Thoughts on Hovercraft Ferry Service
Lake Sakakawea & Fort Berthold Reservation

Opinion:

After visiting the area I can see where a hovercraft ferry and water taxi service could safely, reliably, and efficiently serve the needs of the Fort Berthold Reservation and the residents; improving the quality of life for many. The lake and surrounding land, along with the climate and existing infrastructure seem almost ideal for this application.

The preliminary planning work performed by LSC Transportation Consultants, Inc. (LSC) in the form of their Technical Memorandum #2.2 (TM2.2) was very well done. I second their preliminary recommendation for public transit and ferry service via a three phase approach. The next step in that process will be to take LSC's preliminary work and advance the hovercraft plans to a greater level of detail and refine the capital and operating cost estimates.

It is this author's recommendation that the following hovercraft options be explored in greater depth and detail:

- Hovercraft Water Taxi Service – served by three small passenger only hovercraft operating in conjunction with on demand over the road buses to operate in two loops on the lake; a northern loop and a southern loop calling on existing (but improved) recreational boat ramps/marinas. The loops would have a common meeting point to allow interlining of passengers as needed, and to make connections available to the ferry.
- Hovercraft Ferry Service – served by one larger hovercraft that can carry passengers and automobiles, light trucks and towed trailers; running point to point at a centralized lake location such as the Old Highway 8 bridge alignment. This centralized location would be home base to all hovercraft operations and supporting infrastructure.

Pending approval by the Three Affiliated Tribes, the project would then involve the following major components to be addressed in the next level of planning:

- Definition of Vessels
- Definition of Landside Infrastructure
- Environmental and Permitting Clearances
- Establishment of Operations

These four steps are briefly outlined and discussed on the following pages.

I. Definition of Vessels

a. Water Taxi Hovercraft - The three water taxi hovercraft could be the size and type similar to the Griffon 2000TD, see attached sheet for some general information. Unlike the Airform hovercraft mentioned in TM2.2, the Griffon line of hovercraft have a quality pedigree, are of a mature design, and have been demonstrated in severe winter service (see Arctic Hawk Case Study attached). This model can easily accommodate up to 20 passengers. The craft should be rated for severe winter weather and incorporate appropriate de-icing equipment for the near-arctic operating conditions of North Dakota winters. The vessel must provide for ADA access to/from shore facilities. The vessel can be operated by a crew of one US Coast Guard licensed pilot holding a 100 Ton Master's License with a hovercraft endorsement. The craft must be built to meet or exceed US Coast Guard 46CFR

Subchapter T requirements. The Griffon can be built in modules off-site at a commercial shipyard in the United States, then shipped to North Dakota for final assembly and testing. The Griffon 2000TD is 42 feet in length with a beam of 20 feet. It can be built in three sections delivered by flatbed truck or rail.

At any given time during the operating day, the hovercraft can be operated on circular routes that intersect at key locations to allow transfers between the two routes. Perhaps one route operating clockwise and the other counter-clockwise with one or two common meeting points to allow for transfers. The third hovercraft would be in reserve status, undergoing preventative maintenance or repairs; most times it will be available as a ready service replacement should one of the operating craft have a mechanical issue. The three craft size is the optimal fleet for the type of service envisioned here. Given a few days per year of adverse weather, I would predict >98% availability for the service given the 5 days per week operating tempo.

b. Ferry Hovercraft – One larger hovercraft could be of the size and type similar to the BHT 130 as operated by the Aleutian East Borough in Alaska. This type of craft would be sized to carry up to 49 passengers and perhaps 6 automobiles or some light trucks with trailers. Optimal sizing would probably allow for 12-15 tons of vehicle weight as the upper limit on payload. This ferry would operate point-to-point providing a highway connection between two points located central on the lake as recommended by LSC. Again, ferries designed by Griffon or British HoverTravel are mature designs utilizing proven and mature technology. Similar to the water taxis, craft of this size can be built in modular fashion, transported to the site, and assembled and tested on the lake. The cited similar craft SUNA X was 95 feet long with a beam of 45 feet; fitted out with a hydraulic ramp on the bow for vehicles and ADA passenger access. There would be significant design effort to achieve the modularity and there would have to be a careful study of this issue, and a comparison to the option of setting up for on-site construction (see infrastructure discussion below). This type of craft would be flown by a licensed pilot and co-pilot and staffed with one or two licensed deckhands for a total crew of 3-4. Given the 7 day per week tempo outlined by LSC, there will be some days when the hovercraft will be out of service for maintenance, repair, and inspections. There will be other days when weather may preclude safe operation (high winds, waves, reduced visibility due to snow or fog). I would reasonably project ±95% availability for this craft.

Vessels must be built in the United States, be built to US Coast Rules and Regulations or International Maritime Organization equivalency, be ADA accessible, be rated for ice and arctic type operating conditions. Vessels should be built to a mature and proven hovercraft design, by a reputable and experienced shipyard. Depending on capital funds used, may need to meet Buy America provisions for vessel content, and will need to meet EPA rules for diesel engines.

My experience in the realm of hovercraft is that there are a lot of people and companies out there that talk a good talk, but have precious little real world experience to back it all up. I call these folks “hovernuts” and there are many of them out there. Proceed with due caution.

II. Definition of Landside Infrastructure

A hovercraft transportation system as recommended and envisioned will need certain landside infrastructure created to support safe, reliable, and efficient operations.

a. Water Taxi Terminals – for the water taxi stops created around the lake at existing boat ramps and marinas, the investment and impacts will be quite modest. At each location the following elements and improvements would be required:

- Concrete or paved ramp of suitable slope and area to accept hovercraft.
- Portable ramping to allow for ADA access to/from the vessel.
- Shelter area for waiting passengers.
- Communications link to on-demand surface transportation.

b. Ferry Terminals – for the hovercraft ferry terminals, one should be set up as a system wide operating base (primary ferry terminal) while the other is set up much as indicated above for the water taxis (secondary ferry terminal):

- Primary Ferry Terminal should include the following elements:
    - Large concrete ramp and pad suitable for multiple hovercraft to come and go.
    - Connecting road improvements for operations and vehicular traffic.
    - Large hangar for hovercraft ferry.
    - Smaller hangar for hovercraft water taxis (see attached Griffon 2000TD Base & Hangar).
    - Fueling area.
    - Shelter area for waiting passengers.
    - All hangers to be enclosed for protection from the elements.
    - Offices for crews and maintenance staff, can be integral to large hangar.
    - Containers set up for spare parts, materials, machinery, and equipment.
    - Communications center.

- Secondary Ferry Terminal(s):
    - Concrete ramp and pad suitable for hovercraft ferry.
    - Shelter for waiting passengers.
    - Connecting road improvements for vehicular traffic.

Some thought should be given to establishing another secondary hovercraft ferry terminal located near New Town or Four Bears Village. This option would provide for hovercraft ferry service for vehicle and ambulance access from the southern reaches of the lake directly to the services and facilities located there at the northern edge of the reservation. For a 40-50 knot hovercraft ferry, the trip between Old Highway 8 and New Town would take about 50 minutes. This terminal could allow for a safer and faster transport alternative for passengers and/or vehicles on an as needed or emergency basis. The investment would be rather modest and benefits could prove to be substantial.

III. Environmental and Permitting Clearances

All of the plans and recommendations certainly carry with them a host of potential impacts on the land, water, environment, wildlife, and residents of the area. The author is not well versed on how these issues are to be resolved, or the timelines required to do so.

Until such time that more information is made available, the assumption should be made that permitting for hovercraft operations will require some level of environmental study and ultimate approval. The hovercraft operations in Alaska were encumbered by many agencies that were concerned with impacts to land and wildlife. Given my brief tour around the lake I must assume that similar work will be required at Lake Sakakawea. While hovercraft have been known to carry with them a certain environmental stigma, this author's experience has proven that if done correctly, and with proper planning and attention to detail, that the footprints of a hovercraft ferry and water taxi service can be quite benign, with negligible negative impacts.

In terms of operating the proposed service, it is believed that the US Army Corps of Engineers would have "jurisdiction" over the service and would probably delegate the oversight and regulation of ferry operations to the US Coast Guard.

The US Coast Guard is deeply versed in regulatory control over ferry operations in general, in terms of vessel construction and safety standards, and the licensing of the merchant mariners that operate ferries. However, they have precious little experience with hovercraft. The work done by HoverLink, LLC along with our Canadian partners SeaMasters and Hovertek Consulting for the Akutan hovercraft ferry service was largely a matter of us leading the US Coast Guard through a hovercraft learning experience. Ultimately they issued a Certificate of Inspection to the SUNA X and approved a comprehensive hovercraft Safety Management System to allow the hovercraft ferry routes to operate.

It is anticipated that it might take 4-6 months to set up and gain approval for an operational structure with the US Coast Guard, once given the go ahead to do so.

IV. Establishment of Operations

The following steps serve as a general outline to make this service a reality once environmental and permitting issues are resolved, or once a clear path is established.

- Work cost estimates from Class D (as currently established by LSC) to refine them to Class A accuracy, and confirm budgets for capital and operations in order to shape plans accordingly – my personal belief is that LSC's estimates are on the low side of what actual costs would be, perhaps by 25% or so for both capital and operations, at least until more is known regarding environmental and permitting requirements
- Release Request for Proposals or Invitation for Bids for landside improvements
- Release Request for Proposals for hovercraft design and construction
    - Allow two years from start until hovercraft ready for service to allow for
    - Contracting
    - Engineering
    - Construction
- Determine operating structure for crews, direct hire by Three Affiliated Tribes or contracted services?

Given the recommendations of TM2.2, there would be a requirement to staff the proposed hovercraft services as follow:

a. Hovercraft Water Taxis:

    - Four full time hovercraft pilots, with USCG 100 Ton license + hovercraft endorsement
    - Two full time hovercraft mechanics
    - Administrative support

b. Hovercraft Ferry:

    - Four full time hovercraft pilots (pilots and co-pilots)
    - Three to Four full time deckhands
    - Two full time hovercraft mechanics
    - Administrative support

The process of finding, hiring, and training crews would take 6-9 months and can occur comfortably during the time required to procure hovercraft and complete landside infrastructure improvements.

Establish administrative functions such as:

- Human Resources
- Training
- USCG Compliance and Reporting Criteria
- Procurement & Purchasing
- Revenue Collection and Accounting
- Customer Service and Community Support

- Logistics
- Insurance
- Management and Reporting
- And many more details to account for …

<u>Summary</u>:

Can it be done … without a doubt the answer is an unqualified **YES**.

As mentioned above, I think more study is warranted in regards to the economics as presented in TM2.2 before too much more effort is expended, and perhaps before the decision makers take the matter up. Regardless, it should be the first order of business should the decision be made to carry the initiative forward.

As spoken to last week, the only necessary ingredients are:

- Vision
- Creativity
- Imagination
- Energy
- Time
- And money

Attachments

1. Griffon 2000TD
2. Arctic Hawk Case Study
3. BHT 130 SUNA X
4. Griffon 2000TD Base & Hangar
5. Hovercraft Water Taxi Loops
6. 3rd Hovercraft Ferry Terminal – New Town or Four Bears Village

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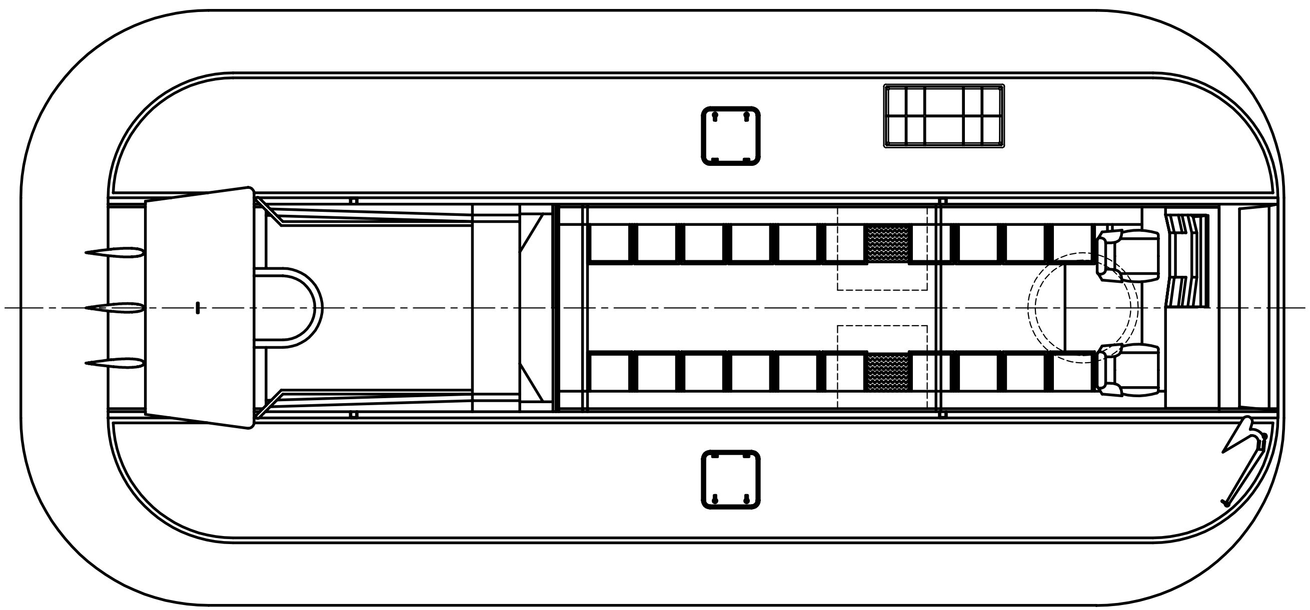
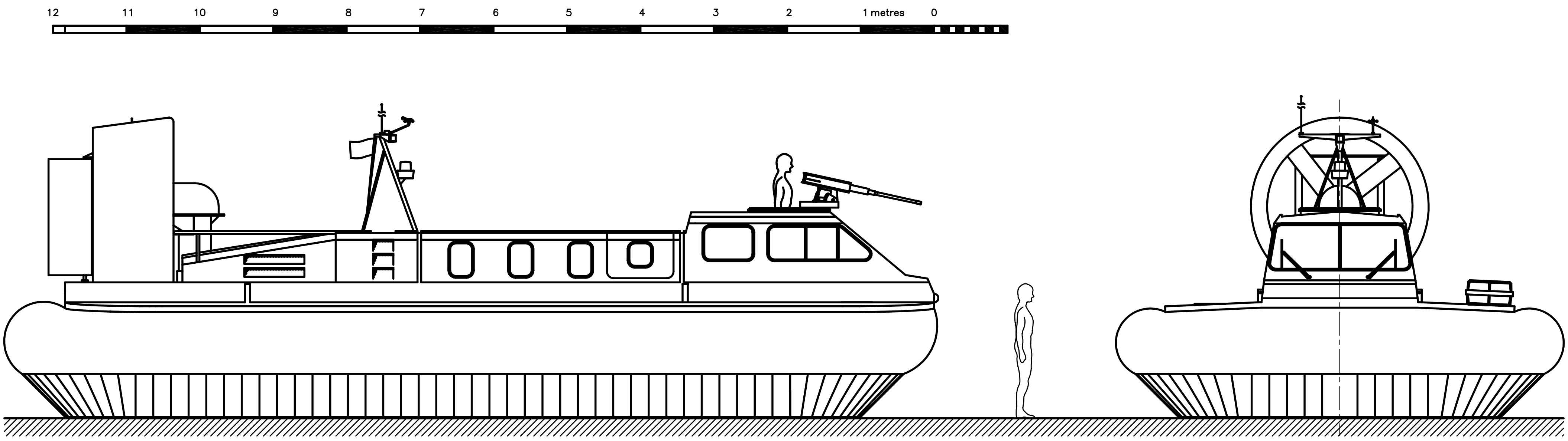
Griffon 2000TD(M)

Principal Dimensions

Length overall:	12.70m
Beam overall:	6.10m
Height overall:	3.93m





Case Study: Arctic Hawk

The 'Arctic Hawk' hovercraft operates between 9 and 10 months a year in freezing conditions, transporting cargo and passengers to Northstar Island, Alaska

With a total of 11,750 operating hours since 2003, the 2000TD hovercraft "Arctic Hawk" has accumulated the most operating hours in cold climates of any Griffon Hovercraft.

The 2000TD Mk2 hovercraft was licensed built in 2003 by Kvichak Marine for Griffon Hoverwork and to Griffon's designs. The Arctic Hawk 2000TD is operated by Crowley Marine services. She operates between Prudhoe Bay and Northstar Island, a manmade oil production platform 6 miles off shore into the Beaufort sea, transferring cargo and BP work crews.

The hovercraft must traverse open water in summer, ice during the winter, and a mixture of both during freeze-up and break-up. It is therefore the most practical and economical mode of transport for this service.

On average the craft shifts 60 passengers and 7600kg of cargo per week, totalling 11,000 trips since the craft first started operations.

The Arctic Hawk team face temperatures down to minus 40 degrees, ice rubble, harsh 30 knot winds and rough seas.

Arctic Hawk operates over the water until freeze up in mid November. During the mid winter, the Northstar team build an ice road to access the island; this allows trucks to run across with crew changes, food and equipment, and emergency services, rivalling local helicopter operations. In early Spring when the road starts to deteriorate the Arctic Hawk returns to action. During summer months boats can be used but the hovercraft is relied upon in between.

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Case Study: Arctic Hawk

The Arctic Hawk 2000TD hovercraft is modified to face cold climates and is specially kitted out to endure harsher temperatures.

With low decibel noise frequency and low level underwater noise, hovercraft are much more environmentally friendly than conventional vessels and helicopters; as a result, hovercraft are the ideal solution when environmental preservation in colder climates is key. In climates with snow, ice or blizzards, a hovercraft's ability to traverse terrain with ease make them the only viable transport solution.

To optimise operational time in isolated areas where re-fuelling is difficult, Griffon craft can be fitted with long range tanks for an additional 1500 liters of fuel. This increases the amount of time the craft can operate, allowing the customer to get maximum efficiency from their hovercraft. The hovercraft is stored under a hangar to protect it from the elements when not in operation.

Since it's build in 2003, the craft has undergone further modifications and adaptations to help her continue to operate in Alaska. These include:

- A cold weather engine for sub-zero starting
- Heated windows in control cabin and heated fixed side windows
- 2 x Diesel-fired cabin heaters
- Insulated ducts for windows to assist with defrosting
- Webasto 5000 heaters
- SST skirt shift pins and brackets with bronze bearings to sustain sand and grit wear
- 2 HID remote controlled spotlights and 4 flood-lights for the front of the craft
- Installed louvers in the aft engine cover bulk-head to redirect or restrict air flow in accord-ance with outside temperatures

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95’ BHT 130 HOVERCRAFT

VESSEL SPECIFICATIONS

BUILDER ....Vigor (formerly Kvichak Marine)
DESIGNER ....Griffon Hoverwork, Ltd.
LENGTH (OVERALL) ....95’ (28.95m)
BEAM (OVERALL) .... 45’ (13.7m)
FUEL CAPACITY .... 2,000 gal (7570l)
DISPLACEMENT .... 80 tons
CRUISING SPEED (APPROX)................. ~35 knots
TOP SPEED (APPROX) .... 50+ knots
MAIN ENGINES .....(2) MTU 16V2000, 1205 BHP each
LIFT ENGINES ....(2) MTU 16V2000, 905 BHP each
PROPULSORS ....(2) 12’ Hartzell 5-bladed props
12’ Electro-hydraulic bow ramp
49 Passenger capacity

Cargo deck rated for vehicles

VIGOR.NET MARINESALES@VIGOR.NET

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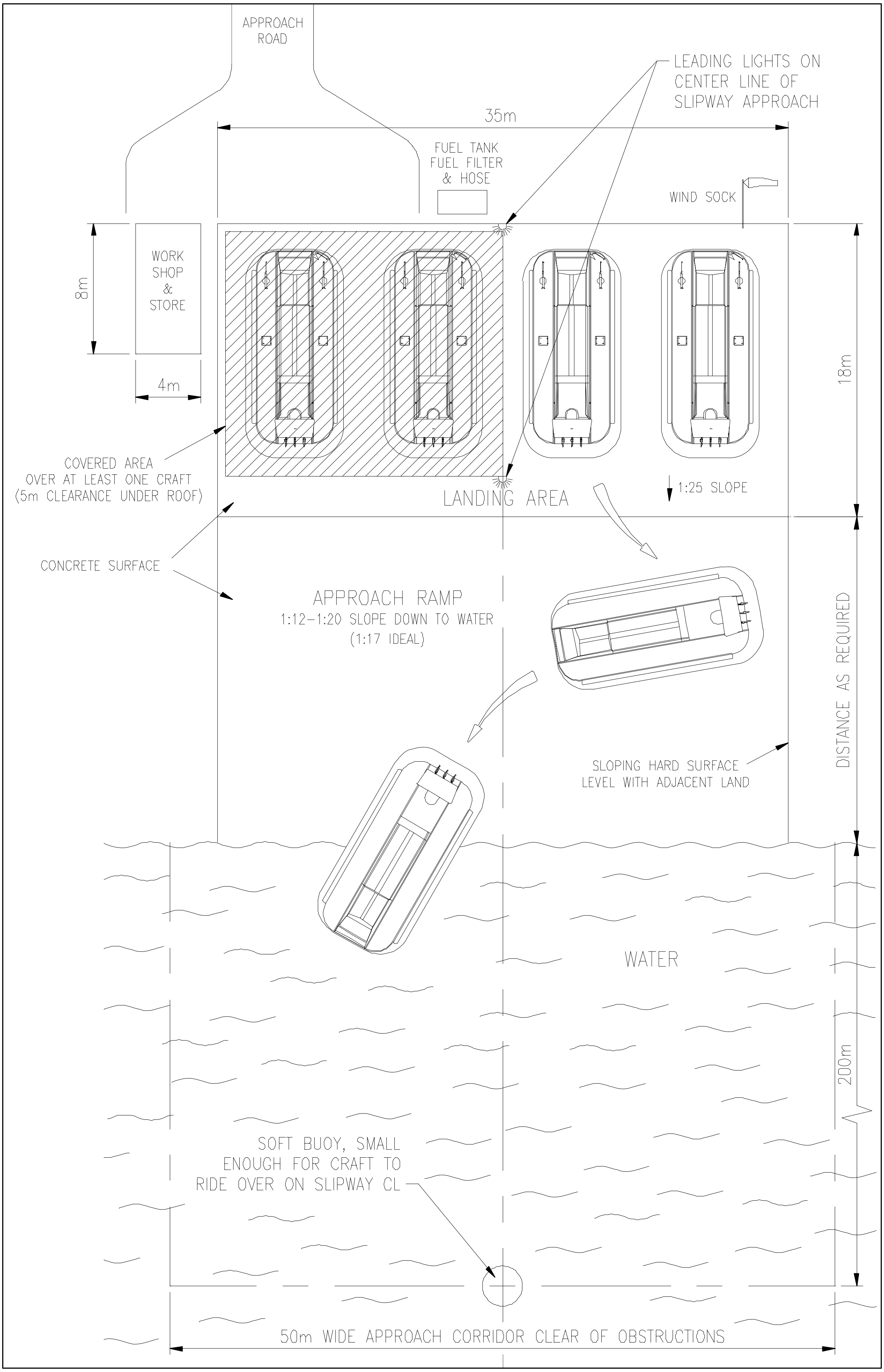
Operation Base Layout

Griffon Hovercraft Ltd



Figure

Fig 1: Plan of base

Base Layout

Figure 1 shows a proposed base for 4 Griffon 2000TD(M) hovercraft. The design of a good operational base for any hovercraft is crucial to a successful hovercraft operation.

Slipway (approach ramp)

The importance of a safe and predictable slipway cannot be over-emphasised. It is the only part of a hovercraft's working area that a craft will have to negotiate at least twice during every operation. Here are a few design pointers:

- The slipway will need a minimum 200m long x 50m wide approach corridor clear of any obstructions *at all states of tide*.
- The slipway must have a consistent gradient across its width. Hovercraft will fall down a gradient and any cross slope may cause unpredictable and potentially dangerous approaches.
- There should be no camber, the slipway should be flat across its width.
- If there is a choice of sites, a prevailing wind that blows directly offshore is desirable.
- The approach gradient is critical: The craft will be able to negotiate a steeper than 1:12 slope but will need more speed to do so. Therefore a longer landing area will be required to allow the craft to stop safely.

Landing Area

- A 1:25 gradient will ensure that the craft will 'fall off' the slope to assist reverse pitch for a fast and predictable deployment. It will also allow water to drain off the area to facilitate skirt maintenance.
- There should be no camber, the landing area should be flat across its width.

The ground pressure of the craft's landing pads under the parked craft is maximum 0.4kg/cm2. The surface across both the slipway (approach ramp) and the landing area should be able to withstand this pressure.

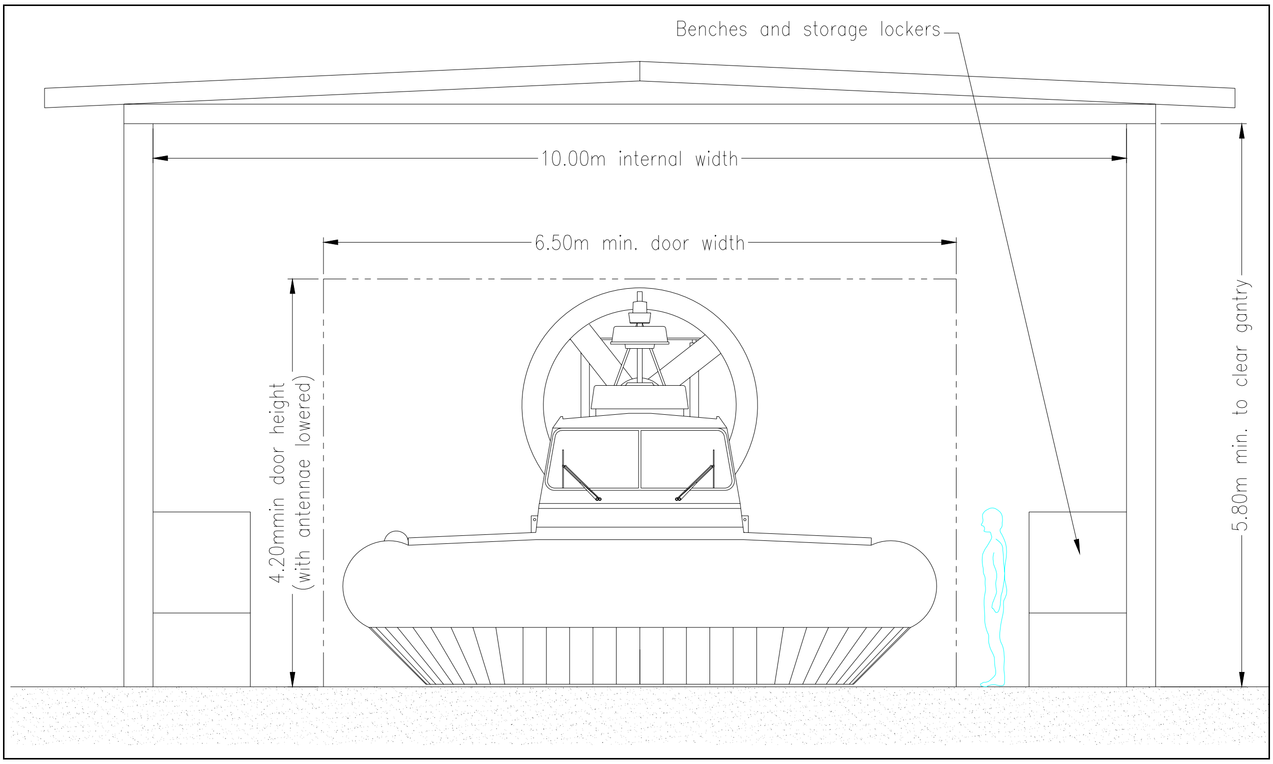


Figure 2: Hangar dimensions

Hangars

If a hangar is to be provided for storage and maintenance it should either: (a) be built on a 1:25 gradient with a single door on the low side or, (b) be on a level surface with doors at both ends.

(a) If it is built on a slope the craft will exit backwards from the hangar and therefore the hangar should be orientated to allow easy access to the sea from it. No cross slopes can be tolerated with this method. One advantage of this arrangement is that water will drain naturally out of the doorway. Some negative camber can also be useful in this configuration if the hangar is for one craft only. This will tend to guide the craft through the centre of the doorway and also allow water to drain out under the centre of the craft.

(b) If a ‘drive through’ hangar is to be used it should be flat and level in both directions. Drainage under the floor should therefore be provided. Space should be allowed for the craft to exit and turn at both ends, so that the driver can use either door dependent on wind direction. See figures 2 and 3 for basic hangar dimensions.

	Minimum
Doorway width	*6.5m*
Doorway height	*4.2m**
Hangar internal width	*10.0*
Hangar internal length	*15.0m*

Figure 3: Hangar dimensions

**this does not include antennae, if it is feasible to lower the craft’s antennae before entry this dimension can be used. Otherwise an allowance should be made.*

Slinging

The craft can be lifted using a mobile crane. The maximum slinging weight when lifting the craft is 5.1 tonnes. See C11 for slinging details. A crane with a minimum capacity of 5.1 tonnes at 6.0 metres is required.

A gantry is useful for the removal of machinery for maintenance, and for the installation and removal of the modules. The gantry will require a minimum span of 6 metres to pass along the craft without damaging the skirt. See figure 4 for basic dimensions. A Safe working load of 1500kg will be enough to lift all the craft's major components individually.

A pair of gantries may also be used for raising the whole craft. Each gantry should be equipped with two chain hoists. See table below for safe working loads of components.

	No of hoists	Hoist SWL	No of gantries	Gantry SWL
Whole craft	*4*	*3 tonne*	*2*	*6 tonne*
Machinery package	*1*	*1.5 tonne*	*1*	*1.5 tonne*

Figure 4: Gantry and hoist details

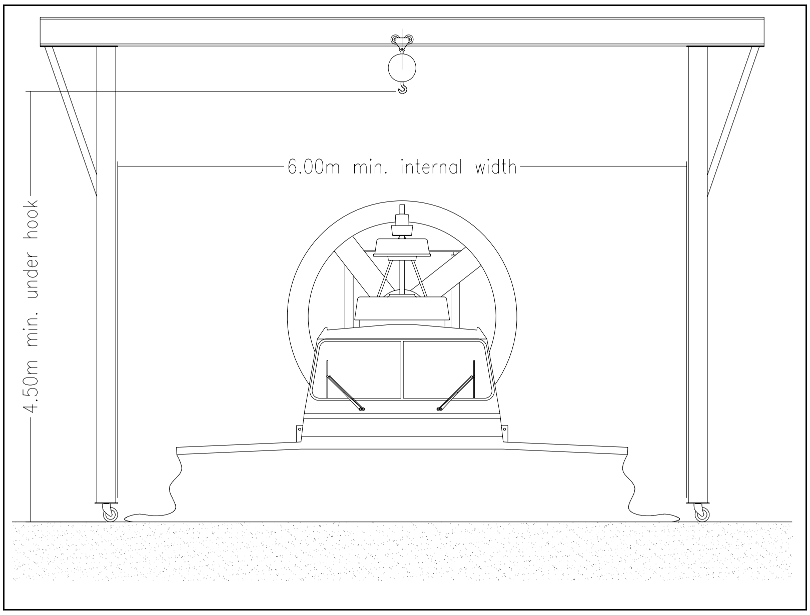


Figure 5: Gantry dimensions

Jacking

The craft can be raised using the jacking post system provided with the craft. This is described in the craft's operating manual Section A2.19.

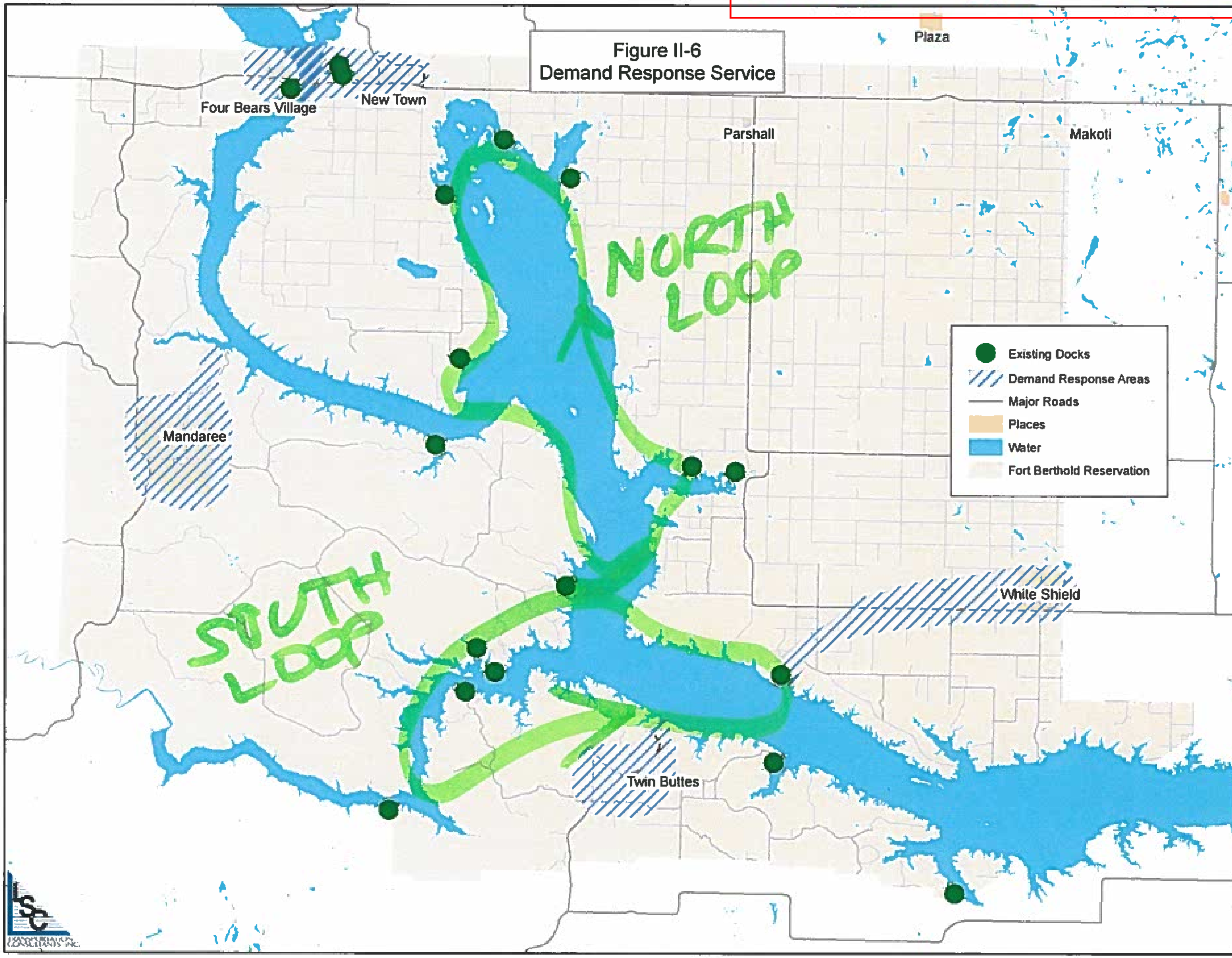
Ground pressure

Although the surface pressure of the craft underway is negligible, when it is parked or jacked more pressure is exerted. The ground pressure of the craft's landing pads under the parked craft is maximum 0.4kg/cm^2. The surface right across both the slipway (approach ramp) and the landing area should be able to withstand this pressure. When raised on the jacking posts there will be a ground pressure in excess of 125kg/cm^2. It is recommended that unless the surface is thick concrete, metal plates are positioned under the jacking posts before the craft is jacked.

Power

The power requirements for lighting and equipment on the base are to comply with local requirements.

WATER TAXI LOOPS



3rd TERMINAL → 38 NAUTICAL MILES, 50 MINUTES