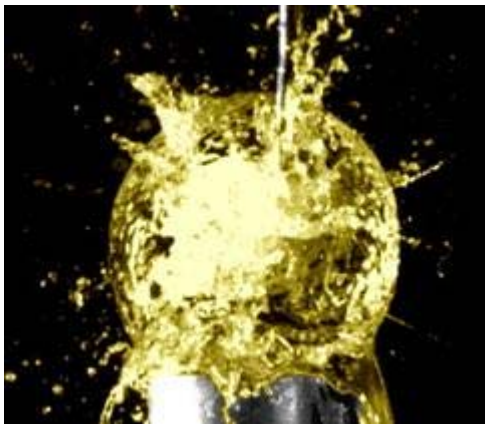
Nobel Intent

ars

September 20, 2006 @ 7:17AM - posted by Chris Lee

Bubble bubble



Pumps and propulsion systems like ship propellers generate a pressure difference between the different sides of the blades. This is a consequence of the thrust generated. However, when the blades are rotated beyond a certain speed, the pressure difference becomes too great and gas bubbles form on the low pressure side. This is called cavitation and is a source of headaches. The formation and subsequent destruction of the bubbles creates a highly abrasive environment that destroys all sorts of marine equipment. On the bonus side of the coin, cavitation can be used as a cleaning and disinfection agent. Understanding and, depending on the situation, preventing or encouraging the onset of cavitation has been the subject of intense study for many years.

Now some new studies performed in the microgravity of parabolic flight profiles are shedding new light on the subject (click here for a free summary). Microgravity has allowed the researchers to study larger bubbles and their interaction with a range of surfaces that cannot be recreated on terrestrial conditions—in particular they were interested in interactions with spherical surfaces of fluid. The found that when the bubbles was created in a spherical drop of fluid, it was only spherical if it was very near the center. When created off-center, the bubbles collapsed in a toroidal shape with a fast jet ejected out of the center of the toroid. The shockwave generated by the bubble collapse generated a fine mist of secondary cavitation bubbles. When the bubbles were generated in the center of the fluid drop, the collapse was spherically symmetric as expected, however the bubbles collapsed much faster than theory would have predicted. This was because the theory assumes that the bubble sits within an infinite volume of fluid. When the theory was reformulated to take into account the finite volume of the fluid, the results fit the new model very well.

READER COMMENTS

Posted September 20, 2006 @ 8:04AM by Qui3xote

I love coming to Ars and reading about things that I hardly even knew existed beforehand. But as a layperson with an interest in science, I always appreciate it when an effort is made to draw the results into a larger context. After all, I could go read the journals myself - I look to Ars to help me understand what all this emerging science means, and with this article I'm left with a nagging feeling of 'So what?'

Anyway, that's my two cents.

Posted September 20, 2006 @ 8:16AM by Arroba

It's actually impressive to see what cavitation does to boat's propellers, no matter who big.

Posted September 20, 2006 @ 8:43AM by Svlad Cjelli

Yeah, Boat props. Or closer to home, the fins on the fan in my pump on my water cooling kit.

Posted September 20, 2006 @ 8:43AM by wynlyndd

As Arroba alluded to, that "highly abrasive environment" is responsible for crazy pitting on propellors and such. It is impressive to see what bubbles can do to a big piece of metal spinning in the ocean.

Also cavitation is what nuke subs try to avoid so that they aren't detected. See Red October.

Plus cavitation on a large scale has been experimented with to make torpedos go faster. a misfire of one of these torpedos (Skval) is one hypothesis about the Russian sub, Kursk, and its sinking.