An amphibious landing of infantry troops on a beachhead is one of the most complex military manoeuvres in the modern era of warfare. The complexity comes from coordinating all the various components of an amphibious landing to come together in a very smooth and precise manner. A modern amphibious landing brings together a number of military specialties, such as air support, naval gunfire, specialised equipment like air cushion vehicles, as well as personnel trained in amphibious landings which require extensive planning and training for all components involved.

Amphibious assault is one component of amphibious landing that has been somewhat neglected by most armed forces in the recent years. This is because only a number of armed forces have marines or naval infantry branches and those that have, only have them in small numbers. Thus, the need to have dedicated amphibious assault vehicles is somewhat lower on the priority list than the need to have more conventional assets such as tanks, frigates and fighters.

Many armoured vehicles currently in service with the armed forces around the world have limited amphibious capabilities that can be utilised. However, most of these armoured vehicles are not built to travel in water for long periods of time or for a ship-to-shore journey. Most armoured vehicles utilise their own tracks or wheels to provide traction in the water, and only a few are equipped with more effective means such as propellers or water jets. ADJ looks at a number of modern amphibious assault vehicles currently in service and under development.

**General Dynamics Land Systems Expeditionary Fighting Vehicle**

Expeditionary Fighting Vehicle or EFV is a new amphibious assault vehicle from General Dynamics. EFV, previously known as Advanced Amphibious Assault Vehicle (AAAV), is designed to replace the AAVP7-A1 currently in service with the US Marine Corps as well as a number of users abroad. EFV is designed to achieve several parameters, namely high water speed, good cross-country mobility, as well as adequate firepower and protection for amphibious landings. The EFV has the ability to be launched from 20-25 nautical miles out at sea and transport troops, its crew of three and 17 combat-ready marines, to shore at speeds in excess of 37km/h, which is three times the speed of AAVP7-A1. Because of its high speed, good firepower and protection, the EFV will provide the US Marine Corps with the elements of flexibility and tactical surprise, which is crucial to establish battlefield dominance. Its good cross-country mobility also ensures that the EFV can support the landing force far beyond the initial beachheads, and take the fight further inland.

The EFV is equipped with a retractable hydropneumatic suspension system, two water jets for water propulsion, and can travel at a speed of up to 72km/h on land and 46km/h in water. In terms of armament, the EFV is equipped with a 30mm Bushmaster Mk 44 gun as its primary weapon, and a 7.62mm machinegun as its secondary weapon. It can carry 600 30mm rounds, and 2,400 7.62mm rounds, both ready and stowed. In terms of protection, the EFV is designed to withstand hits from 14.5mm AP rounds and 155mm artillery shrapnel. The EFV is currently under development for the US Marine Corps, and low rate initial production (LRIP) is projected to begin in 2011.
BAE Systems’ Assault Amphibious Vehicle AA7A1
AA7A1 is a proven amphibious assault vehicle from BAE Systems, Ground Systems Division. The AA7 was first introduced in 1984. The vehicle is very rugged, and has very good mobility for transporting troops and cargo from ship-to-shore. Members of the AA7A1 family of vehicles include the AA7C1 Command Vehicle, the AA7P1 Personnel Vehicle, and the AA7R1 Recovery Vehicle. AA7A1 features torsion bar suspension, and two 14,000-gpm water jet pumps that enable the AA7A1 a cruising speed of 13km/h, as well as the ability to negotiate 10-foot plunging surf's heading either to shore or seaward. On land, the AA7A1 can travel at a speed of up to 72km/h. In terms of armament, the AA7A1 is equipped with a 50-caliber/Mk 19 40mm grenade launcher weapon station as its primary weapon.

In 1998, BAE Systems was chosen to take part in the AA7A1 Reliability, Availability and Maintainability/Rebuild to Standard (RAM/RS) Programme. BAE Systems’ role was to provide manufacturing and logistics support in the manufacturing and design of modified RAM/RS hulls to the US Marine Corps’ logistic bases. Among improvements for the RAM/RS version of the AA7A1 are a Bradley Fighting Vehicle suspension, and a more powerful 525hp turbocharged diesel engine and power train. Increased commonality with the Bradley Fighting Vehicle enables improved maintainability for the RAM/RS AA7A1s.

Before the RAM/RS programme, the AA7A1 is equipped with 400hp turbocharged diesel V-8 engines. The AA7A1 is currently in service with a number of marine units around the world including the US Marine Corps, Royal Thai Marines, Spanish Marines, Republic of Korea Marines and the Italian Lagunari and San Marco regiments.

MOWAG’s Piranha IIIIC
The Piranha family is one of the most popular armoured vehicles in service today. The Piranha III from MOWAG GmbH features modular design, power pack in front, large useable volume at the rear for weapon stations, troops and cargo, and central driveline system. The features are identical throughout all versions of the family, and this includes amphibious capability. Piranha IIIIC is a fully amphibious version of the Piranha III, designed for seawater operation and has a good cross-country mobility on land.

The Piranha IIIIC features independent wheel suspension, with coil springs and control arms in front and torsion bars at the rear, two propellers for water propulsion and can travel at a speed of up to 100km/h on land and 10km/h in water. In terms of armament, the Piranha IIIIC features a 25mm M242 chain gun with thermal imaging as its primary weapon and a 7.62mm M240 coaxial machinegun as its secondary weapon. The Piranha IIIIC can carry 240 25mm rounds, and 400 7.62mm rounds. The vehicle can fire on the move or while swimming. The Piranha IIIIC is also equipped with eight 76mm smoke and fragmentation grenade launchers. The amphibious kit includes a seawater cooling system, bilge pumps, closable louvres of engine grills, automatically operated trim vanes and steering control of the twin rudders.

The Piranha IIIIC has been ordered for the Spanish and Brazilian Marines. The Spanish Marines have ordered 39 units in two batches (18+21), which will be manufactured in Kreuzlingen, Switzerland and will be delivered from 2009 to 2014. The Brazilian Marines have also ordered 12 units in two batches (7+5), with the latest order announced on Dec 7, 2007. The US Marine Corps uses the Light Armoured Vehicle (LAV), which are based on the Piranha family of vehicles. In February 2006, General Dynamics was awarded a contract to produce 157 LAV-A2 in six different variants for the US Marine Corps. The LAV-A2 is an updated version of the LAV series, which are in service since the 1980s. The LAV-A2 features upgraded suspension, fitted for enhanced armour protection as well as automatic fire suppression for crew protection. First delivery of the LAV-A2 was on Oct 12, 2007.

Lockheed Martin/Gibbs Technologies’ Amphibious Combat Craft
Lockheed Martin and Gibbs Technologies are developing three new, high-speed amphibious vehicles. The militarised High Speed Amphibians (HSAs) are designed around technologies used in a fleet of prototype amphibious vehicles developed by Gibbs Technologies for civil use, including the Gibbs Quadski, an amphibious all terrain vehicle, Gibbs Humdinga, a four-wheel military vehicle and the Gibbs Aquada, a three-person sports car. Lockheed Martin and Gibbs Technologies are developing three new concept amphibians, the Amphibious Combat Craft-Expeditionary (ACC-E), the Amphibious Combat Craft-Riverine (ACC-R) and the Terraquad.
Two of the concept craft look to be capable of filling the role as amphibious assault vehicles, the ACC-E, which is a 20-foot, four wheeled amphibian capable of 128km/h on land and 64km/h in water, and the ACC-R, a six wheeled, 35-foot amphibian capable of 112km/h on land and 64km/h in water. The hull is designed to be aerodynamic in road mode and hydrodynamic in marine mode. The military version will have a network capability to share and distribute information from on-board and remote sensors, and the craft will be able to accommodate a variety of weapon systems, depending on specific customer requirements. One unique feature of the ACC-E and ACC-R is the ability to transition from water-to-land or land-to-water configurations in five seconds. This feature is highly desirable from the standpoint of military littoral, riverine or maritime special operations.

Gibbs Technologies was founded in New Zealand in 1996, and initial amphibian concept was undertaken soon after that in 1997 and 1998 in Detroit. In 2006, Gibbs Technologies won a US Department of Defense Foreign Comparative Test contract for evaluation of HSA technologies for military purposes, and in February 2007, the company announced that they have agreed to jointly develop a family of high-speed amphibians for military operations with Lockheed Martin. The vehicles are currently under development, and production has illustrated the flexibility of the technology, which will enable highly mobile, widely dispersed operations at long ranges.

**Russian Developments**

The Russians have a number of amphibious armoured vehicles in service and available for export. Among them are the BTR-90, BMD-3 and BMP-3.

The BTR-90 is an armoured personnel carrier designed to transport troops and cargo as well as provide fire support on the battlefield. The BTR-90 features independent torsion bar suspension, and can travel up to a speed of 100km/h on land and 9km/h in water. In terms of armament, the BTR-90 is equipped with a 30mm 2A42 automatic cannon and a Konkurs-M anti-tank guided missile system as its primary weapons. As secondary weapon, the BTR-90 is equipped with a 30mm AG-17 automatic grenade launcher and a 7.62mm PKTM coaxial machinegun. It can carry 500 30mm rounds, four missiles, 400 30mm VOG-17M grenades and 2,000 7.62mm rounds.

The BMD-3 is a highly manoeuvrable tracked light armoured amphibious vehicle. The BMD-3 can travel at a speed of up to 70km/h on land and 10km/h in water. In terms of armament, this vehicle shares a high commonality with the BTR-90. Like the BTR-90, the BMD-3 is equipped with a 30mm 2A42 automatic cannon and a 9K113 or 9K113M (Konkurs-M) anti-tank guided missile system as its primary weapons. As secondary weapon, the BTR-90 is equipped with a 30mm AG-17 automatic grenade launcher and a 7.62mm PKTM coaxial machinegun. It can carry 500 30mm rounds, four missiles (9K113) or two missiles (9K113M), 290 30mm VOG-17M grenades and 2,000 7.62mm rounds.

BMP-3 is one of the best-armed armoured personnel carriers available on the market today. The vehicle can travel at a speed of up to 70km/h on land and 10km/h in water. In terms of armament, the BMP-3 is equipped with a 105mm gun, a version armed with a 30mm cannon and an anti-tank guided missile system and lastly an armoured logistic vehicle version. The ZBD97 is another new development, a tracked amphibious armoured vehicle that features a BMP-3 style turret. Two versions have been identified, an infantry fighting vehicle with a 105mm gun, an armoured recovery vehicle version. The ZBD2000 is a fully amphibious armoured vehicle that looks to succeed the ZTS63A (Type 63A) amphibious tank currently in service with the PLA Marine Corps. Three versions have been identified, a version armed with a 105mm gun, a version armed with a 30mm cannon and an anti-tank guided missile system and lastly an armoured logistic vehicle version. The ZBD97 is another new development, a tracked amphibious armoured vehicle that features a BMP-3 style turret. Two versions have been identified, an infantry fighting vehicle with a 100mm and a 30mm coaxial gun, and an armoured recovery vehicle version. Besides the new vehicle designs, the PLA also has several upgrade programmes for its older Type 86 IFV and Type 63 APC to increase their amphibious capabilities.

**Prospects for Asian Countries**

A number of Asian countries have long coastlines, which prompted the development of their own naval infantry units. However, most of these naval infantry units are only equipped with obsolete or near obsolete equipment such as the BTR-50 APC, PT-76 light tanks, LVT-5 and LVTH-6. A few like the Republic of Korea and the Royal Thai Marines have relatively modern AAV7A1, but as in the case with the adoption of EFV by the US Marine Corps, these too will have to be replaced or upgraded in the near future. Thus, modern amphibious assault vehicles such as the EFV, Piranha IIIC, and BMP-3F will have a bright prospect in Asia in the upcoming years as these naval infantry units found their current amphibious assault assets increasingly unable to cope with the harsh demands of modern amphibious warfare.

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**Vehicle** | **Maker** | **Max weight (tonnes)** | **Max speed (land/water) km/h** | **Range (land) km** | **Crew/Troop**
---|---|---|---|---|---
EFV | General Dynamics | 34.4 | 72/46 | 523 | 3/17
Piranha IIIC | MOWAG | 22 | 100/10 | 750 | 3/10
BMP-3 | Kurganmashrazavod JSC | 18.7 | 70/10 | 600 | 3/7