Testimony of
Jane Hawkins Ph.D., Member of the Board of Trustees and Treasurer of the
American Mathematical Society
On
FY 2013 Appropriations for the National Science Foundation
Before
The House Committee on Appropriations
Subcommittee on Commerce, Justice, Science, and Related Agencies
Congressman Frank R. Wolf, Chair
Congressman Chaka Fattah, Ranking Member

Chairman Wolf, Ranking Member Fattah, and members of the committee, I am Jane Hawkins, member of the Board of Trustees and Treasurer of the American Mathematical Society (AMS) and a Professor of Mathematics at the University of North Carolina – Chapel Hill. AMS is a member organization of over 30,000 professional mathematicians. I am here today to request a FY 2013 budget of $7.373 billion for the National Science Foundation (NSF). This investment will allow the NSF to continue to support innovative and transformational scientific research that fuels the American economy, upholds national security, maintains our global competitiveness, and improves health and quality of life for millions of Americans.

I would like to thank the Committee, especially the Chairman and Ranking Member, for past support of NSF. This support has been very important for maintaining our Nation's scientific enterprise, which is critical for continued innovation and technological development. The Chairman's effort in behalf of NSF's budget during the conference for the FY 2012 "minibus" appropriations bill is greatly appreciated.

These are difficult economic times and Congress continues to face the arduous task of reducing the federal budget deficit. However, even in this fiscal environment we must continue to make investments that will benefit our country in the future. Adequate, sustained federal support

for scientific research and education is one of these investments, and NSF is the perfect agency through which investments in education and high value research can be made.

NSF is the only federal agency that supports research and education across all fields of science, engineering, and mathematics and at all educational levels. Research and education programs supported through NSF are fundamental for increasing and developing the knowledge base needed for pushing the frontiers of science, mathematics, and engineering disciplines, developing new fields of inquiry, and supporting technological innovation. Dependable funding will enable the scientific community to plan, develop infrastructure and create a manageable pipeline of graduate and postdoctoral students. Predictable funding patterns will facilitate a continuous stream of high level research and researchers.

In FY 2011 over ninety percent of NSF's budget went to support research and education projects in colleges and universities in all fifty states. The Agency evaluated over 51,000 proposals through its merit review process, funding over 11,000 of these proposals. This resulted in a success rate of 22 percent, indicating how competitive it is to receive an NSF grant. With this level of difficulty in obtaining research support, researchers can become disillusioned with the grant process, especially young scientists, and leave the profession. This low success rate doesn't go unnoticed by undergraduate students who might consider going into scientific and engineering research.

Society has benefitted from many products, procedures, and methods resulting from NSF supported research, products such as Google, magnetic resonance imaging, arterial stents, and bar codes. These innovations have come out of inquires in quite a different context, often just scientific discovery. Research of this kind is essential to breakthroughs relevant to our modern world even though at the time of discovery relevance is not even suspected. I will give one small illustration here. The study of partial differential equations is a difficult and abstract field of mathematics that was born from attempts to

understand physical problems such as a vibrating string or the spread of heat through material. It goes back to the 1700's and has developed into an extremely broad area of mathematics, with applications emerging each decade that are much more sophisticated than could have been imagined ten years earlier. In other words, mathematicians were pushing their ideas into unknown territory when they came up with the underpinnings of many of today's applications.

At my home institution, the University of North Carolina at Chapel Hill, NSF funding has played a large role in the development of students in partial differential equations (PDEs), on both the undergraduate and graduate levels. Professor Jason Metcalfe is a young research faculty member there who recently won an NSF CAREER award to train undergraduates throughout the academic year and to run a small summer school in topics such as special relativity, a field first studied by Einstein two hundred years after PDEs were first discovered. The research of this group is fundamental to understanding the stability of our universe and future space exploration. As another example, recent Ph.D. graduate Benjamin Dodson works in Berkeley California on research related to using PDEs to detect hidden objects. These results are used in medical imaging, oil exploration, and have military uses for detecting an invisible object with properties different from its surrounding medium.

Modern studies of fluid flow, at first thought to be too difficult to study using PDEs, have led to a much deeper understanding of weather prediction, water flow, and environmental cleanup. Nathan Pennington was supported at the University of North Carolina on an NSF grant awarded to his advisor. In turn, he is employed by the I-Center at Kansas State University which is funded by NSF money and enables Nathan to train undergraduates alongside faculty and graduate students in an interdisciplinary environment, studying properties of fluids of varying viscosities.

Anna Mazzucato, also a UNC NSF-supported Ph.D. student is currently at Penn State University in an applied math group where she is deeply involved in applications of PDEs to answer questions about hidden

objects when the boundaries are rough, so the object is difficult to disentangle from its environment. Her work has many potential applications.

This provides a small sample of how 3 NSF-funded Ph.D students in North Carolina are now involved in the training and education of undergraduate and graduate students at large state universities in California, Pennsylvania, and Kansas in a field of fundamental importance to science and society.

Other NSF funded students from our university currently work at the National Security Agency, universities in states such as Texas, North Carolina, Oklahoma, and Virginia, software development companies, and an oil exploration company in California. One other student made the transition from math modeling of the spread of HIV to the hands-on application of the theory by becoming a research medical doctor. To summarize, each NSF grant gets leveraged to affect the lives of tens of thousands of Americans eventually. Some of the benefits are seen immediately while others develop slowly in universities over many years with applications hard to imagine a decade in advance, such as the invention of Google.

NSF accounts for 64 percent of federal support for academic research in the mathematical sciences and it is the only agency that supports mathematics research broadly across all fields. Mathematics research is primarily carried out in colleges and universities. Mathematics is not the only field that benefits from NSF funding. NSF accounts for over 80 percent of federal support for academic research in computer science; over 60 percent for non-medical and environmental biology, and social sciences; 59 percent for environmental sciences; 48 percent for physical sciences; and, 39 percent for engineering. Moreover NSF grants facilitate interdisciplinary collaborations to occur among these fields, which provide cross fertilization of clever ideas and move the frontiers of science forward.

NSF is a very important component of the U.S. scientific enterprise. I ask that the Committee give strong consideration to providing an FY

2013 budget of $7.373 billion for NSF. Thank you for this opportunity to speak to you and for your support of NSF.