Hovercraft support in Antarctica

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ANTARCTICA

Antarctica, the ice buried continent that covers and surrounds the South Pole forms the coldest and iciest region in the world, with the South Pole lying near the center of the continent.

Antarctica, larger than either Australia or Europe, would be the smallest continent if it did not have its ice cap. This layer of ice, more than two (2) miles (3.2 kilometers) thick, increases the surface area and makes Antarctica the highest continent in terms of average elevation, seventy-five hundred (7,500) feet (2272 meters above sea level.

Antarctica, isolated from other continents by the stormy waters of the southern Atlantic, Indian and Pacific oceans, contains a hostile environment for man and equipment.

Towering icebergs and huge piles of annual ice pose many problems for ships trying to reach the continent. On land gigantic glaciers move slowly downhill toward the sea, with coastal ice moving seaward as much as four hundred ninety (490) feet (148 meters) a year.

This movement of the ice cap causes breaks to occur forming crevasses which pose problems to travel. Routes must be reconnoitered and marked to avoid these and other obstacles.

Temperatures in Antarctica rarely reach above 32 degrees fahrenheit (0 degrees celsius) with the world's lowest temperature of -128.6 degrees fahrenheit (-89.6 degrees celsius) being recorded there. This extreme temperature is often accompanied by strong winds, which makes travel impossible due to blowing snow.

HISTORY OF TRAVEL

Gone are the days of the dog sled as a means of transportation in Antarctica!

The constant hum of vehicle engines dominate the Antarctic summer. Being met at the airfield by a pickup truck will demolish many myths for the uninitiated visitor arriving at McMurdo Sound.

The modern dependence on motor vehicles in Antarctica is frowned upon by those who claim damage to the pristine character of the wilderness. However, early explorers did not agree.

In 1907, Ernest Shackleton took a New Arrol-Johnston motor car with him to Cape Royds. This vehicle was not of value, since it easily bogged down, even in the light snow cover on the sea ice.

Next came Captain Scott with his crawler, tracked, tractors in 1910. Two were used successfully to unload the ship, However, one tractor fell through the ice and remains off shore at Cape Evans. The air cooled engines on the remaining two tractors overheated on the Ross Ice shelf and the vehicles were abandoned.

Later Mawson, Charcot and Shackleton tried various types of vehicles on their expeditions, without any vehicles working well.

It was only through the enormous technological advances made during World War I that vehicles found a place in Antarctica.

Admiral Richard Byrd used both tracked and half-tracked vehicles in logistical support functions and as prime movers on traverses away from base during his post war expeditions.

Even with the success of the post World War I vehicles, it was not until the post World War II expeditions that the first independent long range mechanical traverses were realized.

The use of United States military surplus M-29 Weasel tracked vehicles by the Norweigan - British - Swedish Expedition of 1949-52, set the stage for long distance mechanical traverses, which began during the International Geographical year.

Since this expedition, technological advances in vehicles have made both wheeled and tracked vehicles more compatible to the hostile environment found in Antarctica.

MCMURDO TODAY

The McMurdo Sound of 1988 is vastly different than when Shackleton brought his car there in 1907. The logistical support bases, scientific activities, airfields and new construction are widely separated and diverse. This makes vehicular activity of vital importance to carry out the U.S. Antarctic Program.

Base support includes the day to day local movement of people and material, in addition to the seasonal flurry of activity during the ship offload.

Airfield support includes local airfield logistics and the transport of passengers and cargo between the airfield locations and main base.

Construction support includes the transport of many tons of material around the base camp and to outlying camps, which are often many miles away.

Scientific support includes the transport of personnel, materials and sophisticated, electronic, equipment between the main base and the outposts.

SEASONAL EFFECTS

The short Antarctic summer is composed of two (2) distinct seasons, which affect the forementioned categories of vehicular support. During early summer and prior to mid-December the sea ice offers a firm reliable route for wheeled vehicles to travel. While in mid-summer, accelerated use and summer melting of the ice surface cause wheeled vehicles to become immobilized. This deterioration of the surface ice, coupled with icebreaker activity makes the sea ice impossible to use in late summer.

The ice shelf however poses diffrent conditions, since there are few areas on which normal wheeled vehicles can easily operate. Prepared snow roads are constructed and maintained to the airfield for wheeled vehicle operation. These prepared surfaces start to deteriorate by mid-summer and reliance must be placed on the terra-tired (balloon tired) frame steered wheeled vehicles and tracked vehicles.

Unfortunately, when these conditions exist movement of personnel and cargo is slowed considerably, while the demand for movement is increasing at the airfield.

Elsewhere on the Ice Shelf and anywhere in the field, the year round requirement has been for tracked vehicles, except McMurdo Station. Here the roads are on the volcanic cinders of Ross Island and mobility is seldom a problem, but range is restricted to about two (2) miles.

CURRENT VEHICLES

Vehicles in use by the US Antarctic Program prior to the Antarctic summer of 1988 can be divided between wheeled and tracked, with several variations of each type in use.

A basic observation for vehicle use has been that steep slopes and soft surfaces require the use of tracked vehicles, while higher speed requirements and firm surfaces require the use of wheeled vehicles.

WHEELED VEHICLES

Wheeled vehicles are the most economical to buy, maintain and operate. Unfortunately, for all their efficiency they have the least mobility. Even the very large terra-tired vehicles become immobilized once the snow becomes too soft or if multiple passes are made over a snow surface. Although these vehicles have a reputation of being off road vehicles, their operation is limited to surveyed routes and under very narrow circumstances.

Wheeled vehicles include all wheel drive pickup trucks, vans, army CUCV (basically Chevrolet Blazers), military 5-ton dump and semi-trailer trucks and the very large terra-tired Canadian Foremost Delta series.

TRACKED VEHICLES

Tracked vehicles are more expensive to buy, operate and maintain than a wheeled vehicle in the same size range. Their use is dictated by a requirement to leave prepared surfaces, traverse slopes and move personnel and cargo when wheeled vehicles cannot travel.

Tracked vehicles include snowmobiles, ASV's (all season vehicles), Logan Sprytes, Tucker Sno-Cats, CN110- which is the largest tracked carrier with a 5 ton payload and the caterpillar LGP D-8 bulldozer.

Unfortunately, for all the mobility of tracked vehicles, the user sacrifices, economy, range, speed, payload and personal comforts in comparison to wheeled vehicles of the same size.

The forementioned problems and terrain are not new. They have been there since the Antarctic program and have been accepted.

However, in recent years the National Science Foundation has become concerned with the age and composition of its vehicle fleet in Antarctica. Increased demands for service in the program have caused the problems to be addressed and new solutions sought.

One of the new solutions being tested is the use of an air-cushion vehicle, which was contracted for and built by Hover Systems, Inc., of Eddy-Stone, PA, in 1987.

HOVERCRAFT SUPPORT

During the Antarctic summer of 1988, support for the United States scientific program will take on a new dimension. The wheeled and tracked vehicles will be supported by a bright international orange Hover Systems Husky Model G-1500TD Hovercraft.

INTRODUCTION

The Husky Model G-1500TD is a fully amphibious, thirty-three (33) foot, diesel powered hovercraft, capable of carrying seventeen (17) passengers or a thirty-three hundred (3300) pound (1500 kilogram) payload. The maximum speed over water is thirty (30) mph (48 kilometers), with speeds in excess of forty (40) mph (64 kilometrs) possible over smooth ice.

The air-cooled turbo-charged Deutz dieselinstallation combined with a simple transmission and control system provides for ease of operation and maintenance.

This craft combines modern developments in diesel technology with the latest advances in hovercraft hull and skirt design. The result is a fully amphibious small commercial hovercraft designed to the certification regulations of the United States Coast Guard and the International Maritime Organization.

CRAFT DESIGN

The climatic conditions and terrain over which the craft will operate dictated numerous changes in the design of the Husky Model G1500TD, Antarctic, hovercraft. All components assembled on the craft were required to be tested as functional at temperatures of -50 degrees fahrenheit (-10 degrees celsius).

The marinized aluminum hull has increased thickness of bottom plating adjacent to the two aluminum runners which run the full length of the craft. These runners are an added safety feature should the craft bottom out on ice ridges. They also provide strength, which prevents damage to the hull and serve as the landing pads when the craft is off hover.

The specially designed fiberglass cabin is fabricated in three (3) separate pieces. The crew cabin is riveted to the top of the bow and is fitted with special heated glass windows which provide a clear all around view. The main passenger cabin is covered with forward and aft sections, fitted with easily replaceable polycarbonate windows, treated to withstand temperature of -65 degrees fahrenheit (-18 degrees celsius). The aft six foot (6') section of the cabin is easily removable to expose an open cargo area. Padded bench type seats are provided in the cabin area. These seats, which are covered by a special fabric designed to withstand the cold temperature, are easily removable to expose cargo tie down rings.

The craft is powered by a Deutz, air-cooled diesel engine, rated at one hundred ninety (190) horsepower at twenty-five hundred (2500) RPM. This engine is specially equipped with thermostatic controlled heaters and is capable of satisfactory performance on a commercial grade distilled petroleum fuel oil, equivalent to Arctic grade DFA with a minimum cetane rating of thirty-five (35). The fuel system is specially designed for this craft with additional filters for water and contamination removal.

The craft is supported on a cushion of high volume, low pressure air, provided by a centrifugal fan driven from the front of the engine. This air is contained under the craft by a flexible skirt, which is a continuous loop of natural rubber coated material attached around the periphery of the hull.

The propulsion system consists of a four bladed fixed pitch propeller, matched to an aerodynamic duct, and driven from the rear of the engine. The engine is equipped with a clutch to the propulsion system. This allows ease of movement, full hover height without movement and assists with maneuvering.

Craft maneuverability is enhanced by triple airfoil rudders mounted in the immediate slip stream of the duct to provide directional control. Lateral control and horizontal trim is maintained by the skirt shift mechanism, while pitch control and longitudinal trim is accomplished by four (4) elevators mounted in the duct and the fuel ballast system.

Cargo handling is facilitated by use of a rotating boom equipped with an electric winch and designed to handle a six hundred (600) pound (273 kilogram) payload, from inboard or outboard of the craft. The remote controls for the winch allow one person to load or offload cargo.

The davit is designed for easy removal by the crew or it can be left in place while the craft is in operation.

CRAFT OPERATION

Enhancement of inclement weather operation is provided by a navigational radar unit, magnetic compass and electromagnetic compass. These navigational aids will allow rapid movement of resources over defined routes, even during periods of low visibility.

The hover height of seventeen (17) inches (43 centimeters) will allow passage over ice ridges and narrow cravasses to provide a more direct route to and from work areas. The amphibious capabilities of the craft will allow the work to continue in those areas during periods of thawing, which inhibits resource transport by wheeled and tracked vehicles.

The ten (10) hour operational range of the Husky can be easily extended by carrying extra drums of fuel, which can be loaded by the cargo boom. In addition, a snowmobile can be easily transported to enhance scientific support.

Primary assignments for the Husky Hovercraft include, operating over the sea ice as a support vehicle for scientists. This will hopefully reduce current travel time to exploration sites, reduce drain on enormously expensive helicopter time and extend the season for working on the ice edge.

Another assignment for the craft will be high speed passenger and cargo shuttle between the airfield and main base during periods of soft surface conditions. This will reduce current travel time, reduce current operational expenses and enhance passenger comfort several fold.

The hovercraft is also planned for use on the Ice Shelf, over reconnoitered routes and may be used further inland or on the plateau if scientific activity demands it. Other factors which promote inland use include the fact that it can be transported in a single C-130 aircraft, its ultra-low cushion pressure may make it a much safer vehicle in crevassed areas, its speed and range is several times that of the tracked vehicles and the personnel comfort is far superior to tracked vehicles.

ANTARCTIC TEST RESULTS

During early February, 1988 the Husky Model 1500TD hovercraft was assembled and tested in Antarctic, before winterizing and storing.

During this short test period, results were very encouraging. Speeds in excess of forty (40) knots (46 mph - 74 kilometers/hr.) were obtained over smooth ice, with speeds of twenty-five (25) knots (29 mph - 47 kilometers/hr.) being obtained against a thirty-two knot (37 mph - 59 kilometers/hr.) headwind, with six (6) passengers on board. This exhilarating performance was farther enhanced when the craft exceeded thirty-five (35) knots (40 mph - 64 kilometers/hr.) at cruise throttle, with fourteen (14) passengers on board.

Another encouraging operation took place over soft snow fields. As we expected, high speed performance was possible without any problems. One trip was made in thirty-four (34) knot (39 mph - 63 kilometers/hr.) winds with five (5) foot high blowing surface snow, white out conditions. During this trip, the use of navigational radar allowed a speed in excess of thirty (30) knots (34 mph - 55 kilometers/hr.) to be made, as compared to three (3) to ten (10) mile per hour for conventional transporters.

The Husky Model G-1500TD successfully negotiated ice ridges up to two (2) feet (.6 meter) high along Willy Road and pressure ridges up to six (6) feet (1.8 meters) high, with sloping sides and rounding tops.

The Willy ramp from the ice shelf to the sea ice, likewise posed no problems. The craft brought off hover at the steepest point on the ramp, hovered up and proceeded to climb the ramp. This transition was very encouraging.

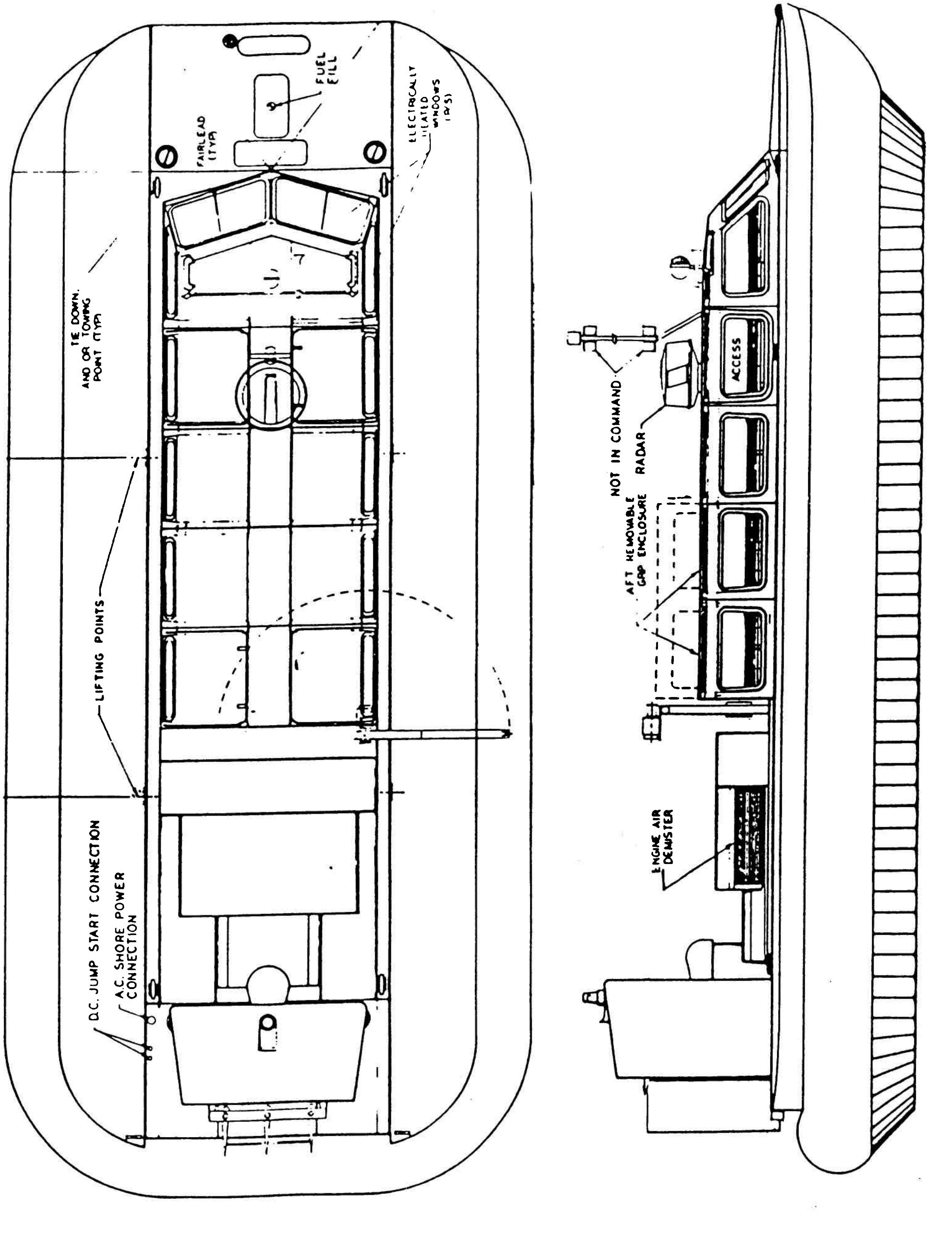
Another trip of interest involved a run from Williams Field to White Island which took fifty (50) minutes. This compares very favorable to the average time of three (3) hours for wheeled vehicles, when they can operate, and up to eight (8) hours for tracked vehicles to make the trip.

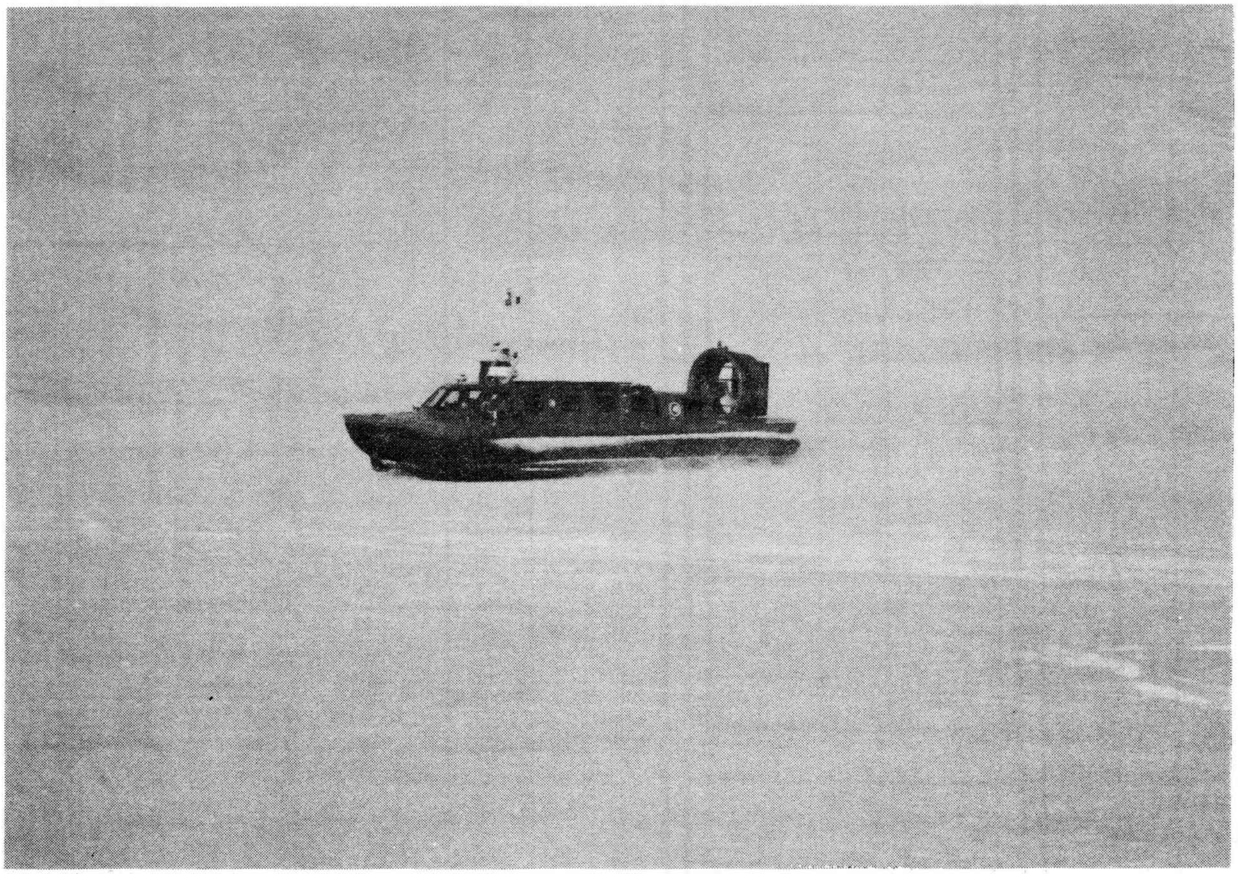
These preliminary tests proximate our predictions and exceed the design criteria. This comes as no surprise to me, however, more extensive tests will be conducted during actual operations in the austral summer of 1988-89.

It is my prediction the hovercraft will reduce that transport time for passengers and cargo by at least fifty (50) percent and operational cost will be reduced by thirty (30) percent when compared to current conventional vehicles in use.

In addition, valuable, expensive, helicopter time will be reduced, scientific studies will be extended, especially along the ice edge, and new areas will be open to exploration.

If my predictions are correct, the Husky Model 1500TD performance should dispell the adverse performance of predecessor air cushion vehicles used by other countries in Antarctics.


FUEL FILL
FAIRLEAD (TYP)
ELECTRICALLY HEATED WINDOWS (P/S)
TIE DOWN AND OR TOWING POINT (TYP)
LIFTING POINTS
D.C. JUMP START CONNECTION
A.C. SHORE POWER CONNECTION
NOT IN COMMAND
RADAR
AFT REMOVABLE GRP ENCLOSURE
ACCESS
ENGINE AIR DEMISTER



Husky Model G-1500 TD operating on the ice-shelf, February 1988, Antarctica

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