEO-wide approach to infrastructure lifecycle management; this is an important practical and conceptual approach that should help in addressing the long-term implications of investment in infrastructure.

AGI is impressed by the ongoing efforts of GEO to critically analyze and assess its priorities, as reflected in the 1999 *NSF Geosciences Beyond 2000* report, the 2009 *GEO Vision* report, the follow-on 2012 *Strategic Frameworks* report, and now this *Dynamic Earth* report. We strongly support your goal of advancing the understanding of the planet's integrated systems to benefit the nation and thank you for your openness to consultation with the geoscience community and beyond.

Please contact Maeve Boland, Director of Geoscience Policy, ([mboland@agiweb.org](mailto:mboland@agiweb.org), 703-379-2480, ext. 228) if you have any questions or would like further information.

Sincerely,

A handwritten signature in black ink, appearing to read 'P. Patrick Leahy', with a long horizontal stroke extending to the right.

P. Patrick Leahy  
Executive Director