Considering a Squid Water Pulse Jet Propulsion Engine as a Communications Transmitter:

As the Subject indicates I theorize, based for the most part upon real world observations, that squid can communicate, that their pulse jet engine could serve a dual purpose, to wit: locomotion and as a pulse burst communications transmitter?

A recent paper by T. Aran Mooney concerning "Squid Hearing" rekindled a lingering belief that these intelligent animals were capable of intra-species communications. In brief Aran has discovered that squid have "Ears" and that they can "Hear", exactly how they use that trait is the subject of ongoing investigations. From my viewpoint seeing the printed words "Squid Hearing" immediately invoked thoughts of a long range communications or a sonar system, however the "ears" being only a receiver are half of a system, where is the transmitter and what is the carrier?

Consider the California Market Squid (Loligo Op.): In this locale major squid spawning grounds are found on the back-side of Catalina Island inshore over sand beds but close to waves pounding on the rocks and shoreline, usually very turbid noisy water with poor visibility and a running current. Typically we anchor a few hundred feet from shore in about 40 feet of water over sand beds and deploy our FADs consisting of a 400 watt full spectrum metal halide underwater light and a floating LED array. Over the course of many squid outings I have noticed that it may take up to 30 minutes to attract a few squid, then maybe 15 minutes later larger schools start showing up, and then more and more until you could almost walk on them, we have drawn squid from a great distance and often from commercial squid boats in the area that use conventional (up to 30,000 watts) of overhead lights. I attributed our success to the FAD design and underwater deployment, however I soon came to realize that the underwater light in turbid water surrounded by squid was visible for only a short distance, it would appear that there had to be another reason that we were able to attract and hold such large schools close to our boat, and for many hours. On the other hand based upon years of observations I know that during the evening hours of the spawning season large and small schools of squid will travel up and down several miles of their traditional spawning grounds eventually converging upon a light source suggesting that a potential long range communication system was a factor in bringing these schools together?

Typically we take only a few buckets of squid for bait as we are there to fish the following day(s) for white seabass; the seabass usually sweep in around dawn (if you're lucky and in the right spot, a 50/50 chance) gulping down squid that expired after spawning and egg sac placement or live squid still hovering around the bottom sand beds doing their spawning thing. After "making bait" I am able to spend many quite late evening hours just observing these little guys and experimenting with my FAD's and other toys. Seals are the bane of Commercial Squidders, their powerful overhead squid lights and an occasional seal bomb acts as "dinner bells" attracting seals from miles away. Seals are very selective and deliberate hunters, with thousands of squid around they will pick out one individual and quickly chase it down, that target squid is usually a member of a small grouping of maybe a dozen squid on the periphery of the mass, when the seal charges toward the group the squid seem to know which member is targeted as the others break off to sides and dive while the target squid powers up and takes off straightaway. The seal using his whisker motion sensors and keen eyesight usually overtakes the targeted squid within seconds.

On certain quite midnight occasions meaning no seals and squid harvesting over, with squid now almost motionless and spread out around the boat like a floating blanket you get a strong sense that these squid are talking to each other, if so particle motion is most likely the carrier. It is an interesting sight promoting much speculation, for the most part the squid are motionless, close together and seemingly very comfortable and secure within their immediate surroundings, maybe they are just transfixed by the underwater lamp and glow of a small surface floating LED array? When the light is turned off the squid sink into the deep but return when the light is switched on? They do not seem to be feeding nor are they mating so what's going on? On those special occasions I assumed that we were anchored directly over a selected sand bed and that the squid were hanging in place waiting the morning spawning, egg laying and sac placement ritual?

Now consider the large Humboldt squid: I maintained a fishing boat and residence in Ensenada, Mexico for several years, the Humboldt's showed up in mass about 2005 and stayed for about 5 years eating

everything in the area, in late 2010 they vanished. During that same time frame they made appearances in Southern California and were plentiful in Central/Northern California mostly around Monterey and Half Moon Bay. I fished those waters, did a Discovery Channel Expedition in 2009 and contributed to a NatGeoTV Documentary in 2010. Thus over several years between Mexico and California I had much opportunity to capture and observe these creatures. Humboldt's are large voracious predators, they hunt in coordinated packs sometimes small and at other times numbering in the thousands, they practice cannibalisms and seem to relish lunching on each other, I have witnessed this behavior many times. They do have large sensitive eyes however their bodies do not fluoresce nor have luminescent appendages, electro, thermal nor lateral line sensors. In the early evening hours they migrate to surface waters to feed upon lanternfish and other pelagic animals that too are near the surface enjoying an evening snack, in this circumstance where some ambient light is available the Humboldt's eyes (and their skin color changing pattern, a possible signaling system) may come into play however on other occasions in the deep dark ocean I question their ability to visually see the many close surrounding fast moving pack members, should two collide during a foraging session they most likely would attack each other starting a feeding frenzy. If repeated often that activity would quickly reduce the pack to a few animals? So how at night do they co-ordinate foraging and the attack and keep from bumping into each other if they do not have lateral sensors? They must have some other way to communicate over distance in the dark and to make their actions and presences known to each other? From my viewpoint Humboldt activities suggest long range communications ability.

Understanding that water is a very good sound medium I considered what mechanisms squid may have that could generate a sound wave, a sound wave carrier that could be modulated to "say" different things, like the little market squid screaming "Hey guys! Really big sex orgy going on here, come join us" and the Humboldt transmitting prey sightings and a warning to other pack members: "I'm here, keep your distance". By observing their swimming patterns and reviewing technical papers on that subject it is apparent that they do have infinite control of locomotion. I would think that this very intelligent species could further modulate that basic output pulse to do something other than locomotion, like utilizing their pulse generating muscles to produce a transmission carrier, a data transmitter or maybe a short range sonar pulse. Their body parts when translated into an electro-mechanical system seem to have the necessary equipment; if nature programmed their brain accordingly they should be able to transmit....

I assume that a water burst/pulse injected into the surrounding ocean would generate both a particle motion component and an acoustic pressure or sound wave, I know that squid are (at least appear to be) insensitive to certain pressure waves (an exploding Seal Bomb being a good example) if squid are in fact insensitive to sound waves then my theory would be D.O.A, I'm thinking that this insensitivity may be selective? I recall an experimental hearing protective headset I tested one time while target shooting my .44 Magnum revolver, the high pressure sound waves were muted but I could hear a whisper. Squid hearing may have similar circuitry, what with eons of evolution behind them they could have worked it out. Particle motion may provide short range indications of what may be going on in the immediate area but it has no "legs", whereas even a weak sound pulse would travel a great distance, granted it would be of a low decibel level suggesting that it would be lost in the background noise? I think not, if we know exactly what we are looking for we can pull a microwatt pulse containing an encoded data pack out of a megawatt outdoor rock concert, and we know that whatever we can do electronically in the lab some living thing in nature can probably do it better...

In reviewing many well documented and informative papers it is apparent that the authors know in great detail the inner workings of the squids locomotion/propulsion system, they have observed these animals, did the math, took the pictures and recorded much data. I'm wondering if there were times when the squid was not "jetting" but stationery or moving a bit with just mantle/body motion, during these moments have the authors ever noticed, detected, photographed or recorded any acoustic activity, maybe a questionable out-of-place pulse? My thinking being that any acoustic activity during such a "quite" period may be a communications signal?