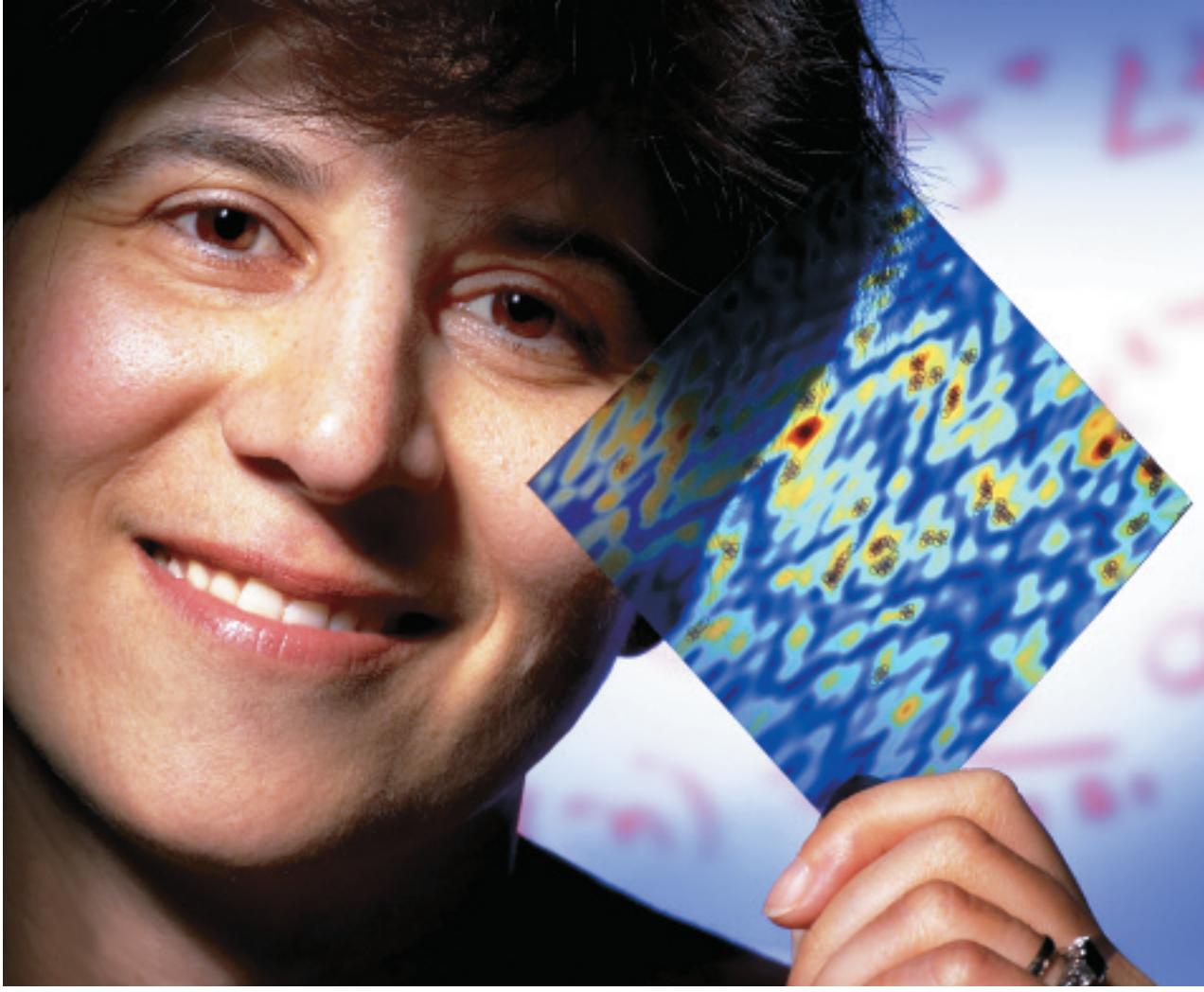
the challenge:
Build the Department of Mathematical Sciences to national prominence by 2008.

the progress:
Mathematical Sciences has increased its grant support to $1.5 million from $1.1 million in FY 2004 and met its goal for expansion of the doctoral program, graduating seven PhDs in 2005. The department has also strengthened its concentration in biomath, incorporating the Division of Biological Sciences into the department.



achievement

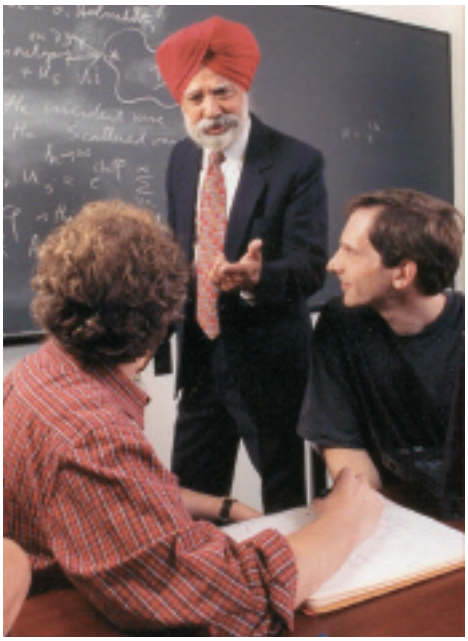
A Calculated Defense Effort

Solutions to real-world problems in such areas as medicine, pharmaceuticals, manufacturing and business are the focus of NJIT's mathematics researchers. But the work of Associate Professor Eliza Michalopoulou in ocean acoustics has an even more compelling and timely bottom line — national defense.

With expertise in both mathematical analysis and signal processing, she studies how sounds move in the ocean and how they are affected by factors like temperature, ocean depth, seafloor composition and currents. The main goal is to help the U.S. Navy, which supports her research through the Office of Naval Research, to identify better techniques for detecting submarines, particularly along the nation's seacoasts. Using analytic techniques including matched field processing and inversion analysis, she studies oceanic sound propagation and localization, including the influence of geological features beneath the ocean floor that must be acoustically imaged. The end products of her work are algorithms that can be used in developing next-generation security systems.

Her work also provides important insights into climate trends and global warming — the warmer the water, the faster sound travels through it — and changes in water composition due to harmful contaminants.

The image Michalopoulou is holding (above) plots the likely locations of sound sources with respect to the depth of the ocean and range, or distance, from receiving sensors: red indicating a likely source, while blue locations are least likely.



SUPERCOMPUTERS TAKE A GIANT LEAP

Daljit Ahluwalia, professor and chair, and director of the Center for Applied Mathematics and Statistics, received a Major Research Instrumentation grant from the National Science Foundation to acquire a 64-node Beowulf class computer cluster. The supercomputer cluster, which will be one of the leading computational facilities contained within a department of mathematical sciences in the United States, will be used in research to study fundamental processes in physical science and biology, such as research in molecular dynamics to chart interactions between drug molecules and their protein targets, and simulations of neuron interaction in the visual cortex designed to improve understanding of high-level visual processing events.

In Other Projects

Associate Professor **AMITABHA BOSE** *is developing with NSF grant support an Undergraduate Biology and Mathematics Training Program that will prepare students for research at the interface of mathematics and biology.*

The goal is to enhance the biological abilities of mathematicians and mathematical abilities of biologists. Open to undergraduates in any major, the program educates students to recognize how mathematics and biology complement one another, thereby allowing them to formulate novel hypotheses, and equipping them with the tools needed to test their predictions.

MICHAEL SEIGEL, *associate professor, is leading an NSF-supported study with collaborators from UCLA and Caltech on singularity formation for the three-dimensional euler equations – specialized equations that govern motion in fluid dynamics. He expects substantial implications for fluid dynamics, particularly the role of euler singularies in the onset and structure of turbulence, an important factor in the design of aircraft and watercraft.*

Associate Professor **SHELDON WANG** *has two new NSF grants – a project to study manufacturing processes for biocompatible implant materials, and a study to develop new computational models for normal and sickle red blood cells in an aqueous environment with the goal of developing a better understanding of sickle cell diseases and their treatments.*

GREGORY KRIEGSMANN, *distinguished professor and Foundation Chair, was awarded a grant by the U.S. Department of Energy to support his ongoing studies of the microwave processing of ceramics, a process of importance in the manufacture of high-temperature structural components of automatic turbochargers, jet engines and tank armor.*