

New Developments in Medical Robotics:
In-Situ Virtual Images and Forces to
Augment Image Guided Intervention

George Stetten, MD, PhD



U.S. Patent Jul. 29, 2003 Sheet 1 of 7 US 6,599,247 B1

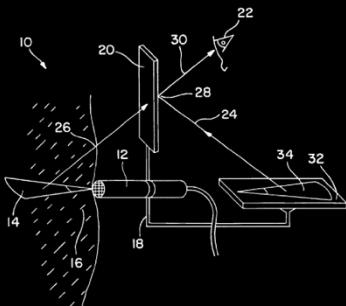
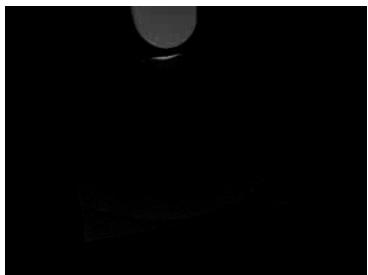
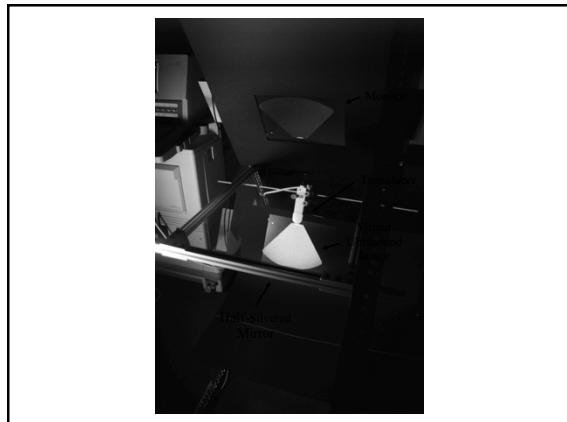
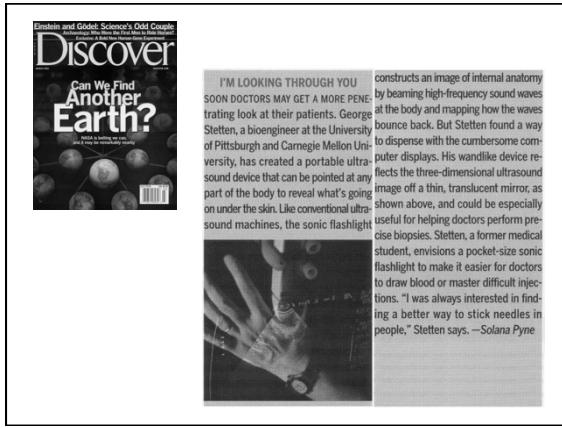
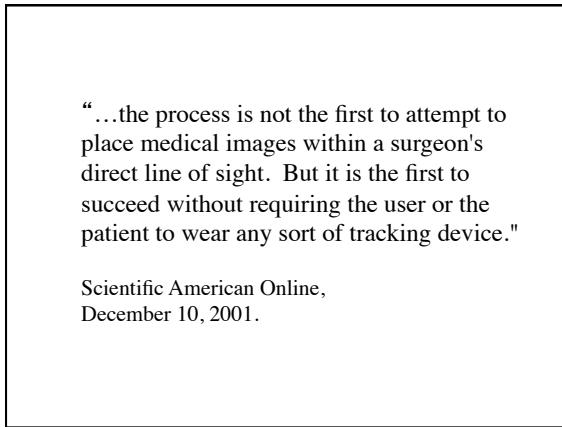


FIG. 1



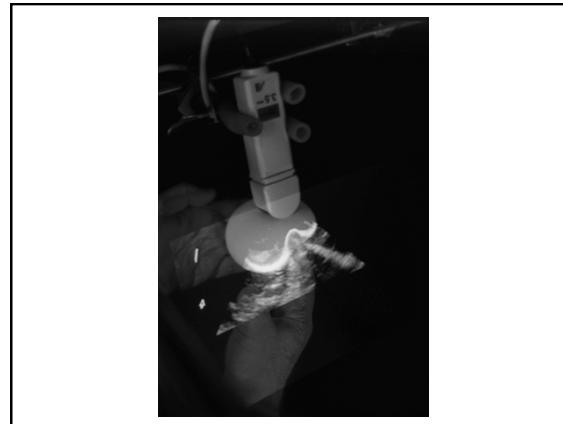
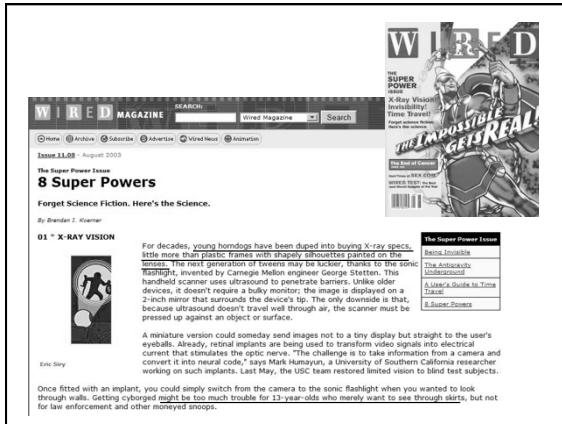


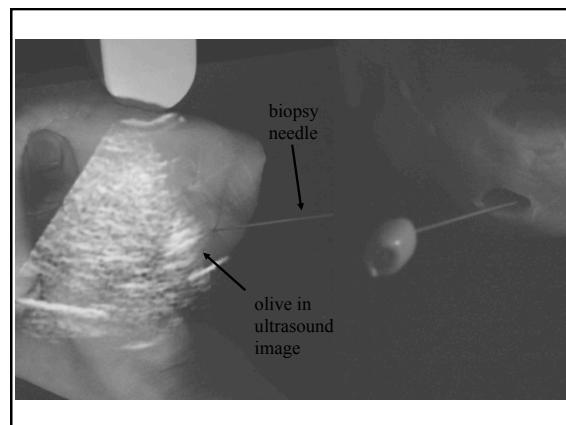
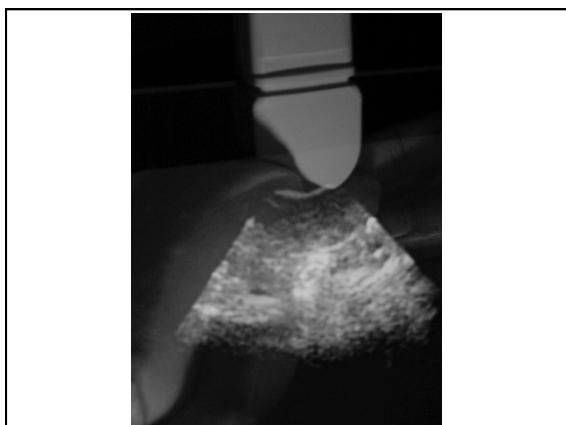
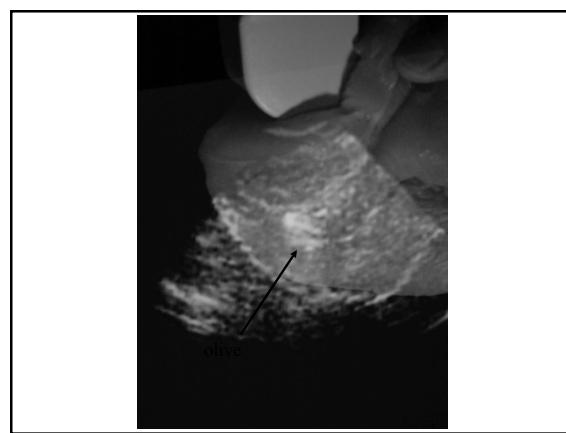
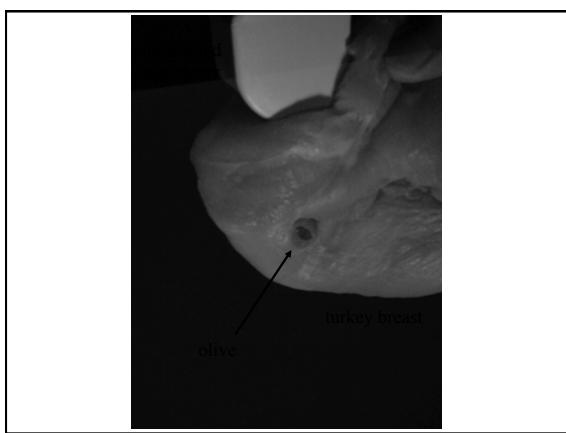
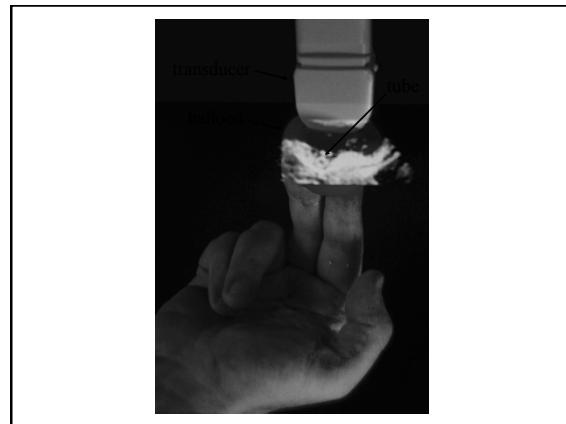
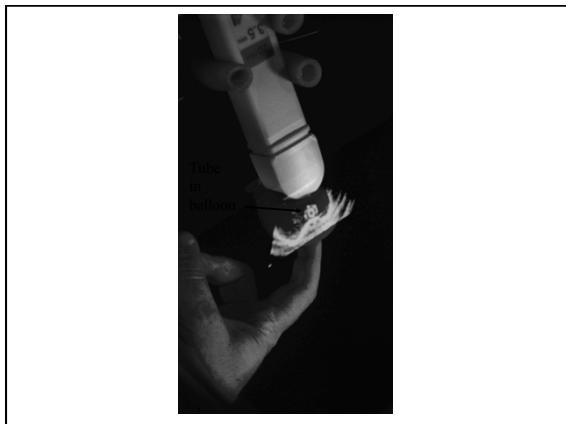
I'M LOOKING THROUGH YOU
SOON DOCTORS MAY GET A MORE PENE-
TRATING LOOK AT THEIR PATIENTS. George
Stetten, a biophysicist at the University of
Pittsburgh and Carnegie Mellon Uni-
versity, has created a portable ultra-
sound device that can be pointed at any
part of the body to reveal what's going
on under the skin. Like conventional ultra-
sound machines, the sonic flashlight
constructs an image of internal anatomy
by beaming high-frequency sound waves
at the body and mapping how the waves
bounce back. But Stetten found a way
to dispense with the cumbersome com-
puter displays. His handheld device re-
flects the three-dimensional ultrasound
image off a thin, translucent mirror, as
shown above, and could be especially
useful for helping doctors perform pre-
cise biopsies. Stetten, a former medical
student, envisions a pocket-size sonic
flashlight to make it easier for doctors
to draw blood or master difficult injections. "I was always interested in find-
ing a better way to stick needles in
people," Stetten says. —Solana Pyne

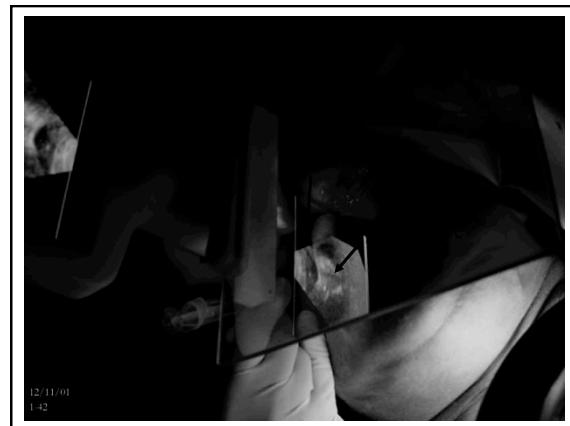
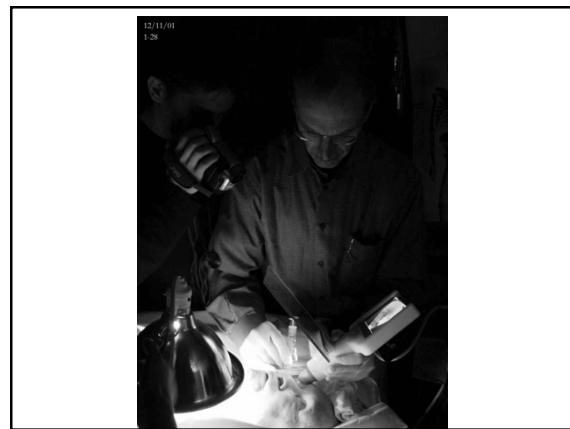
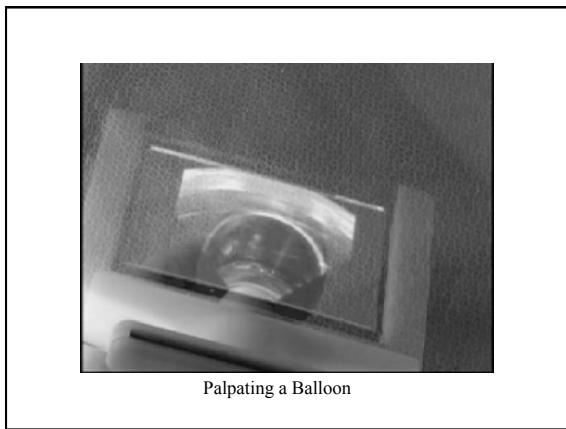
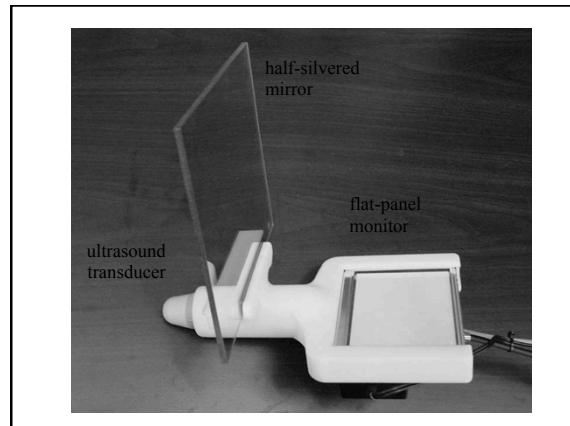
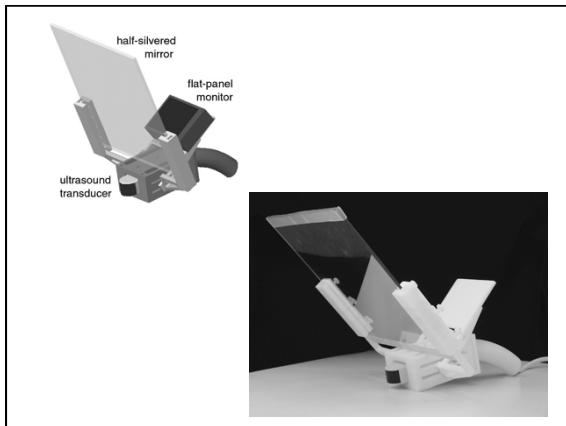



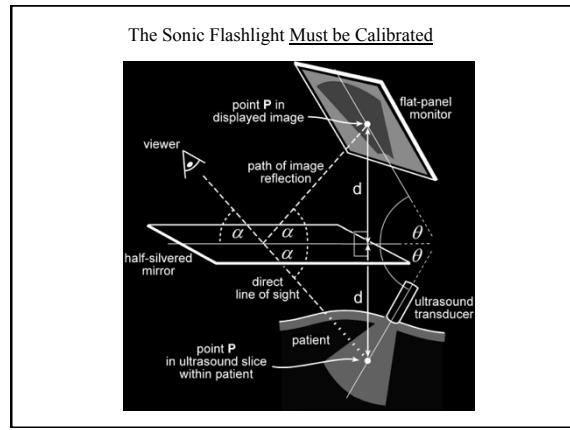
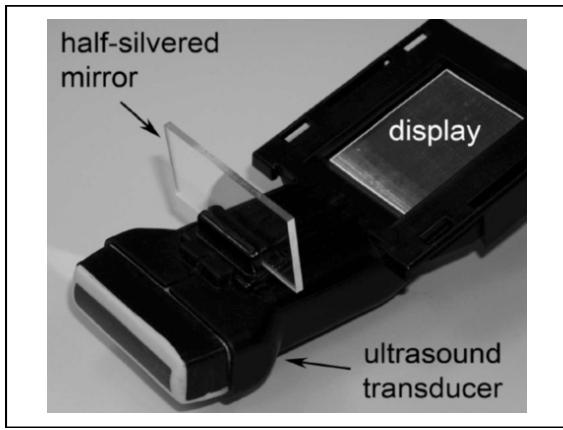
"...the process is not the first to attempt to place medical images within a surgeon's direct line of sight. But it is the first to succeed without requiring the user or the patient to wear any sort of tracking device."

Scientific American Online,
December 10, 2001.

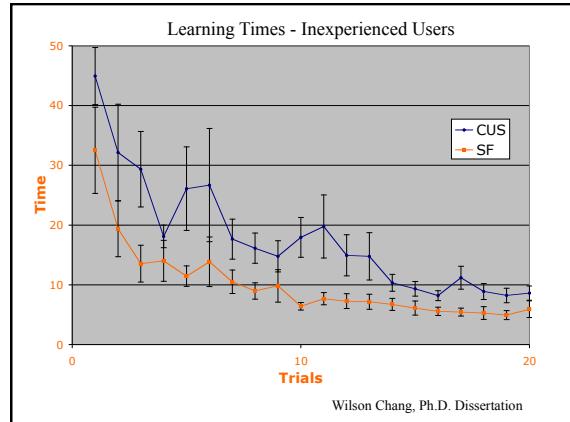
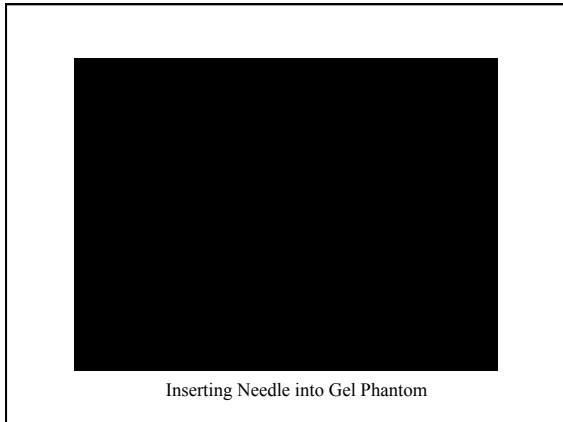
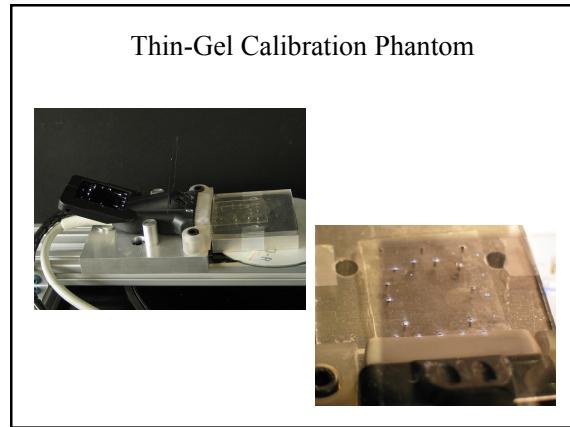


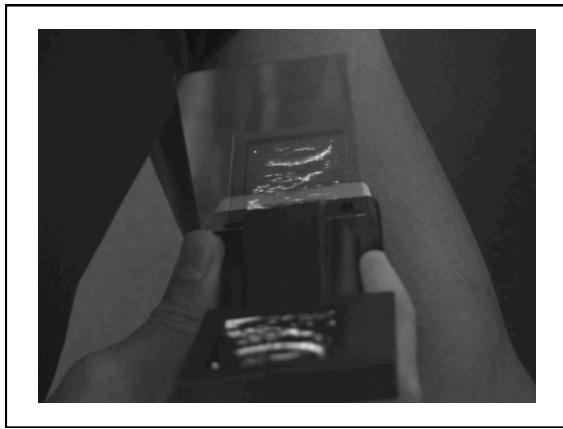
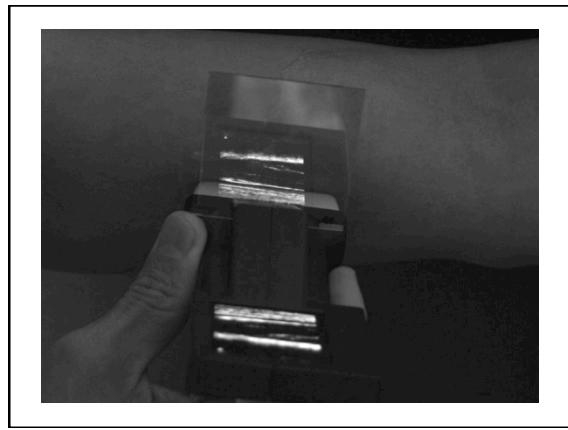
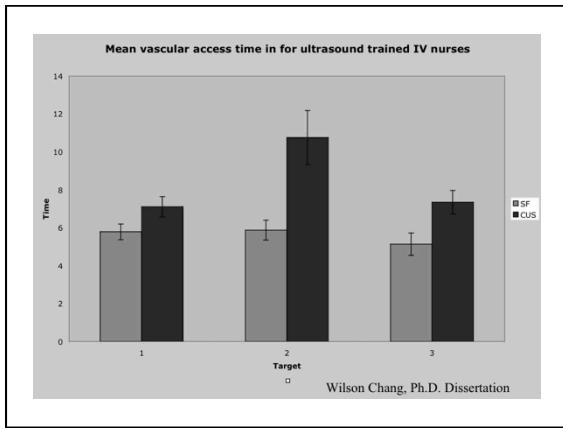






$$\begin{bmatrix} x'_1 & x'_2 & x'_3 \\ y'_1 & y'_2 & y'_3 \\ 1 & 1 & 1 \end{bmatrix} = \begin{bmatrix} a_{1,1} & a_{1,2} & a_{1,3} \\ a_{2,1} & a_{2,2} & a_{2,3} \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 & x_2 & x_3 \\ y_1 & y_2 & y_3 \\ 1 & 1 & 1 \end{bmatrix}$$

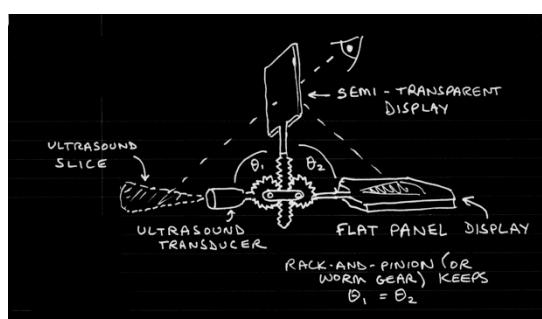


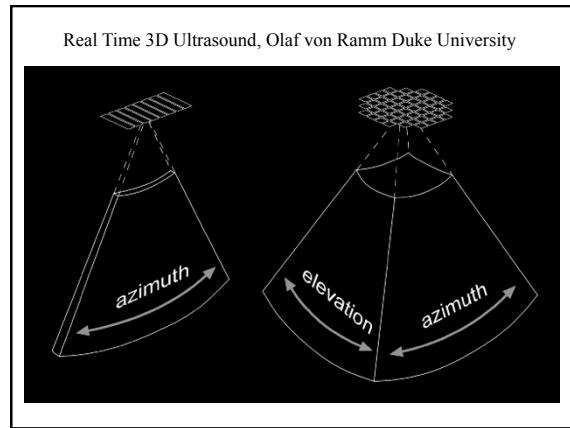
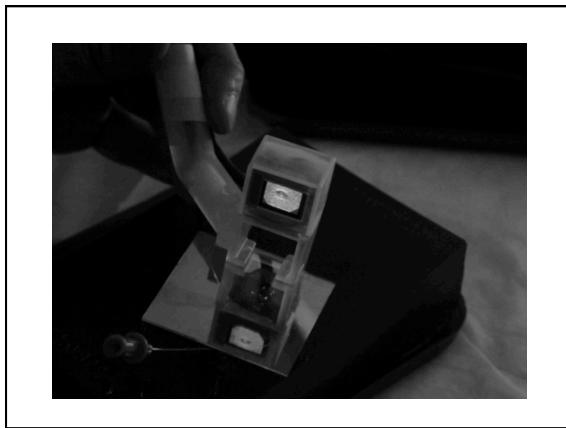
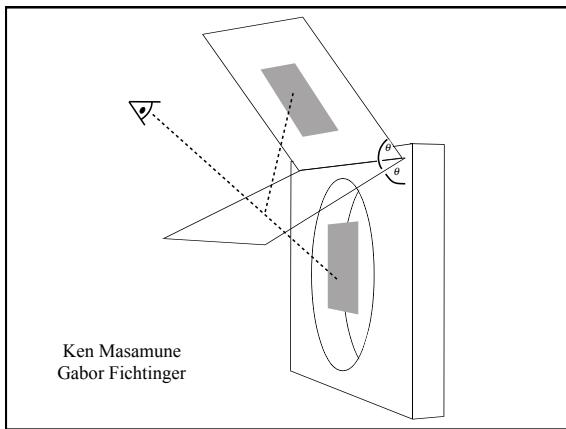
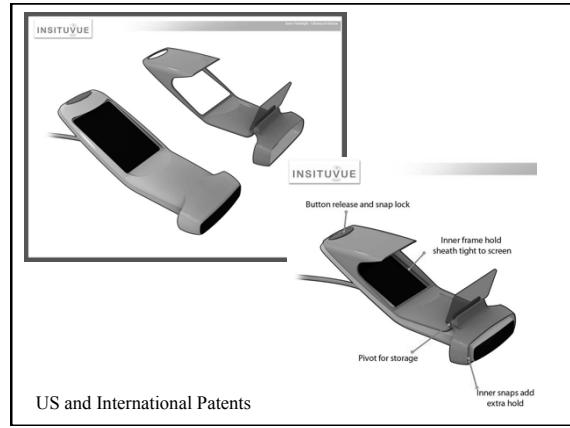


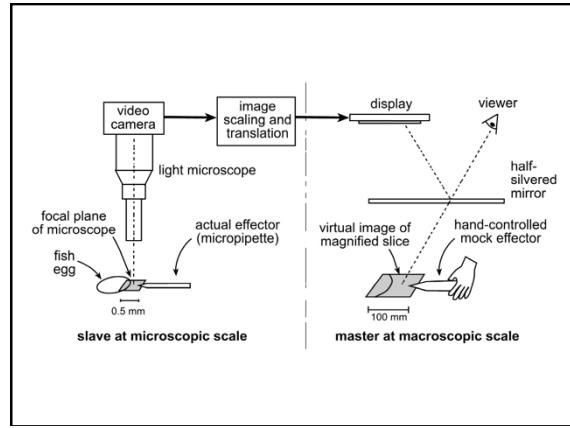
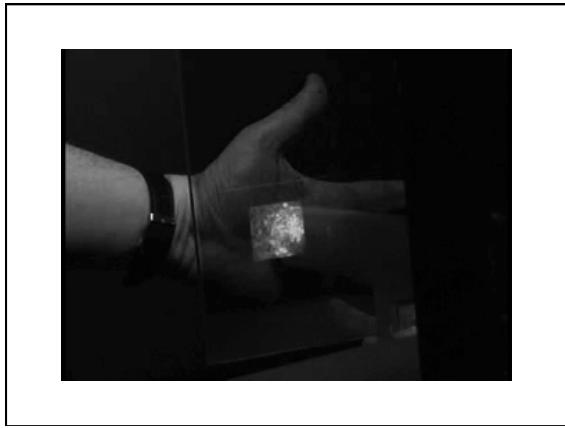
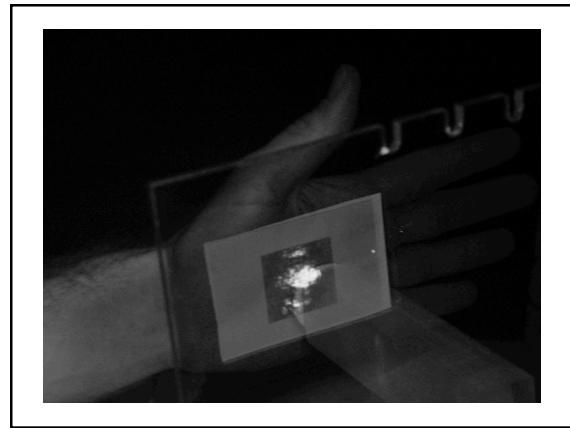
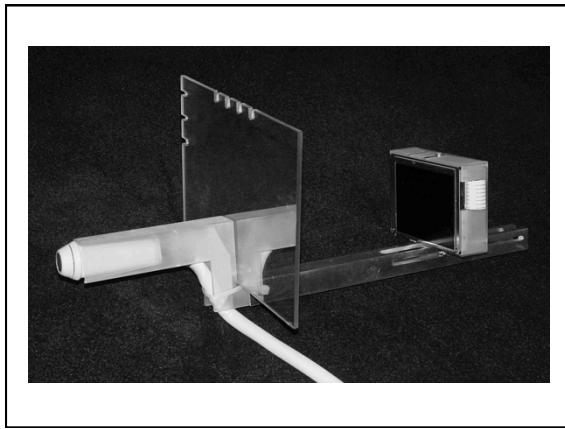
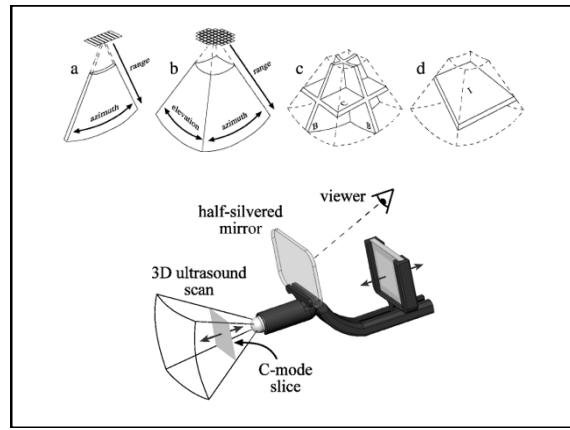
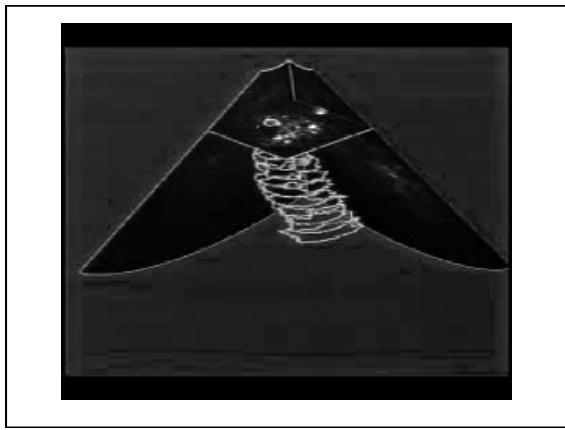


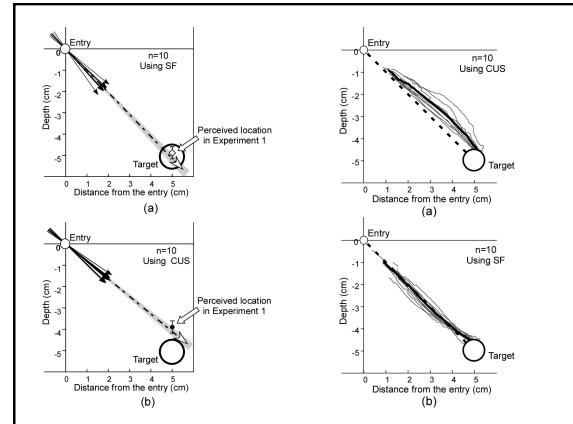
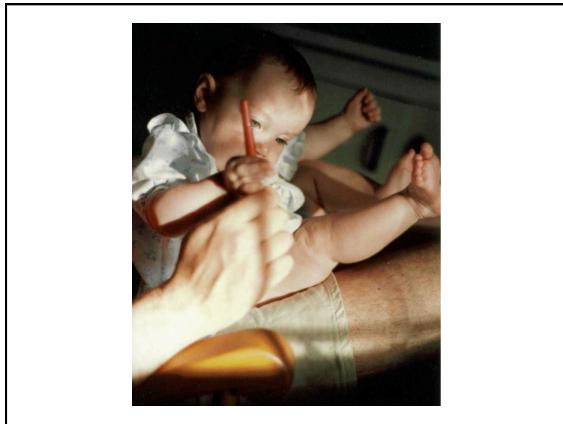
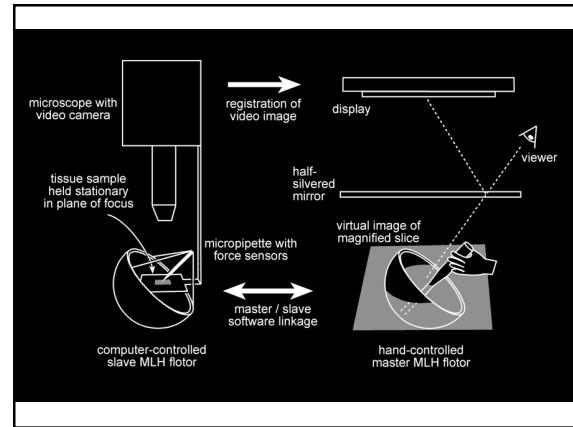
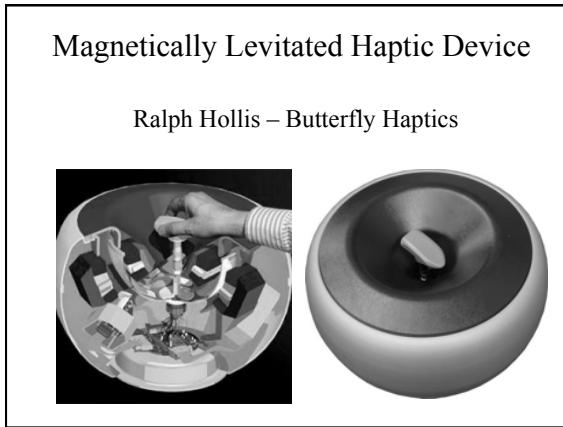
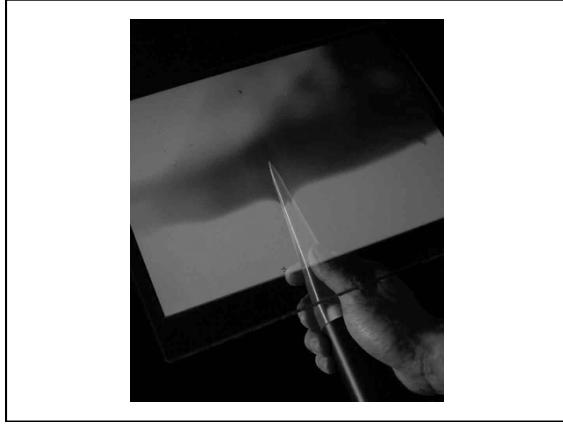
Neurosurgeons can't afford to look away

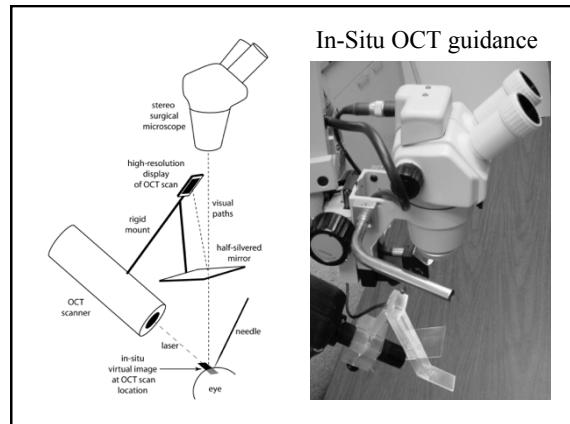
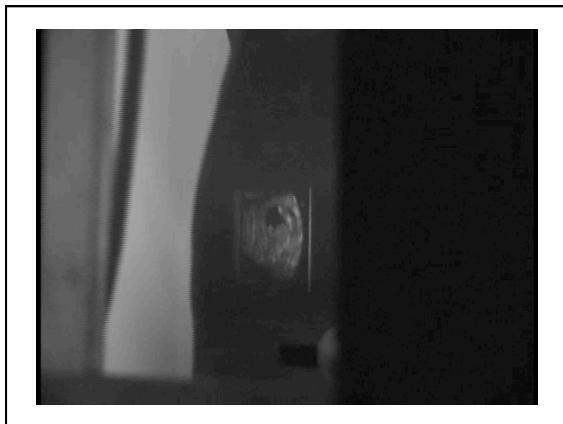
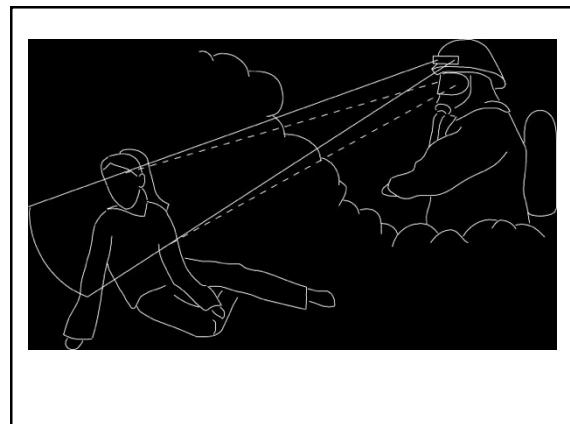
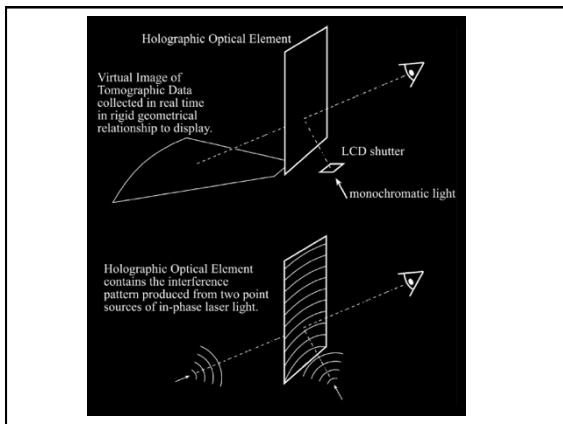
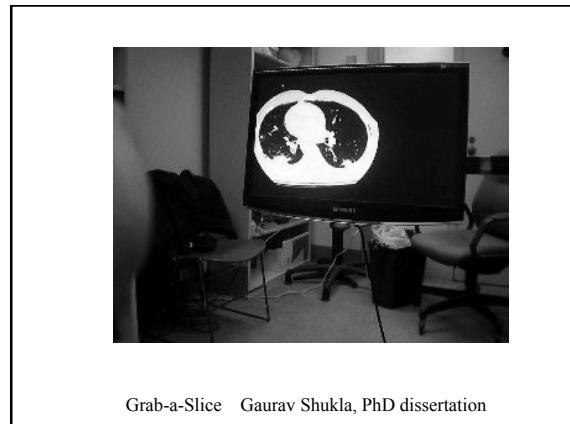
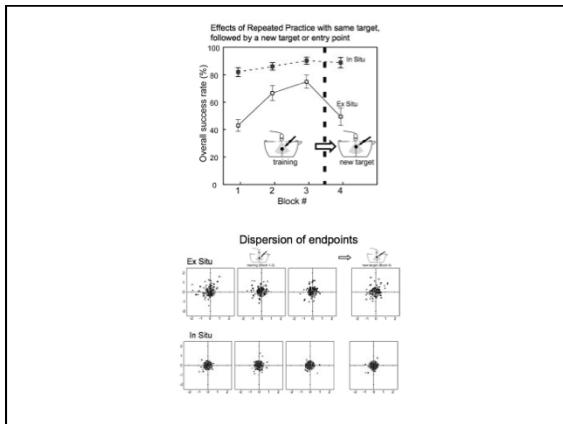
Commercialization: cell phone sized Sonic Flashlight

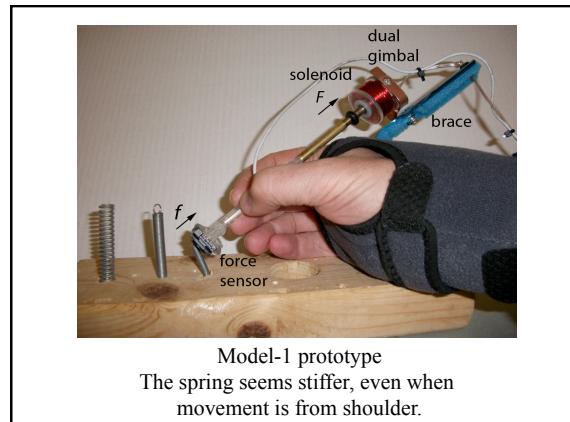
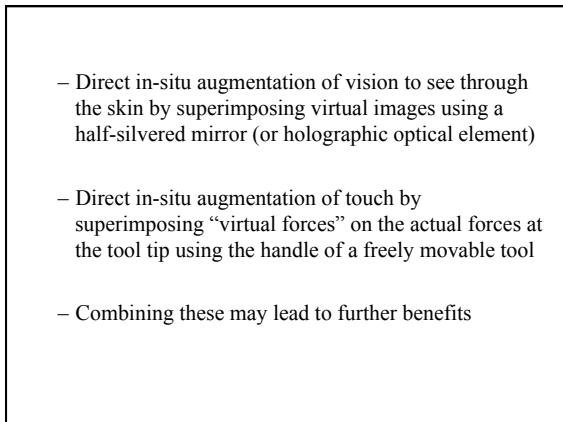
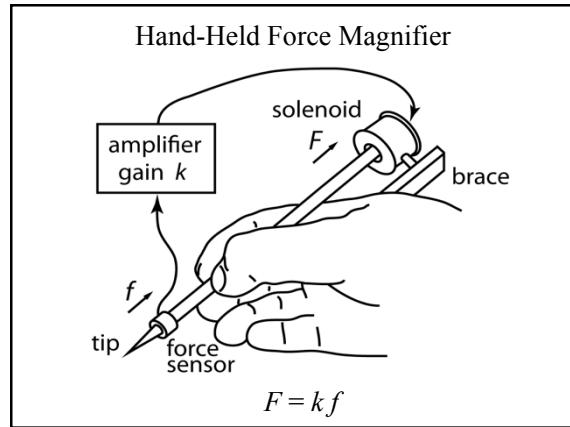
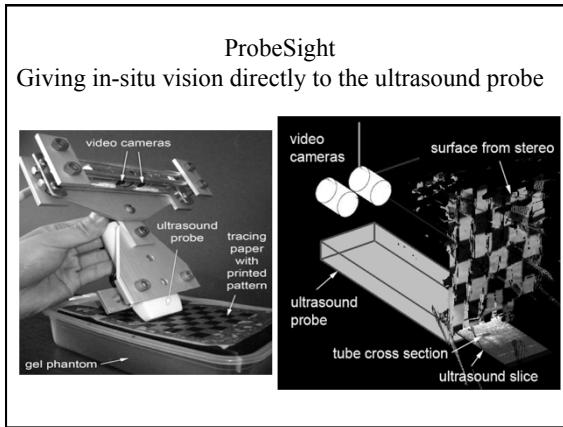
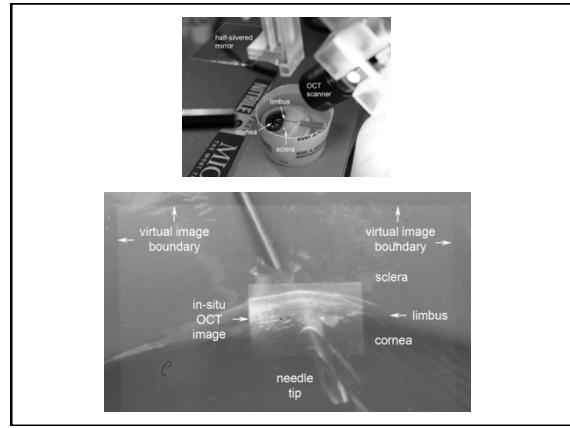
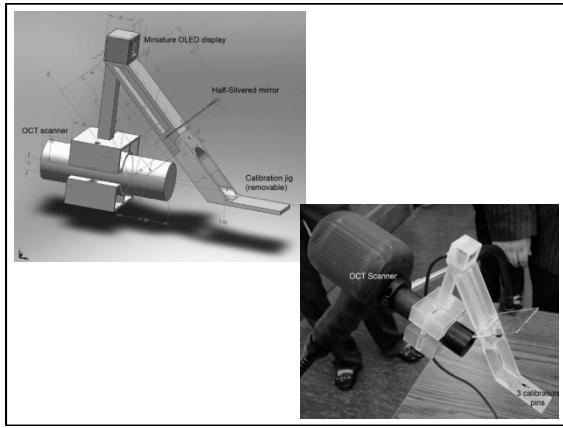


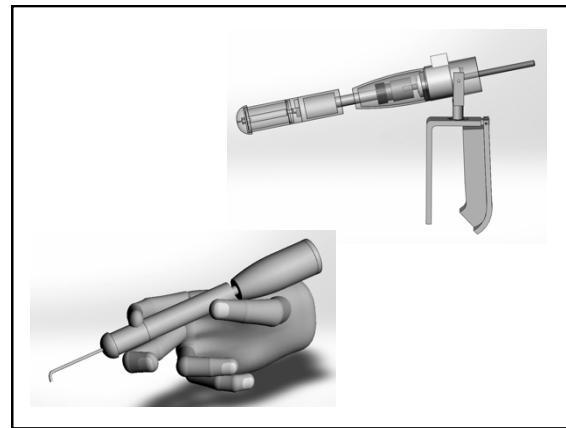
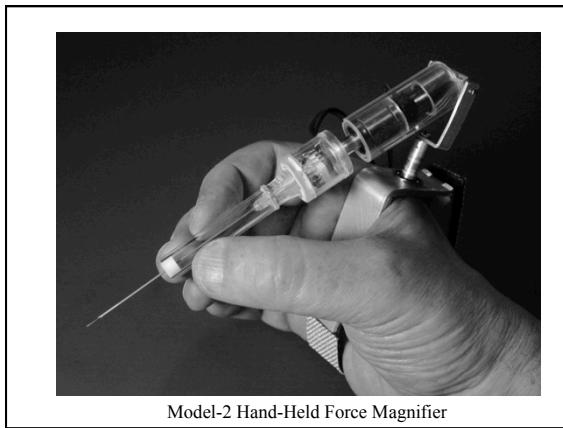
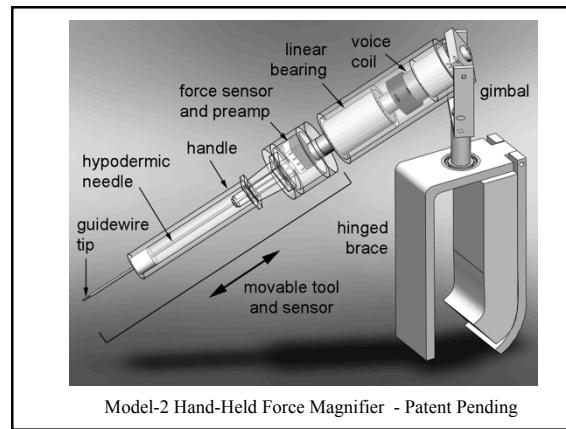
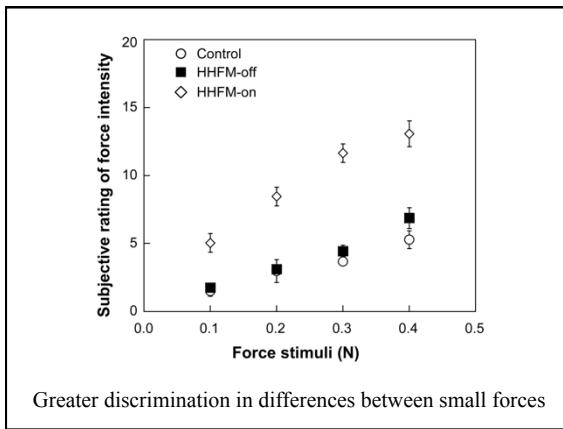
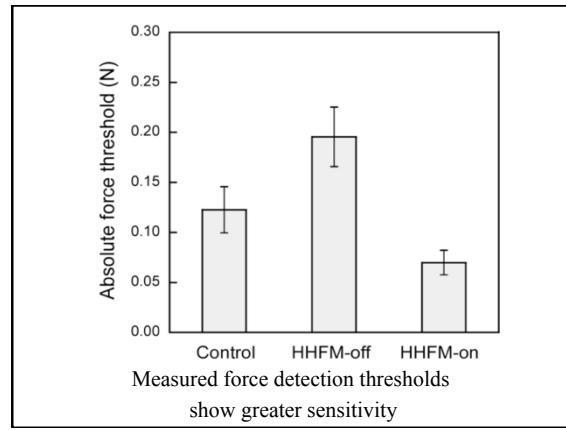
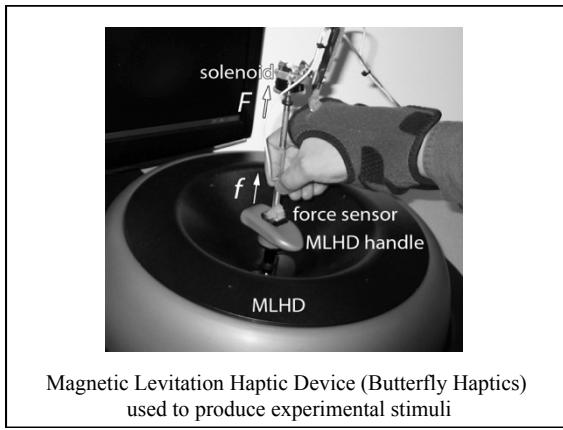


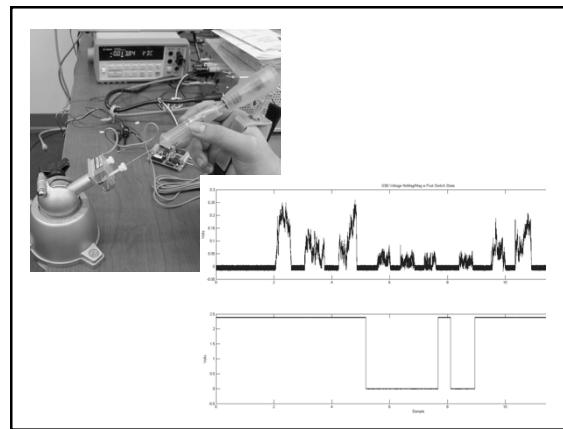
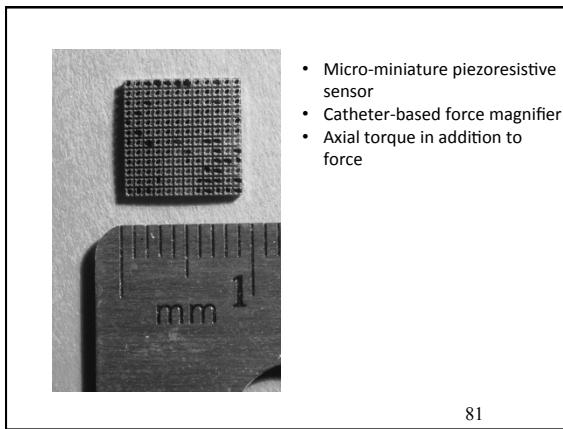
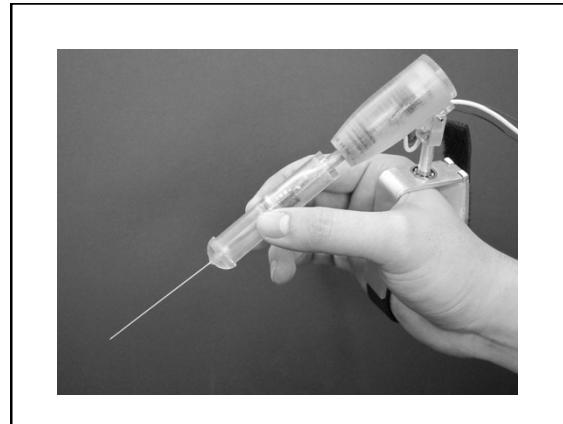
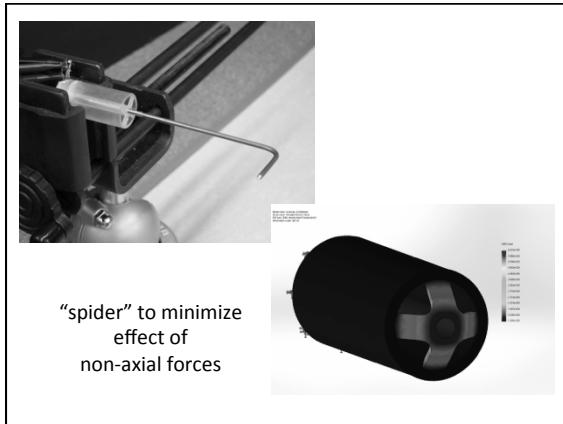












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COLLEAGUES

Andreas Nowatzky, Ph.D.
Roberta Klatzky, Ph.D.
Mel Siegel, Ph.D.
Nikhil Amesur, M.D.
Ralph Hollis, Ph.D.
Louis Lobes, M.D.
Joel Schuman, M.D.
Bing Wu, Ph.D.

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STUDENTS

Vikram Chib, Ph.D.
Wilson Chang, M.D., Ph.D.
Damion Shelton, Ph.D.
John Galeotti, Ph.D.
David Weiser
Aaron Cois, Ph.D.
David Wang, M.D., Ph.D.
Gaurav Shukla, Ph.D.
Sam Clanton, Ph.D.
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Samantha Horvath, Ph.D.
Vikas Shivaprabhu, M.S.
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