



PEAK

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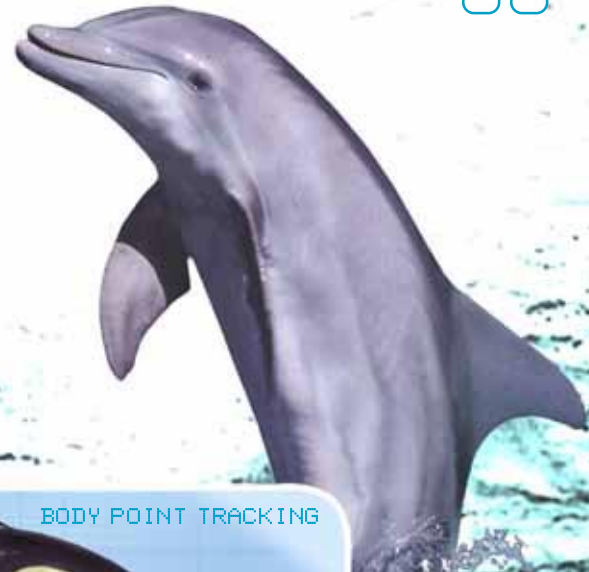


Biology / Zoology

Medical

Sports

ERGONOMICS / INDUSTRIAL



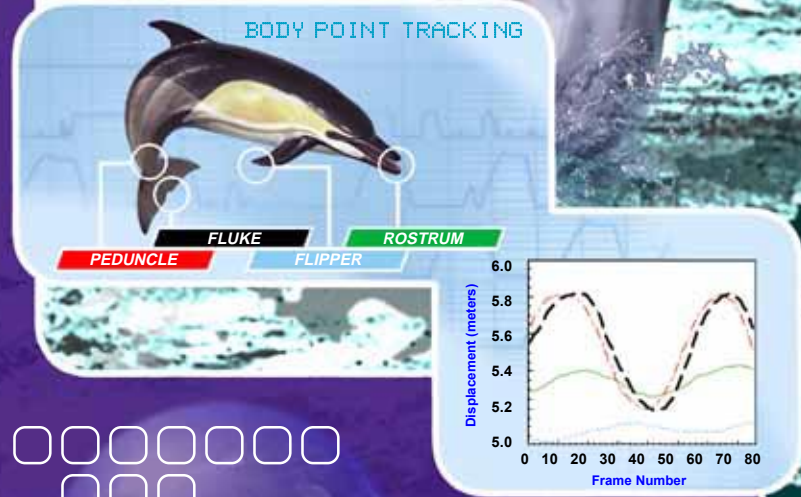
A WHALE OF A STUDY

Ever wonder how whales and dolphins are able to swim so fast, or jump so high out of the water? Three researchers, Dr. Frank Fish and John Peacock, from West Chester University's Department of Biology in West Chester, PA, along with Dr. James Rohr from the Space and Naval Warfare Systems Center in San Diego, CA, recently conducted a study looking into just that question. Their study, *Phase Relationships Between Body Components of Odontocete Cetaceans in Relation to Stability and Propulsive Mechanisms*, sought to look into the mechanisms by which such mammals (termed thunniform swimmers) generate torque. Surprisingly, the propulsive ability of these swimmers has been found to produce thrust with higher efficiencies than mechanical propellers!* Those involved in the science of biomimetics (i.e., designing engineered products that mimic biological mechanisms) hope to apply these principles to the development of underwater vehicles with increased efficiencies and powers. However, before such principles can be implemented into an underwater craft, an understanding of the range of motion and mechanisms of control by thunniform swimmers is necessary.

With the cooperation of several species of whales and dolphins (e.g., the beluga whale, pilot whale, killer whale, false killer whale, striped dolphin, spotted dolphin, and bottlenose dolphin) from various SeaWorld parks throughout the United States, as well as The National Aquarium in Baltimore, MD, Dr. Fish and his colleagues collected one hundred and forty-three swimming trials. A 60 Hz video camera was placed along the viewing glass of the aquarium tanks to obtain underwater views. The animals were then cued from trainers to routinely swim with varying speeds along the wall of the pool, thus passing in front of the glass.

Initially Dr. Fish and his colleagues had the task of figuring out how to accurately calibrate the space in which the subjects were swimming. Because this was a 2D analysis, the subjects had to stay in one plane of motion. However, controlling the speed at which the animals swam was easier than controlling the plane in which they swam. So, Dr. Fish and colleagues cleverly decided to use the animal itself as a calibration tool. By obtaining the exact length of each animal from the respective Sea World parks and The National Aquarium, Dr. Fish and colleagues waited until the animal's swimming cycle was such that they were fully extended, and then used that frame of the video as the calibration clip.

After collection, the video was then taken back to the lab for digitizing. To aid the manual digitizing process using the Peak Motus® system, zinc oxide was painted on the animals at various points of interest in cases where Dr. Fish and his colleagues were able to do so. Although this was a manual tracking application, the



paint was used to help identify the exact location of anatomical landmarks that Dr. Fish and colleagues were interested in tracking.

Dr. Fish and colleagues then present the collected data to engineers, who can then design products that mimic the biological mechanisms studied. Thus, by combining modern day technology with the study of undersea locomotion techniques, engineers can advance closer to the development of underwater vehicles that operate as efficiently and as powerfully as these animals. ■

Information provided by:
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Dept. of Biology
<http://www.wcupa.edu>



* References
G.S. Triantafyllou and M. S. Triantafyllou, "An efficient swimming machine," *Sci. Amer.*, vol. 272, pp. 64-70, 1995.

J. M. Anderson, K. Kerrebrock, 1999. "The vorticity control unmanned undersea vehicle (VCUUV) performance results," in *Eleventh International Symposium on Unmanned Untethered Submersible Technology*, Lee, New Hampshire: Autonomous Undersea Systems Institute, 1999, pp. 360-369.

M. Nakashima and K. Ono, "Experimental study of two-joint dolphin robot," in *Eleventh International Symposium on Unmanned Untethered Submersible Technology*, Lee, New Hampshire: Autonomous Undersea Systems Institute, 1999, pp. 211-218.

J. M. Anderson, K. Streitlien, D. S. Barrett, and M. S. Triantafyllou, "Oscillating foils of high propulsive efficiency," *J. Fluid Mech.*, 360: 41-72, 1998.

NEW RELEASES

The Newest Version of the Peak Motus® VERSION 6.0 Motion Measurement System is Here! New Features Include:

Video Acquisition

- Accommodates 120 Hz mode for the JVC 9600 digital Camcorder
- Adjustable sized zoom window
- Change color/display of zoom reticle up to 16x zoom

Optical Capture

- APL: Automatic Path Labeling (specify a geometry of how points are arrayed and on sequential trials, the points will be automatically labeled)

Report

- Mouse controlled panning, zoom and rotation of stick figure objects
- Overlay vectors (e.g., force or velocity) on stick figure or video
- Export animated reports to AVI files and play them on other computers
- Overlay objects on other objects (e.g., stick figures on video)
- Text on parameter graphs
- Bar graphs on video
- Auto align graph objects

KineCalc™

- Access data from files outside of the trial

Pan & Tilt

- Display the pan & tilt angles on the status bar during digitizing

Events

- Color code events for graphics and spread sheet display
- Event editor

Trial Averaging

- Average many cycles within a trial
- User can specify the number of samples to normalize (previously 201 only)

A driver is now available that reads the miroVIDEO AVI file format *without* requiring a video capture board in the computer. This eliminates the need to convert the video clip to the Cinepak CODEC.

Contact support@peakperform.com for more information!

TIPS & TRICKS

RECENTLY PUBLISHED ARTICLES

Bygrave, Sally, Myers, Stephen, Llewellyn, Michael. (2000) "The Effect of Tightness of Fit of a Backpack on Energy Cost, Lung Function and Post-Jump Balance" In *Proceedings of XVIII International Symposium on Biomechanics in Sports* Volume II (pp.946-947)

Hofmann, S., Matis, U., Off W., Kosfeld, H.U., Baetzner, E., (2000) "Clinical Gait Analysis in Dogs" Ludwig Maximilians University of Munich May, 2000

Collins, S., Jones, R., Llewellyn, M. (2000). "Ground Reaction Forces During Physical Training in Military Recruits" In *Proceedings of XVIII International Symposium on Biomechanics in Sports* Volume I (pp.28-31)

CALENDAR OF EVENTS

SICB 2001 - Society for Integrative and Comparative Biology
Chicago, IL ~ Jan. 3-7, 2001

**APTA & CSM 2001 - American Physical Therapy Association
Combined Meetings**
Houston, TX ~ Feb. 15-17, 2001

**AAHPERD - American Alliance: Health, Physical Education,
Recreation, and Dance**
Cincinnati, OH ~ Mar. 27-31, 2001

ACSM - American College of Sports Medicine
Baltimore, MD ~ Mar. 30-Jun1, 2001



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