

Phase Scope

This phase is intended to provide the ADF with a new air-deployable amphibious vehicle (ADAV) capability.

Background

The Department of Defence has identified a need for a new capability that will allow units to move small groups of military personnel around river, estuary and littoral environments. The changing nature of operations in land and littoral environments requires the Army's ADAV capability to have the ability to support operations under a variety of environmental and threat conditions in a modern, network-enabled battle space. The ADAV capability will be characterised by responsiveness, high tactical mobility, autonomy and survivability. It is intended that the ADAV capability will complement current and future ADF operational and logistic capabilities.

Acquisition

The project intends to utilise a conventional acquisition model. It is anticipated that the methods of procurement will be through open competition. It is anticipated that Phase 1 will provide the following:

- > provision of the ADAV system capability which comprises a mission systems and support system;
- > integration of the new ADAV into the Defence network-enabled battle management environment; and
- > development of appropriate training systems and provision of maintenance and sustainment functions.

Through-Life Support

The industry requirements will be based around developing and maintaining sufficient capability within local industry to undertake the range of through-life maintenance and support activities necessary to sustain the system(s). The overall objective is to have the full scope of support services in place by the time delivery of the mission system has been completed.

Industry Capabilities and Activities

It is anticipated that Phase 1 will provide the following industry opportunities:

Activity	Capability	
	Vehicle System	Support System
Design	U	D
Training	A	D
Manufacture	A	A
Modelling/Simulation	D	D
Repair/Maintain	D	D
Logistics Support	A & U	D
Test and Evaluate	D	D
Systems Integration	U	D
In-service/Through-life Support	D	D

Note - the industry capability and activity is likely to be **desirable** in: D - Australia, A - America, U = United Kingdom

Operational scenarios

This section details key scenarios that were developed to be used throughout the design process.

The three scenarios are as follows:

- Scenario 1 - Air-Deployment via C-17;
- Scenario 2 - Sea-Deployment via RAN Landing Helicopter Deck (LHD) with beach landing; and
- Scenario 3 - Foot-Soldier extraction from front line.
- Scenario 4 – Training
- Scenario 5 – Maintenance and sustainment

Scenario 1 - Air-Deployment via C17

This mission relies heavily on the ADAV's ability to load and unload from an aircraft and to neutralise enemy soldiers and vehicles.

Scenario Attributes

Landscape	Estuary and beachhead regions with no roadways, with low-level tree and shrub density.
Weather	Dry, dusty with temperatures that range from 5°C to 50°C.
Duration	2 months of missions; where each mission is separated by 4 days to allow the operators to rest and to repair and service the vehicle.
Concurrency	Each mission can support up to 3 ADAVs at once.

Scenario Activities

1. Prepare ADAV
 - i. Load Mission data into ADAV.
 - ii. Load Fuel and Consumables.
2. Load onto a C-17 transport aircraft.
 - i. Drive onto C-17
 - ii. Place the vehicle in its stowed position
3. Take-off, transit to base-airstrip that is 100km from the combat zone and land.
4. Unload from C-17
 - i. Remove vehicle from its stowed position
 - ii. Drive off C-17
5. Transit across land to the combat zone that involves numerous river and lake crossings.
6. Whilst in transit, protect the occupants and vehicle from enemy fire from amphibious and light armoured vehicles.
7. Remain on station at the combat zone for 48 hours.

8. Whilst at the combat zone, neutralise the following threats:
 - i. enemy soldiers
 - ii. light armoured vehicles
 - iii. amphibious vehicles
9. Return to the air-strip for extraction via C17.

Scenario 2 - Sea-Deployment via LHD with beach landing Scenario

This mission relies heavily on the ADAV's ability to load and unload from a ship at sea and to neutralise enemy soldiers and vehicles.

Scenario Attributes

Landscape	Estuary and beachhead regions with some rocky roadways, with medium-level tree and shrub density.
Weather	Dry, dusty with temperatures that range from 5°C to 50°C.
Duration	2 months of missions; where each mission is separated by 4 days to allow the operators to rest and to repair and service the vehicle.
Concurrency	Each mission can support up to 8 ADAVs at once.

Scenario Activities

1. Prepare ADAV
 - i. Load Mission data into ADAV.
 - ii. Load Fuel and Consumables.
2. Load onto a LHD ship at port and transit to a coastal location within 100km of inland combat zone.
3. Unload from a LHD ship at sea.
4. Move over water to shore whilst under attack from the following:
 - i. enemy soldiers utilising hand guns and mortars
 - ii. amphibious vehicles
5. Transition quickly from water to land.
6. Transit across land to the inland combat zone that involves numerous river and lake crossings.
7. Whilst in transit, protect the occupants and vehicle from enemy fire from amphibious and light armoured vehicles.
8. Remain on station at the combat zone for 48 hours.
9. Whilst at the combat zone, neutralise the following threats:
 - i. enemy soldiers utilising hand guns and mortars
 - ii. light armoured vehicles
 - iii. amphibious vehicles
10. Return to ship for extraction.

Scenarios 3 - Foot-Soldier Extraction from front-line

This mission relies heavily on the ADAV's ability to operate in a stealthy mode.

Scenario Attributes

Landscape	Estuary and beachhead regions with some rocky roadways, with medium level tree and shrub density.
Weather	Dry, dusty with temperatures that range from 5°C to 50°C.
Duration	2 months of missions; where each mission is separated by 4 days to allow the operators to rest and to repair and service the vehicle.
Concurrency	Each mission can support up to 8 ADAVs at once.

Mission Description

1. Prepare ADAV
 - i. Load Mission data into ADAV.
 - ii. Load Fuel and Consumables.
2. Load onto a LHD ship at port and transit to a coastal location within 100km of an inland soldier extraction point.
3. Unload from a LHD ship at sea.
4. Move over water to shore whilst under attack from the following:
 - i. enemy soldiers utilising hand guns and mortars
 - ii. amphibious vehicles
5. Transition quickly from water to land.
6. Transit a distance of approximately 100 km across land to the inland soldier extraction point that involves numerous river and lake crossings.
7. Whilst in transit perform the following:
 - i. Operate the ADAV in its stealthiest mode to avoid being detected and engaged by the enemy
 - ii. Sense and avoid Nuclear, Biological and Chemical (NBC) agents.
 - iii. Protect the occupants and vehicle from enemy fire from amphibious and light armoured vehicles.
8. Pick up soldiers. Provide cover fire for the soldiers as they board the ADAV.
9. Return to ship whilst operating the ADAV in its stealthiest mode to avoid being detected and engaged by the enemy. Protect the occupants and vehicle from enemy fire from amphibious and light armoured vehicles.

Scenario 4 - Training

This mission relies heavily on the ADAV's ability to operate its systems in training mode.

Scenario Attributes

Landscape	Estuary and beachhead regions with some rocky dirt roadways, with medium level tree and shrub density.
Weather	Dry, dusty with temperatures that range from 5°C to 50°C.
Duration	2 months of missions; where each mission is separated by 4 days to allow the operators to rest and to repair and service the vehicle.
Concurrency	Each mission can support up to 15 ADAVs at once.

Scenario Activities

1. Prepare ADAV
 - i. Load Training Scenario.
 - ii. Configure ADAV for training mode.
 - iii. Load Fuel and Consumables.
2. Load crew and trainees
3. Transit across land to the inland simulated combat zone that involves numerous river and lake crossings.
4. Whilst in transit, protect the occupants and vehicle from simulated enemy fire from amphibious and light armoured vehicles.
5. Remain on station at the combat zone for 48 hours.
6. Whilst at the combat zone, neutralise the following simulated threats:
 - i. enemy soldiers utilising hand guns and mortars
 - ii. light armoured vehicles
 - iii. amphibious vehicles
7. Return to training start location.

Scenario 5 – Maintenance and Sustainment

For you to update

ADAV SAMPLE SYSTEMS REQUIREMENTS

Req No	Requirements	Weighting
	<u>(Note: There are errors in these requirements. I challenge the team to identify and correct them, & submit with your Project Proposal (as an Annex) for 5% Bonus Points)</u>	
1	Lethality/Key Functionality	
1.01	The system shall be able to detect stationary standing persons within direct line of sight at any angle within a radius of 1 km.	Essential
1.01a	The system shall be able to detect standing persons moving at up to 20 km/h within direct line of sight at any angle within a radius of 1 km.	Essential
1.01b	The system shall be able to detect at least four persons within 5 seconds.	Essential
1.02	The system shall be able to detect stationary vehicles positioned in direct line of sight at any angle within a radius of 5 km.	Essential
1.02a	The system shall be able to detect vehicles moving at up to 100 km/h in direct line of sight at any angle within a radius of 5 km.	Essential
1.02b	The system shall be able to detect at least four tanks or light vehicles within 5 seconds.	Essential
1.03	The system shall be able to detect stationary boats positioned in direct line of sight at any angle within a radius of 5 km.	Essential
1.03b	The system shall be able to detect boats moving at up to 40 knots in direct line of sight at any angle within a radius of 5 km.	Essential
1.03c	The system shall be able to detect at least four boats within 5 seconds.	Essential
1.04	The system shall be able to identify detected persons at a range of up to 250 m as friend or foe.	Essential
1.05	The system shall be able to identify detected vehicles at a range of 2 km as friend or foe.	Essential
1.06	The system shall be able to identify detected boats at a range of 1 km as friend or foe within 5 seconds after detection.	Essential
1.07	The system shall be able to prevent persons from movement and offensive action towards the system for at least 2 minutes in up to four locations each spaced no more than 20 m from the nearest position at a range up to 250 m.	Desirable
1.08	The system shall be able to render inoperable an identified light-armoured vehicle moving in direct line of sight at up 50 km/h at ranges between 5 to 500 m.	Essential
1.08a	The system shall be able to kill a group of four light-armoured vehicles within 60 seconds.	Essential
1.09	The system shall be able to render inoperable an identified light-armoured boat moving in direct line of sight at up 20 knots at ranges between 5 to 500 m.	Essential
1.09a	The system shall be able to kill a group of four light-armoured boats within 60 seconds.	Essential
1.10	The system shall be able to kill an identified person moving in direct line of sight at up 10 km/h at ranges between 1 to 250 m.	Essential
1.10a	The system shall be able to kill a group of four persons within 30 seconds.	Desirable

Req No	Requirements <u>(Note: There are errors in these requirements. I challenge the team to identify and correct them, & submit with your Project Proposal (as an Annex) for 5% Bonus Points)</u>	Weighting
1.11	The system shall be able to identify and kill threats defined in 1.08, 1.09 and 1.10 within 30 seconds of detection.	Desirable
2	Survivability	
2.01	The system shall remain fully operational after impact by 125 gram 7.62 mm munitions travelling at 2350 ft/sec.	Essential
2.02	The system shall at most suffer mobility degradation after impact by a fragmentation grenade at 0 m.	Desirable
2.03	The system shall at most suffer mobility degradation after impact by an fragmentation mine at 0 m.	Desirable
2.04	The system shall at most suffer mobility degradation whilst immersed in a petrol fire for a period of 5 minutes.	Desirable
2.05	The system shall be able to remain afloat in the event of a power failure on water for at least 12 hours.	Essential
2.06	The system shall be able to deploy a smoke screen within 10 seconds to prevent visible spectrum view to a radius 5 m around the vehicle under wind speeds up to 10 km/h.	Desirable
2.07	The system shall be able to deploy camouflage netting suited to the environment over itself whilst stationary on land within 1 minute.	Desirable
2.08	The system shall be able to operate at a sound pressure level of 70 dBA at a distance of 1 m. The system may be stationary and not performing offensive actions to meet this requirement.	Essential
2.09	The system shall be able to protect human occupants from rifle fire, hand grenades, anti-personnel mines and immersion in flame as described in 2.01, 2.02, 2.03 and 2.04.	Essential
3	Mobility	
3.01	The system shall be able to move forward on land at a rate of 90 km/h	Essential
3.01a	The system shall be able to reach maximum forward speed on land from standstill within 15 seconds.	Desirable
3.02	The system shall be able to move forward on water at a rate of 30knots.	Essential
3.02a	The system shall be able to reach maximum forward speed on water from stand still within 15 seconds.	Desirable
3.03	The system shall be able to reverse on land at a rate of 30 km/h.	Desirable
3.04	The system shall be able to reverse on water at a rate of 10 knots.	Desirable
3.05	The system shall be able to turn 360° on land with a turning circle radius less than or equal to 10m.	Essential
3.06	The system shall be able to turn 360° on water with a turning circle radius less than or equal to 10m.	Desirable
3.07	The system shall be able to achieve 100% of full speed on flat bitumen roads less than or equal to 3m wide.	Essential
3.08	The system shall be able to achieve 75% of full speed on flat, dry sand.	Essential

Req No	Requirements	Weighting
	<u>(Note: There are errors in these requirements. I challenge the team to identify and correct them, & submit with your Project Proposal (as an Annex) for 5% Bonus Points)</u>	
3.09	The system shall be able to climb sand slopes less than or equal to 30°.	Essential
3.10	The system shall be able to achieve 100% of full speed on water in sea state 1.	Essential
3.11	The system shall be able to transition between land and water within 5 seconds.	Essential
4	Deployability	
4.01	The system shall be able to be made ready for transport from a mission ready state within 12 hours.	Desirable
4.02	The system shall be able to be made mission ready within 24 hours from a transport ready state.	Essential
4.02a	The system shall be able to be made mission ready after having returned from a mission within 6 hours.	Essential
4.03	The system shall be able to be loaded onto a C17 by the operators without additional moving equipment.	Desirable
4.04	The system shall be able to be unloaded from a C17 by the operators without additional moving equipment.	Desirable
4.05	<DELETED>	
4.06	The system shall be able to travel a distance of 300 km on road without resupply.	Essential
4.07	The system shall be able to travel a distance of 100 km off road without resupply.	Essential
4.08	The system shall be able to travel a distance of 100 km on water without resupply.	Essential
4.09	The system shall be able to be transported by a C17.	Essential
4.10	The system shall be able to be transported by current Australian Navy Landing Craft Heavy (LCH) and Landing Ship Heavy (LSH) roll-on-roll-off (RORO) vehicle carriers.	Essential
5	Situational Awareness	
5.01	The system shall provide operators with real-time visual images from 360 degrees around the vehicle.	Desirable
5.02	The system shall provide operators with the ability to zoom to at least 10 times at any angle of the un-zoomed visual image data.	Desirable
5.03	The system shall provide operators with a topographical and political map of the local operational area.	Essential
5.04	The system shall provide operators with the last known position of up to 20 combatants and neutrals as detected by the system for a user-defined period of time.	Desirable
5.05	The system shall provide operators with a view of the passenger compartment.	Desirable
5.06	The system shall provide operators with Nuclear, Biological, & Chemical (NBC) sensor warning.	Essential
5.07	The system shall provide operators with a vehicle speed indication accurate to within +/- 1km/h.	Essential

Req No	Requirements <u>(Note: There are errors in these requirements. I challenge the team to identify and correct them, & submit with your Project Proposal (as an Annex) for 5% Bonus Points)</u>	Weighting
5.08	The system shall provide operators with a vehicle heading indication accurate to within +/- 1 degree.	Essential
5.09	The system shall provide operators with a vehicle position indication provided in latitude/longitude coordinates accurate to within +/- 1 meter.	Essential
5.10	The system shall provide the operators with vehicle inclination indication accurate to within +/- 1 degree.	Essential
6	Communications	
6.01	The system shall be able to communicate on VHF frequencies.	Essential
6.02	The system shall be able to communicate on UHF frequencies.	Essential
6.03	The system shall be able to communicate up to 100km.	Essential
6.04	The system shall be able to communicate locally with the deployed section.	Essential
7	Climatic Environment	
7.01	The system shall be able to operate in salt water.	Essential
7.02	The system shall be able to operate in fresh water.	Essential
7.02a	The system shall be able to operate in water up to and including sea state 3.	Essential
7.03	The system shall be able to operate in temperatures between -40°C and +50°C.	Essential
7.04	The system shall be able to operate in humidity between 0 and 100%.	Essential
7.05	The system shall be able to operate in Beaufort force 5 wind.	Essential
7.06	The system shall be able to operate in Nuclear, Biological & Chemical (NBC) contaminated areas.	Desirable
7.07	The system shall be able to operate in fog reducing visibility to 500m.	Essential
7.08	The system shall be able to operate in pitch darkness.	Essential
7.09	The system shall be able to operate in bright sunlight.	Essential
7.10	The system shall be able to operate in snow to a depth of 1.5m.	Desirable
8	Availability	
8.01	The system shall have an availability of 95%.	Essential
9	Sustainability	
9.01	The system shall be able to carry out a 48hr mission without resupply, comprising a full load of 8 soldiers travelling a distance of 150km on sealed roads, 25km on sand and 25km on water. The system should carry sufficient munitions to neutralise 30 soldiers, 2 boats and 2 light-armoured vehicles.	Essential
9.02	The system shall utilise power source(s) common to existing ADF vehicles.	Desirable
10	Human Factors	
10.01	The system shall be able to hold an 8-person section plus their kit comprised of a backpack loaded with up to 20 kg of equipment.	Essential
10.02	The system shall be able to hold 2 stretcher-bound casualties plus 6 persons without their kit.	Essential

Req No	Requirements <u>(Note: There are errors in these requirements. I challenge the team to identify and correct them, & submit with your Project Proposal (as an Annex) for 5% Bonus Points)</u>	Weighting
10.03	The system shall allow 8 persons exit the vehicle in 30 secs in an upright orientation on flat ground.	Essential
10.04	The system shall allow 8 persons enter the vehicle in 60 secs in an upright orientation on flat ground.	Essential
10.05	The system shall be able to be operated by persons with less than or equal to 40 hours of additional training.	Desirable
10.06	The system shall be the sole trainer for new operators.	Desirable
10.06a	The system shall provide a training mode that prevents weapon firing.	Essential
10.07	The system shall be able to operate within less than or equal to 2 operators.	Essential
10.08	The system shall allow all human occupants to exit the vehicle in 120 seconds in any vehicle orientation.	Essential
10.09	The system shall allow any human operators space to sleep when not carrying passengers.	Desirable
11	Safety	
11.01	The system shall be able to be made safe for flight in a C17.	Essential
11.02	The system shall conform to Australian road transport legislation.	Essential
11.03	The system shall conform to MIL-STD-1472 for the interior of the vehicle.	Desirable
11.04	<DELETED>	
12	Security	
12.01	<DELETED>	
12.02	The system shall be able to be secured against unauthorised entry when parked.	Essential
12.03	The system shall require coded entry to start it.	Desirable
13	Disposal	
13.01	The system shall be able to be dismantled for recycling.	Desirable
14	Production	
14.01	The system shall be able to be assembled in the USA.	Desirable

1 CANDIDATE SOLUTIONS

A feasibility study has identified that the ADAV can be thought of as primarily an agile, light-armoured, amphibious personnel carrier. The ADAV would operate predominantly on land, traversing estuarine waterways or littoral regions as required to undertake the assigned missions. It is not a front line fighting vehicle, nor is it a craft expected to operate in blue water for extended periods of time.

The Defence Capability Development Manual requires that a COTS/MOTS solution be considered for addressing a capability gap as well as developmental options.

Three design options were identified:

1. Option 1 – Expeditionary Fighting Vehicle (EFV) – US-developed MOTS solution;
2. Option 2 – Modified Gibbs Amphibious Combat Craft Expeditionary (ACC/E); and
3. Option 3 – Hovercraft.

1.1 Option 1 – Expeditionary Fighting Vehicle



Figure 1 – EFV Option.

This option is based on a MOTS solution being developed for the US Marine Corps. The EFV is slated to enter US service in 2015. The EFV can hold up to 17 marines and has a crew of three. Some Australian systems would need to be fitted in place of US systems to permit interoperability in the ADF context.

Specification details for the EFV are:

Manufacturer	General Dynamics
Weight	34,473 kg
Length	10.67 m
Width	3.66 m
Height	3.28 m (turret roof)
Crew	3+17 (passengers)
Armour	ceramic/composite
Primary armament	1 x 30 mm/40 mm MK44 cannon
Secondary armament	1 x 7.62 mm Machinegun
Engine	MTU MT 883 Ka-523 diesel engine 2,702 hp (water), 850 hp (land) Power/weight 34.48 bhp/ton
Operational range	523 km (land), 120 km (water)
Speed	72.41 km/h (road), 46 km/h (24.8 knots) (water)

Some of the key points for this design are:

1. Amphibious armoured tracked vehicle with an aluminium hull
2. Diesel powered
3. Waterjet propulsors are integrated into each side of the hull and hydraulically actuated chines cover the tracks while in seafaring mode.
4. It is fitted with composite armour, mine–blast protection, and a nuclear, biological and chemical defense system (NBC).
5. The standard version also has a 30–mm cannon, which fires up to 250 rounds per minute with single, burst and full auto capabilities up to 2,000 meters in all weather conditions.

Other features:

6. Smoke / Gas Dispensers (32)
7. Rear Troop Hatch
8. Top Troop Hatches (2)
9. Reinforced Crew Compartment

1.2 Option 2 – Developmental Gibbs (ACC/E)

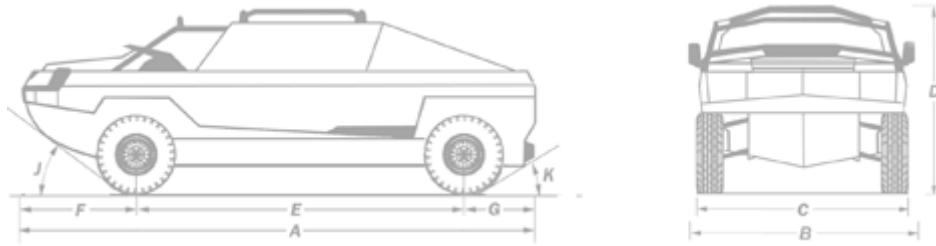
This option is a developmental option based on the Gibbs Amphibious Combat Craft Expeditionary (ACC/E) concept vehicle. It is intended that Gibbs would supply the rolling chassis as a CI whilst other CIs would be acquired from other suppliers as required and the complete ADAV would be integrated by your company.

The vehicle utilises a ‘V-shaped’ hull for water operations with retracting wheels when in its water configuration. The wheels are extended for use on land. Figure shows an artist’s impression of the vehicle in both configurations.



Figure 2 – Gibbs ACC/E in Land and Water Configurations.

The following information has been extracted from the Gibbs web site showing the key vehicle dimensions and specifications for the ACC/E.



A Overall Length	6.096 m
B Overall Width	2.438 m
C Track	2.123 m
D Overall Height	2.438 m. (In addition, the Kongsberg remote weapon system is 0.75 m in height)
E Wheelbase	3.5 m
F Front Overhang	1.376 m
G Rear Overhang	1.22 m
J Approach Angle	35°
K Departure Angle	22°

Wheels and Tyres	315/75R16 BF Goodrich, Mud Terrain T/A
Steering	Power assisted steering
Brakes	Hydraulically operated, powered assisted, ventilated discs
Suspension	Hydro-pneumatic self levelling, with ride height adjustment
Drive layout	4WD
No. of Occupants	Up to 8 people
GVW	4000 kg
Speed	Capable of travelling up to 65 km/h (35 knots) on water and 137 km/h on land

Some key information for the Gibbs vehicle is:

1. A development of the Humdinga 4x4 product range.
2. Large all terrain vehicle with increased payload and High Speed Amphibian capability
3. Modular interior system allowing for different configurations
4. Additional width allows for an efficient hull form
5. Ride height adjustment allowing improved off road capability
6. Currently under design

The ACC/E as devised by Gibbs accommodates eight people, whereas the ADAV is required to accommodate 10 (two Crew and one 8-man section). Design options need to be considered to increase the capacity to 10. Two options are:

1. Reconfigure the interior modular configuration; and
2. Lengthen the rolling chassis.

This option will utilise the Kongsberg Protector Sea Variant remote weapon system (refer to Figure 2.1) customised to include a smoke grenade launcher similar to the M151 variant currently used on the ASLAV and IMV Bushmaster vehicles.



Figure 1.1 – M151 Remote Weapon Station - Sea Protector Variant.

Option 2 requires customisation of some CIs (namely rolling chassis and the Kongsberg RWS) to achieve compliance with the System Specification. However, the underlying vehicle concept is based on an innovative yet sound approach that has been scaled and demonstrated on a number of vehicle types, including the large 4x4 Hummer.

1.3 Option 3 – Hovercraft

Option 3 is a developmental option based on a 1000 TD hovercraft manufactured by Griffon Hovercraft.



Figure 3 – Griffon 1000TD Hovercraft .

Figure 3 shows the Griffon 1000TD hovercraft operating over water. As with Option 2, the rolling chassis CI is to be supplied as a single element with other components being integrated with the rolling chassis.

This option will also utilise the Kongsberg remote weapon system as described for Option 2.

Specification details for the Griffon 1000TD hovercraft are:

Manufacturer	Griffon Hovercraft
Weight	not stated
Length (hovering)	9 m
Beam (hovering)	4.7 m
Height (hovering)	3.05 m excluding the RWS; at least 3.75 m including the RWS
Passengers	8 to 11
Crew	min 1
Payload (max)	1 tonne
Endurance	17 hrs
Fuel Consumption	25 litres/hr
Speed	
(with full payload)	27 knots (50 km/h)
Approx Obstacle	
Clearance	0.43 m
Max recommended	
Wave Height	0.9 m