A Message From the Commanding General Marine Corps Warfighting Laboratory

"The iterative nature of successful force design."

by BGen Benjamin T. Watson

Over nearly three years as the CG Marine Corps Warfighting Lab (MCWL) during an era of significant change, I have learned that force design and capability development are—like war itself—inherently uncertain. To succeed in either, you must recognize the nature of the environment and learn to operate effectively within it. The historically proven method of effective force design and capability development is "spiral development," a term adapted from software design. Spiral development refers to identifying and developing an initial version of the desired capability with the minimum viable features and then refining those features over time through multiple rounds of testing and innovation.

In theory, force design and capability development can be explained in a straightforward manner: national strategy is analyzed; operating concepts are developed, tested, and revised through wargames; research and experiments are conducted to test capabilities; associated requirements documents are prepared; investments are prioritized; and ultimately, new capabilities and force structure are fielded.

In practice, it seldom happens in that neat, linear fashion; although, there are many folks who assume it does. In fact, GEN Dwight D. Eisenhower assumed as much when he described Andrew Jackson Higgins, the New Orleans builder of the Landing Craft, Vehicle and Personnel (LCVP), as "the man who won the war for us ... If Higgins had not designed and built those LCVPs, we never could have landed over an open beach. The whole strategy of the war would have been different."[1]

While Higgins did indeed play a crucial role in producing the boats that answered a critical strategic need in World War II, he did not do it alone nor in a linear fashion. Development of the LCVP exemplifies spiral development, wherein a concept identified the need for a particular capability, initial options were identified at the Service headquarters level, and then potential solutions were tested by the operating forces. Lessons learned from that testing, as well as input from allies and intelligence about adversary capabilities, were then applied to inform innovation and ultimately refine requirements to produce the boat that earned Ike's praise. Numerous individuals—some quite junior in rank—played key roles.

In 1926, Higgins designed what he called the "Eureka boat" for use by oil drillers along the Gulf Coast. It had: a shallow draft; tight turning radius; recessed propeller in the hull so the boat could operate in shallow waters without the prop getting fouled; and the bow was reinforced so it could be run ashore and then backed off with ease. Traditional wooden boats had to stay wet so that their planking would remain expanded and ensure watertight integrity; Higgins put a layer of canvas between two layers of wood so the Eureka could be transported dry on larger vessels and still be watertight when launched. His boat was already in commercial use when the Navy and Marine Corps began testing the ideas embodied in the 1934 *Tentative Manual for Landing Operations*.

In 1938, Fleet Landing Exercise (FLEX) 4 provided enough insights for the Navy to issue an initial requirements document for a purpose-built landing craft. It called for: a gasoline-fueled craft that would be 30' long to fit in existing boat davits; a maximum weight of 10,000 lbs empty; a cargo capacity of 5,000 lbs; a troop capacity of 18; speed in excess of 10 knots; and—most prominently—the ability to land in surf and retract from the beach using an anchor.

To meet this requirement the Navy's Bureau of Construction and Repair (BC&R) came up with its own design. Various incarnations of the "Bureau boat" were tested but found inadequate due to difficulty retracting from the beach. Fortunately, CDR Ralph S. McDowell of BC&R had learned of the Eureka boat and invited Higgins to submit a design. The Navy scraped together $5,200 to contract with Higgins for one 30 foot boat. This prototype included a 250hp engine to improve power, so the Eureka could retract from the beach *without* using an anchor. The FLEX series became an ongoing competition between the Bureau boat and the Eureka. The Marines' preferred the latter, and by FLEX 6, the Commander Atlantic Squadron concurred that the Eureka was "the best all-around boat for the purpose intended."[2]

In July 1940, the British commandoes—already at war and conducting amphibious raids against the Nazis—contracted Higgins to build a 36 foot version that proved faster than a 30 foot boat with the same engine. With the fleet's endorsement and British operational success, and after resolving initial BC&R criticism of the Eureka's fuel efficiency and shipboard compatibility, the Navy signed a contract for a third version of the Eureka. Designated Landing Craft, Personnel, Large (LCPL), a 225hp diesel replaced the gas engine and two machinegun positions were added forward. Significantly, the LCPL could carry 36 troops, double the initial requirement. Like its predecessors, however, the LCPL had a shortcoming. For troops to debark, they had to climb over the side—potentially under fire.

A solution was already at hand. In 1937, while serving as an observer during the Second Sino-Japanese War, 1stLt Victor H. Krulak witnessed Japanese Daihatsu ramped-bow landing craft in operation. Krulak sent photos and a report to Washington where, unfortunately, they were filed away as having come from "some nut out in China."[3] In April 1941, the photos resurfaced and Maj Ernest E. Linsert showed them to Higgins. Together, they re-designed the LCPL to include a 3 foot 4 wide bow ramp. This fourth version, designated Landing Craft, Personnel, Ramp (LCPR), was successfully tested on 21 May 1941 and would be operationally employed on Guadalcanal.

A fifth version, the Landing Craft, Vehicle (LCV), was also created for use after a beach had been secured. It had a 7 foot wide ramp and the machinegun positions were removed. The bigger ramp impeded the coxswain's vision, so the helm was moved to an exposed standing position on the stern. The LCV was less than satisfying, however, and continued innovation yielded the sixth—and final—version of the Higgins boat, the LCVP. It combined the features of the LCPR and LCV and was adopted by the Navy as its standard landing craft in October 1942. Eight companies were contracted to build 23,397 LCVPs, or 76.5 percent of the overall number of Higgins boats built.[4]

The LCVP design illustrates how spiral development allowed the Navy and Marine Corps to put a highly effective solution into production within four years of drafting the initial requirement. The LCVP had a 7 foot wide bow ramp that permitted faster offload of troops, the helm was returned to the main deck, and a fold-down "window" was added in the ramp to improve the coxswain's vision; the machinegun positions were restored but moved aft; and 0.2 steel armor protection was added to the ramp and sides. The contrast between the initial requirement and final design specifications, as shown in Table 1, is interesting.

This example provides useful insights that can inform our efforts to define future littoral maneuver and sustainment requirements, and to refine reconnaissance, counter-reconnaissance, and anti-ship capabilities. While it would be nice to have immediate answers to complex questions so we could start bending metal or changing tables of organization as soon as a new concept is signed, no group working in a windowless room in Quantico—no matter how knowledgeable or creative—can anticipate every question, project every operating condition, identify every requirement, and think through every solution. What they can do is provide the idea (or ideas) that the wider community of our Marines and Sailors, scientists, industry partners, and allies can critically examine, share insights, and help evolve viable solutions.

The *Tentative Manual for Expeditionary Advanced Base Operations*, published exactly a year ago, was developed with that type of decentralized innovation in mind. Its primary purpose is to provide a baseline of information, focused on *Force Design 2030*, to inform "experimentation that will test and refine force structure and capabilities." Thus, *Force Design 2030* should be viewed as a waypoint in a journey rather than the ultimate destination. The Commandant has said as much, having declared that "our force design effort is a work in progress," and more recently noting, "Iterative experimentation and exercises will be required to fully mature" the methods and equipment employed by stand-in forces. [5]

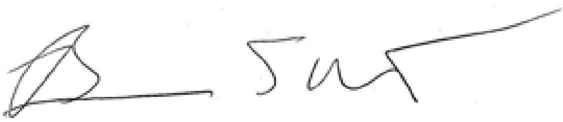
	Initial Requirement	Final LCVP Design
Length	30′	35′9″
Weight	10,000 lbs	18,500 lbs empty 26,000 lbs loaded
Cargo Capacity	5,000 lbs	5,000 lbs
Crew		4
Lift Capacity	18 troops	36 troops or 1 jeep + 12 troops
Fuel	Gasoline	Diesel
Speed	In excess of 10 knots	12 knots empty 9 knots loaded
Armor Protection		0.2″ steel on the ramp and sides
Armament		Two .30 cal machineguns
Critical Features	Ability to land in surf and retract from the beach using an anchor	Ability to land in surf, offload via a ramp, and retract from the beach without using an anchor

Table 1.

Given the foregoing, MCWL has recently published a classified Service Level Experimentation Campaign Plan that provides amplifying details on our way ahead for iterative innovation. The DOD has adopted a more expansive view of what constitutes experimentation, going beyond traditional live force experiments to include virtual and constructive experimentation, concept development, wargaming, science and technology exploration, and modeling and simulation efforts. The content of the Service Level Experimentation Campaign Plan reflects that view.

During the Cold War, the Navy had a mantra that captured the essence of spiral development, *Build a little, test a lot, learn a lot, and then build some more*. Back here in Quantico, and at MCWL in particular, we are excited to work with our partners across the Naval Service, the joint force, industry, and our friends overseas to do just that.

Semper Fidelis,



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Notes

1. Stephen E. Ambrose, *D-Day, June 6, 1944: The Climactic Battle of World War II*, (New York, NY: Simon & Schuster, 1994).

2. LtCol Frank O. Hough, USMCR, Maj Verle E. Ludwig, USMC, and Henry I. Shaw, Jr., *Pearl Harbor to Guadalcanal: History of the U.S. Marine Corps in World War II, Volume I*, (Washington, DC: Headquarters, U.S. Marine Corps, 1968).

3. Robert Coram, *Brute: The Life of Victor Krulak, U.S. Marine,* (New York, NY: Little, Brown, & Company, 2010).

4. Interestingly, both the LCPL and LCPR remained in limited production; the former were used as control and utility boats while the latter were adapted for use as launch and recovery boats for Underwater Demolition Teams.

5. Gen David H. Berger, *Force Design 2030,* (Washington, DC: March 2020); and Gen David H. Berger, *A Concept for Stand-in Forces*, (Washington, DC: December 2021).

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