Environmental Impact of Leisure Hovercraft

Description

Leisure hovercraft are probably better described as small *air cushion* vehicles. An air cushion vehicle is entirely supported above the surface it is travelling over by a cushion of air – no part of the hull structure or propulsion system is in contact with, or pierces the surface. A typical leisure hovercraft is between 2.5 and 5.5 metres in length, has a soft material 'skirt' to help retain the air cushion, is powered by a 4 stroke petrol engine, weighs between 120Kg and 600Kg and can carry 1 to 6 passengers.

A hovercraft is propelled by a rear-mounted fan or air propeller. Directional control is achieved using rudders placed in the airflow behind the fan or propeller. The supporting air cushion is generated using a fan to force air under the craft through the hull (some craft designs use part of the propulsion air to produce the air cushion – there is no significant difference in environmental impact between the various types)

Leisure hovercraft are used predominantly over water. They are operated in the same areas as other leisure water craft (estuaries, lakes, inshore coastal areas and rivers). In addition, due to their amphibious ability, they can also be operated over very shallow water, mud and sand covered areas.

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On the Surface

Because a hovercraft is riding on a cushion of air (the entire craft rides 150 to 300mm above the surface) and has no direct surface contact it can travel over any type of reasonably level surface – including water, land, marsh, mud, grass, etc. The cushion air pressure is typically 50Kg/m2 (11 pounds per square **foot**). This is an extremely low pressure footprint and is an order of magnitude less than any other vehicle or even a human (the pressure is similar to that of a small bird). Due to the very low surface pressure, the hovercraft has virtually no impact on the surface it is travelling over - there is usually no visible indication that a hovercraft has passed over any solid or semi-solid surface (it exerts the same surface pressure as 5cm of water covering an intertidal area). The combination of a low pressure footprint and a hard hull that "floats" above the surface results in virtually no damage to taller vegetation (taller grasses and vegetation simply spring back after the passage of a hovercraft). Hovercraft can safely pass over small ground dwelling animals without causing injury.

During normal water operation a hovercraft rides ***on top*** of the water surface rather than ***in*** the water. The result is that there is no significant wake or surface water disturbance. When starting up from a stop on water, a hovercraft transitions from displacement mode (the air cushion generates a "soft" depression in the water – rather than the damaging "hard" depression caused by a displacement boat) to full hover mode (flying above the surface) at a speed known as "hump speed" (usually around 10mph for most craft). This effect does not occur when travelling from land onto water. Below hump speed, the surface and sub surface disturbance produced by a hovercraft

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is much less than would be produced by a similar sized boat due to the lower craft weight and lack of a surface piercing propulsion unit. Once over hump speed, most hovercraft can then be operated below hump speed without generating any significant wake.

The ***only*** part of a hovercraft that can touch the surface during normal operation is the lower edge of the cushion retention skirt fitted around the periphery of the craft hull - air leakage from the cushion usually prevents the skirt from pressing down onto the surface. On rough surfaces, the skirt can occasionally brush the surface in places – this is the only source of mechanical impact on the surface. The *maximum* pressure the skirt can exert on the surface is the craft cushion pressure (see above).

Sub Surface

It should evident from the above section that there can be no sub-surface disturbance to either the water or the sea or river bed from hovercraft use. As a consequence, underwater organisms, fish and mammals are not affected by the passage of a hovercraft. In addition, due the absence of any significant wake, water bed, bank or shore erosion is non-existent.

Environmental Pollution

Due to the nature of the operation and construction of a hovercraft, the entire fuel and power system is mounted inside or on top of the hull and the engine exhaust is discharged directly to atmosphere (rather than into the water as with most other watercraft). The potential for accidental leakage of raw or burnt hydrocarbons into the water is virtually non-existent as they are fully contained within the topside hull structure In addition, the inherent operating efficiency of a hovercraft results in a significantly lower level of atmospheric pollution when compared to all other powered watercraft (around 30-60% reduction in emissions).

A Hovercraft generates ***zero*** surface and sub-surface pollution and has levels of air pollution similar to a lawn tractor or small road vehicle.

Noise footprint

As detailed above, hovercraft use air drive fans or propellers for propulsion. Moving air at speed will, unavoidably, generate some noise. In addition, the engines and exhausts generate some noise. Extensive testing carried out by the Hovercraft Club GB indicates that the majority of leisure hovercraft generate noise levels less than 84dBa (measured at 25 metres) at maximum power levels. At cruise speed, the noise level is typically 71-76dBA at 25 metres. This noise level is very similar to that generated by a passing car or small van.

Because the hovercraft mechanical components are fitted to the top side of the hull *and* the hull is not in contact with the surface it is travelling over, there is virtually no noise transmitted into or below the surface.

Development work is continually being carried out by the HCGB to further reduce noise levels.

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Summary

In conclusion, hovercraft have a negligible impact on the environment. In virtually all areas they have a significantly lower impact that any other watercraft.

Abstracts and References:

It should be noted that these references are mostly based on the impact of large commercial hovercraft – it should be obvious that the impact of small leisure craft will be significantly lower than these large craft.

"The Final Ecological Monitoring Summary, was released on March 20, 2000. The winter underwater noise monitoring and visual observations showed that the hovercraft had little impact on blackfish subsistence gathering by the local Eskimos. It also showed that, after careful observation and repeated testing performed by Volpe staff over the past three years, the hovercraft has had little impact on waterfowl and only a few dead, injured, or stranded fish have been found."
Ecological Impact of Hovercraft Transportation in Alaska (Paul Valihura — Volpe National Transportation Systems Center Stephen Petron — CH2MHILL)

"The hovercraft does not pierce the surface over which it is travelling the advantage is two-fold, a) less friction = less fuel burnt to move, b) less friction or interruption to the surface = less disturbance of the environment."
"Damage to the shore environment, such as beaches, mud flats and vegetation is virtually nil because of the hovercraft's low pressure "footprint". For example, the average human being when standing on a beach exerts a pressure of some 3lbs per square inch underfoot, rising locally to 25lbs per square inch when walking. The average hovercraft by comparison, exerts a pressure of only 0.33lb per square inch on the surface regardless of speed. This "footprint" pressure is less than that of a seagull standing on one leg! "
"It therefore becomes obvious that fish and other marine life are in no way affected. This has been confirmed by independent scientific tests. "
"There is no exhaust discharge into the water as with most conventional water craft, thus eliminating the pollution of the marine environment by oil and fuel particles, particularly prevalent with two stroke outboard motor usage."
"The wake created by the passage of a hovercraft is minimal, ensuring that river bank erosion and damage to foreshore by the waves created is virtually nil. "
"Last not least - Hovercraft need minimal base requirements. Hovercraft do not require, docks, piers or dredged channels and can operate off many beach sites. Road access to the maintenance base is desirable but not essential. Hovercraft can work in areas and leave without the need for environmentally damaging construction projects

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to support the operation."
Environmental impact of Hovercraft by 4wings hovercraft – http://www.4wings.com

"Studies of the impact of hovercraft on wetland soils and vegetation are limited but generally seem to indicate that effects are minimal and temporary"
INNOVATIVE ALTERNATIVE FOR WETLANDS RESTORATION: TRANSPORT AND DISTRIBUTION OF DREDGED MATERIAL BY LARGE HOVERCRAFT Trudy J. Olin, Michael R. Palermo, Anthony C. Gibson Environmental Laboratory US Army Engineer Waterways Experiment Station Vicksburg, MS 39180

"An indication of the relatively low impact of the ACV may be seen from the fact that bird eggs in nests survived one or two passes without damage. Also, lemmings (small tundra rodents) which in a few cases were inadvertently run over by the ACV did not show any visible injury nor were their burrows or trails effected by several passes. A 5-day old red phalarope chick (sandpiper-like shorebird) survived being run over by the ACV without any injury"
"Generally these effects could be considered as slight, particularly when compared to the level of damage to Louisiana marshes caused by access canals, spoil banks, and caterpillar tracked marsh buggies."
Sikora: Air Cushion Vehicles

"Hovercraft or Air Cushion Vehicles have been in use now for some 30 years and over that time they have worked in some very difficult and sensitive areas.
During that time all the evidence shows that the Air Cushion Vehicle is the idea vehicle for
accessing sensitive areas."
Environmental Impact off Hovercraft by Hoverdril Inc
http://www.hovertrans.com/PDFs/Environmental_Impact_of_Hovercraft.pdf

"A Study on the effects of a mid-sized ACV on wet and dry tundra, one of the most fragile of terrestrial biomes. The ACV used in the tests was a Bell SK-5, ...with a gross weight between 7.7 and 8.8 tons, resulting in a cushion pressure of 0.014 kg per cm2 (0.2 psi)."
"Disturbance from the air flow of 20-30 m per sec (66 to 118 ft'per sec) consisted of displacement of loose, dead vegetation but no apparent damage to live vegetation such as detachment of sedge or grass blades, moss, leaves, or blossoms."
"This study constitutes the most detailed observation of ACV effects on a most biologically fragile terrain from which it could be deduced that air cushion vehicles should have only a slight effect on Louisiana coastal marsh."
Arctic Ecological Impact of ACV Traffic Abele and Brown (1977)

Other literature:

Planning Systems Incorporated 1984. "Environmental Assessment (EA) for Landing Craft Air Cushion (LCAC) Program at NCSC, Panama City, Florida", PSI Job No. 1293, NCSC Contract No. N61331-84-M- 0127, Naval Coastal Systems Center, Panama City, Florida.

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Souder, Paul S., Tobias, Leo, Imperial, J.F., Mushal, Frances C. 1978.

"Dredged Material Transport Systems for Inland Disposal and/or Productive Use Concepts", Technical Report D-78-28, General Research Corporation, McLean, Virginia.