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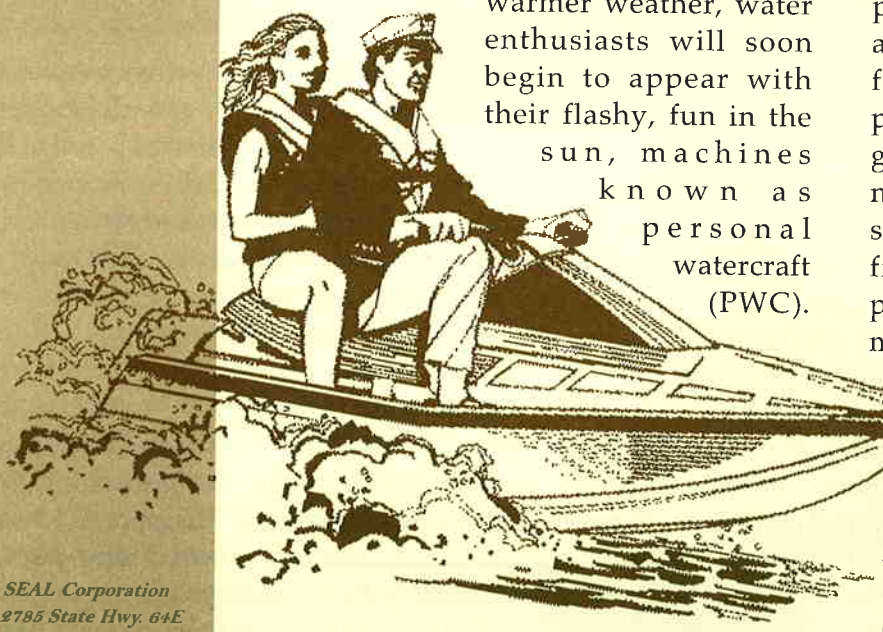
RIDING A PERSONAL WATERCRAFT...
EASY AS FALLING OFF BACKWARDS?

By Mike Burleson, PE, CSP

With the end of winter's chill drawing near, and the dawn of warmer weather, water enthusiasts will soon begin to appear with their flashy, fun in the sun, machines known as personal watercraft (PWC).



Potential buyers will visit watercraft dealerships to explore the new models, and many existing owners will clean up and tune up their prior acquisitions. As the captains of personal watercraft again emerge in the warm weather onto lakes, rivers, and oceans, something else will appear...passengers. Yes, passengers, small and large, young and old, male and female, experienced and novice, will don a life vest and take their place behind the operator of this small, but quick and highly maneuverable vessel. Did I forget to mention the new swimsuit? All is well...or is it?

The operator applies the throttle and off they go. The passenger, relaxed and possibly not so prepared for the acceleration, suddenly experiences a forward surge likened to a high performance automobile, but with a greater takeoff angle. Finding themselves no longer balanced or able to grasp for stability, the passenger is ejected rearward from the watercraft. The uncoupled passenger falls into the water behind the machine, while in a body position possibly best described as similar to the delivery position of a pregnant mother. Unfortunately, from the rear of the watercraft, an extremely powerful jet stream of high pressure water is being expelled in the direction and proximity of the passenger's groin. The story now becomes much too unpleasant to elaborate further, given the horrible rectal / vaginal internal injury that can occur.

Accidents with similar circumstances can and have been occurring to passengers riding PWC for a number of years.

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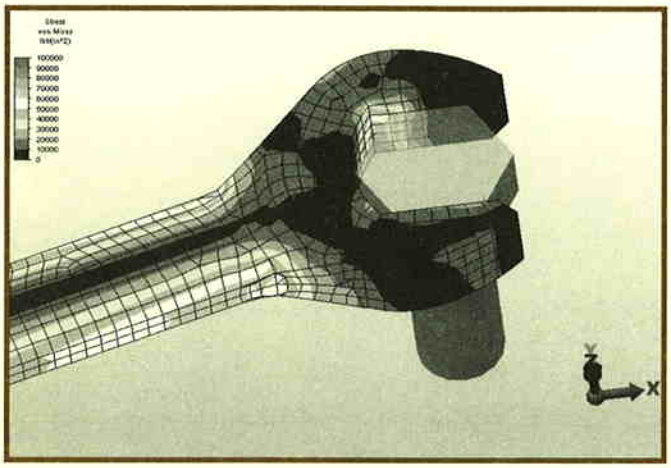
Tools of the Trade:
Finite Element Analysis (F.E.A.)

By Brian Haygood



Perhaps the most dramatic advance in investigative science in the last 20 years is our ability to reconstruct a crucial event with the help of computers and high powered software in the hands of a skilled engineer. Examples include everything from the reconstruction of a terrorist bombing target, to producing a lifelike reconstruction of a murder victim's face from a skull found in a field. While the practical daily application of computerized analysis is often less sensational, our newfound ability to recreate the complex pieces of a larger puzzle is allowing today's engineers to solve investigative dilemmas as never before possible.

Finite element analysis (F.E.A.), a means of analyzing a physical object's response to various structural, electrical, fluid or heat loads, is an increasingly important field. Relied upon heavily for the design, testing and fabrication of new products, it has also become an essential component in the investigation of catastrophic events to find out exactly what went wrong.

> ***"Our newfound ability to recreate the complex pieces...is allowing today's engineers to solve investigative dilemmas as never before possible."***

A basic shape, such as a rectangular chunk of metal, is relatively easy to analyze. Calculating how much it will bend, stretch, or deform under various loads is an easy problem for an engineer. Knowing exactly which regions of the part to pay attention to is also part of an engineer's training. When the geometry of a part becomes more complex, so does its response.

In F.E.A., a 3D model of a complex part or assembly of parts is divided into tens of thousands of tiny blocks or elements. The geometry of each block can be relatively simple when compared to the whole. Usually a model is divided into six-sided brick elements, and four- or five-sided pyramidal elements. The sides of the bricks don't have to be parallel, and the corners don't have to have right-angles, further enhancing the match between the part geometry and the model made of a finite number of elements. After being given the geometry and physical properties of the part, the loads to which the part is subject are specified. With all of the information provided to the computer by the engineer, the computer then proceeds to analyze the response of each element to the given loads.

F.E.A. is also attractive because it is non-destructive, avoids prototyping costs, and allows parts or assemblies to be tested to destruction safely and repeatedly. F.E.A. gives S.E.A.L.'s engineers clear answers to investigative questions, regarding designs and their failure, which are easily understood and easily communicated.

Fire Department Ground Ladder Testing

By Chuck Boston

SEAL Corporation has been testing commercial-use ladders for manufacturers since 1995. We have recently added the capabilities to test fire department ladders. Although covered by a different standard (National Fire Protection Association, NFPA 1932-99), requiring more stringent testing, the testing is quite similar to the standard used for commercial ladders (American National Standards Institute, ANSI A14.2-00). The major difference is that the ANSI standard is used to test ladder design and construction prior to the ladder going into the marketplace. The NFPA standard is used to test fire department ground ladders, that are being used by firefighters, to insure that the ladder is safe for use in fire fighting and rescue operations.

NFPA 1932-99 Requirements and Circumstances for Testing

- Prior to being put into service
- Annually
- If suspected of being unsafe
- If subjected to overloading
- If subjected to excessive heat or direct flame

The Texas Commission on Fire Protection (TCFP) certifies fire departments and firefighters for the state of Texas. Their standards manual states that all equipment used by fire departments must meet NFPA standards. (Chap. 465, para 465.1a & b).

For more information concerning on-site testing capabilities, please call S.E.A.L. at 800-624-0905, or visit our website at www.sealcorp.com.

Riding *(Continued from Page 1)*

PWC manufacturers claim that passengers should have been wearing special protective clothing, such as wetsuits or neoprene shorts, to prevent this injury. This information will have likely been printed alongside many other warnings on the machine and other places. These warnings, however, are ineffective as PWC passengers seldom wear such gear for various reasons including comfort, convenience, availability, and casual unawareness.

Design of PWC can be made safer for passengers. Inclusion of a seatback, similar to those used on snowmobiles, motorcycles and even all-terrain vehicles, would effectively and safely reduce the risk of a rearward ejection injury. Seatbacks can also be made to move out of the way for ease of boarding from the rear of the watercraft.

Correction

In our November 2003 newsletter's "Simple Wind Force Calculation" article, the example calculation equalling 19 lbs. was incorrect. The correct calculation is: a 100 mph (146.7 ft/sec) wind acts on a 1 ft² area of a wall, assuming a flat plate and sea level conditions, the force is $1*½*1.28*0.002265*(146.7)^2$ = 31 lbs.