

# ACOUSTICAL · SOCIETY · OF · AMERICA



## NARRAGANSETT CHAPTER

Serving Southern New England including Rhode Island, Southeastern Massachusetts and Connecticut

<http://acosoc.org/RegChapters/Narragansett/>

### Spring Meeting/Seminar Announcement

Tuesday, 28 April 2009

Seminar is jointly sponsored by the Narragansett Chapter - Acoustical Society of America, The Brain Sciences Program and the Division of Engineering, Brown University.

***“Spoiling the image: Spectral deconvolution serves for both shape perception and clutter rejection by FM echolocating bats”***

**James A. Simmons, Department of Neuroscience**

**Mary E. Bates, Department of Psychology**

**Brown University, Providence, RI 02912**

Location: Carmichael Auditorium, Hunter Psychology Building, Brown University,  
89 Waterman St., Providence Rhode Island

Echolocating big brown bats (*Eptesicus fuscus*) broadcast ultrasonic FM biosonar sounds containing several harmonics (e.g., FM1 sweeping from 55-60 kHz down to 23 kHz, FM2 sweeping from 110 kHz down to 46 kHz). They detect targets at long range using a narrow band of the lowest frequencies (~24-29 kHz) in FM1; these propagate farthest and are the most broadly beamed. Additionally, using the full bandwidth of their sounds (~80 kHz), they perceive target range from echo delay. Each broadcast and its echoes are processed by time-domain mechanisms with neuronal delay-lines for spectrogram correlation. Bats listen to each transmitted sound and set up a template of the FM sweeps in the broadcast that is used to recognize echoes. This template persists for an echo-reception epoch of roughly 30 ms following that broadcast. Like matched-filter (crosscorrelation) receivers, spectrogram correlation is optimal for detecting and determining the arrival-time of echoes for known signals and fragments of signals, with echo-delay accuracy inversely related to (RMS or centralized RMS) bandwidth of the echoes. Bats perform near-optimally for full-band echoes, but performance declines more drastically than the inverse of echo bandwidth, implying that the bat's signal-recognition process explicitly incorporates a component that does rejection.

To classify objects, big brown bats perceive target shape from the echo spectrum, which is determined largely by overlap and interference between reflections from the target's glints. Bats convert the frequencies of spectral notches into estimates of delay separation that are perceived as differences in target range *within* the target, as shape itself. This process is analogous to real-time deconvolution, with the resulting fine shape information being displayed on top of the existing time-domain target range image. If the target is nearer than 1-2 m and kept within the beam by the bat's head aim, overall low-pass attenuation of FM2 is slight. In contrast, off-axis or far-away clutter, such as vegetation, yields echoes containing primarily FM1, with FM2 greatly attenuated, amounting to a stop-band from about 60 to 110 kHz. The bat's auditory system can only encode this broad stop-band in terms of sets of narrower interference notches centered on all of the frequencies in FM2. Because the presence of spectral notches in echoes leads to perception of glints, when the stop-band is processed, the bat perceives numerous estimates of glint delays distributed across hundreds of microseconds. In effect, a target located straight ahead and at relatively close range will have a well-defined shape from its glint structure being depicted in the bat's images. In contrast, off-axis or long-range clutter will have a poorly-defined "shape" due to all possible glints being depicted in the images. In effect, the bat "turns off" the clutter on the shape display by giving it a default all-glint shape while keeping it on the range display to guide navigation.

**(RSVP Please by 23 April 2009 to dbAcoustics@cox.net )**

Donations: \$10 at Door; Students Free.

6:00 - 7:00 Social Hour, Meet and Greet, Light Refreshments.

7:00 - 8:00 Presentation by Dr. James Simmons

Open to the Public. All are welcome.

**Interested in becoming a member?**  
**Interested in becoming a chapter executive committee member?**

The Acoustical Society of America – Narragansett Chapter

While the goal of the national chapter of the Acoustical Society of America is "to increase and diffuse the knowledge of acoustics and its practical applications" - the Narragansett Chapter is chartered with promoting acoustic interests in Southern New England and building relationships and contacts for those practicing or interested in the field of Acoustics.

We are planning new speakers and seminars for the upcoming year and welcome the expansion of the chapter with the addition of new members, students, or suggestions for speakers and meeting venues. If you are interested in joining, or possibly making a seminar style presentation, or hosting a meeting at a new location contact one of our board members. For more information contact us or visit our website.

We are currently soliciting nominations/volunteers for the chapter executive committee positions for the next term beginning July 1 2009. If you are currently a member and interested in serving or would like to nominate someone please let the nominating committee know by April 17, 2009 by contacting Frank Tito by email (frank.tito@navy.mil). Elections will be held at our annual executive business meeting, which will be held at Brown prior to the seminar. All positions are open for nomination.

**2008-2009 Chapter Executive Committee Members and Affiliations**

President: David A. Brown, Univ. of Massachusetts and BTech Acoustics, LLC  
dbAcoustics@cox.net

Vice President: Jack Salisbury, Retired – Naval Undersea Warfare Center, echojack@ieee.org

Treasurer: Hal Robinson, Naval Undersea Warfare Center, harold.c.robinson@navy.mil

Secretary: Frank Tito, Naval Undersea Warfare Center, frank.tito@navy.mil

Medical Acoustics Chair: Frank Baffoni, Physician – MD, fabmd@cox.net

Social Chair: Dino Roberti, Raytheon, dino\_roberti@raytheon.com

WebMaster: Sally Sutherland, Naval Undersea Warfare Center, sally.sutherland@navy.mil

Member-at-Large: Beth McLaughlin, Naval Undersea Warfare Center,  
elizabeth.mclaughlin@navy.mil

Open to the Public. All are welcome.