

## Coast Guard History

# Cigars and Rough Water

*Coast Guard Develops Rough Water Landing Techniques*



CAPT Donald B. MacDiarmid  
Photo courtesy CGAS San Diego.

**B**ACK IN 1949 OUR CO, CAPT Donald ("Mac") MacDiarmid, talked the Navy into loaning a PBM-5 seaplane to CGAS San Diego to determine the best way to land a seaplane or to ditch a fixed-wing landplane in the open sea. He also talked the Martin Aircraft Company into sending two technicians to San Diego. They installed gauges on the PBM-5 at stress points on the wings and hull to measure the pounding the aircraft would take on various headings and sea conditions during landings.

CAPT Mac and his favorite copilot, John ("The Greek") Vuckic, initiated the open sea landing program. The pilots at CGAS San Diego were then brought into the test program on a voluntary basis to record a wider range of reactions. At this stage of the tests CAPT Mac was in the copilot's seat for all of the landings and takeoffs. While the Air Station pilots (some had never made an off-shore landing before) ricocheted, splashed, pounded, and skipped across the hills and valleys of an un placid Pacific, CAPT Mac would sit there smoking his cigar as if he was at home watching TV in his easy chair.

## Who's Flying Now?

Meanwhile in the waist compartment, the three or four crewman held on with white knuckles. Some were white to the elbow.

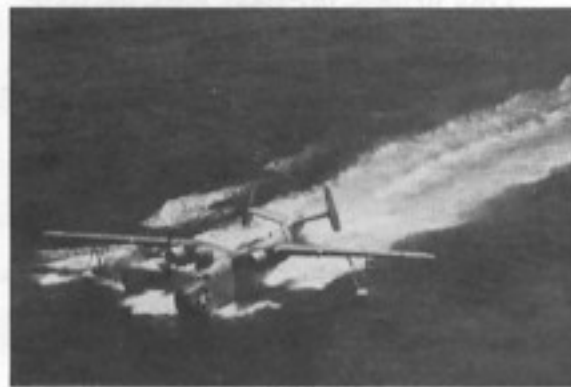
Usually three pilots went along with CAPT Mac. After one had made his series of landings and takeoffs, he would rotate with the pilot who had been riding with the crew in the waist compartment. The pilot who had been observing from the navigators position would move into the pilot's seat. When the pilots rotated, the crew back aft would invariably ask, "Who is flying it now?" At times the knuckles would start bleaching even before the takeoff was started. Riding back aft gave the pilots a good idea of the stress that the crew was subjected, and some of those white knuckles were mine.

## A Crash Is Too Far

It was rumored that CAPT Mac had told

our barber that the only way he could find the limit for a rough sea landing was to crack up a plane. During each landing the crew wondered how close they were to that limit.

In those ancient times, our survival equipment consisted of inflatable life jackets and life rafts. Survival suits and crash helmets were unheard of. Seat belts and shoulder harnesses were worn by the pilots—seat belts only for the navigator, radioman, and flight engineer. The rest of the crew braced themselves and hung on for dear life.



PBM

*Photo courtesy CGAS San Diego.*

CDR (later RADM) Charlie Tighe, a superb exec, kept the Air Station on an even keel, permitting CAPT Mac the freedom to devote most of his time to the off-shore landing project. He would breeze into his office occasionally to catch up on the news, sign a few papers, and replenish his supply of cigars.

### Where's My Cigar?

CAPT Mac was cool and unflappable. Once, when we were tearing down the runway at Lindbergh Field in a PBM-5A, he dropped his cigar. He let go of the controls and started looking for the cigar under the seat. I completed the takeoff and

had the gear up before he assumed command with the cigar in its proper location.

One day in a PBM-5A, Charlie Tighe was flying with CAPT Mac. Charlie had a tough time getting the nose out of the water. It took both pilots on the yoke to lift the nose up for takeoff. They were able to land back at Lindbergh Field without further incident. Inspection showed that one end of one of the nose wheel doors had become detached, allowing the wheel well to fill with water. That was the type of structural failure in which the Navy Bureau of Aeronautics was interested. By that stage of the program the preferred rough water technique had been developed, and as time passed, additional aircraft were provided by the Bureau for rough water evaluation. The PBM-3, PBM-5, PBM-5A, P5M, and UF aircraft were evaluated.

### A Little Oceanography

Before making our first open sea test landings, CAPT Mac would give us a quick course in oceanography. On that particular day he pointed out the large major swell coming down from the Aleutians. Another swell system rolled in from the southwest, generated by a low pressure area in the direction of Hawaii. Other storms would send swells in our direction, but on that day we saw only the two systems. From our altitude of 1500 feet the two systems looked like a checker board. Each swell system was traveling through the other. Occasionally, due to the difference in swell speed and the distance between crests of the two systems, one system would partially fill the trough between the crests of the other swell system. This momentarily formed a relatively smooth area where we would attempt to make a landing.

Local wind conditions formed waves that superimposed on both swell systems without influencing their pattern. When

landing, we disregarded the wind direction unless it was blowing over twenty knots. We landed into the wind and parallel to the major swell system if possible.

Our crash boat would be standing by near a swell height gauge in the off-shore landing area. The gauge, that was brought out and retrieved each landing test day, consisted of a length of pipe, capped at both ends and marked in feet. A dampening plate, attached to the lower end, held the gauge upright and prevented it from moving up and down with the swells. During aircraft landings, the crash boat crew would record the height and speed of the major swells.

Swell speed was derived from the formula:

$$S = 3.03P$$

where  $S$  equals the swell speed in knots, and  $P$  equals the time (or period) in seconds between the passing of successive swell crests.

Some landings were made with the swells eighteen feet high and having a speed of 48.5 knots. The pilots who flew with CAPT Mac on this project kept a record of their landings and takeoffs along with their comments. The Martin Aircraft technicians used various instruments to record data for each landing and takeoff. CAPT Mac didn't keep records. He hated being a clerk.

### 35,000 Horsepower

To better understand the force within a swell, we learned from Bowditch that a four foot swell moving at thirty knots and striking a coast, will expend more than 35,000 horsepower per mile of beach in kinetic energy. Those fifty-five foot waves in the Aleutians become fast moving swells as they pass San Diego southbound, in-

creasing in speed, reducing swell height, and increasing in distance between crests.

Landings and takeoffs into the fast moving major swell system were quickly ruled out. Imagine, if you will, twenty-four tons of nuts and bolts neatly wrapped in a thin layer of aluminum colliding head on with a fast moving mound of water that is packed with churning, tossing, and heaving kinetic energy. Something has to come unglued. And it did several times. One PBM was lost. (I missed that one). Maybe the barber had the straight scoop after all about testing until destruction.

Prior to these off-shore tests, the technique used by most seaplane pilots for landing in rough water was to touch down in a nose high stall attitude with power off. The flight control wheel was held all the way back until the hull came off the step and the nose dropped to a level attitude. This procedure was satisfactory in light seas. The bad feature was that the pilot was committed to land. If the aircraft was thrown back into the air again by swell or wave action with its nose high and below stall speed, application of throttle would only make the bounce higher and the next touchdown harder than the first. A porpoising action would then begin which, when combined with prop torque, could end in serious aircraft damage.

### We Find the Best Technique

The best landing or ditching technique was found to be parallel to the major swells and in the direction that the secondary swells were traveling. The next best choice was landing in the direction that the major swells were traveling and parallel to the secondary swell. Note that landing into any swell was avoided whenever possible. This applied to all aircraft and landing speeds. With winds were over twenty knots, the only choice to land within a forty degree

arc centered on the wind direction. The aircraft was headed into the wind as long as possible to reduce drift, then turned either left or right about twenty degrees just before touchdown—like landing a fixed wing aircraft on a crosswind runway. Here again, the idea was not to smash directly



PBM

*Photo courtesy CGAS San Diego.*

into the seas.

The aircraft was leveled off just above stall speed, hanging on its props. When a relatively smooth area was sighted, power was reduced only enough to allow touchdown. The hull contacted the surface behind the aircraft's center of gravity which lowered the nose to a level attitude.

Great effort was made to maintain that level attitude as the power was gradually reduced. If the sea and swells appeared too rough to complete the landing, power was gradually applied until the aircraft was airborne.

### Not Everyone Convinced

Some of CAPT Mac's senior officers did not share his enthusiasm for seaplanes and open-sea landings. He told in a speech of one admiral whom he had served under who made all decisions on open-sea landings for him. Once, when CAPT Mac thought some lives were unnecessarily lost,

he went to the admiral with a plea that the admiral consider the hundreds of times that he had landed in the open sea and leave the decision to land to his own judgement. The admiral grinned easily and said, "Mac, I don't think a man who would take an airplane into the sea hundreds of times has very good judgement."

### Chanute Award, Hall of Fame

CAPT Mac was awarded the coveted Octave Chanute Award in 1950. He was enshrined in the Naval Aviation Hall of Honor posthumously in 1986. CAPT Mac's open-sea landing tests results have been used to train thousands of flight crews about ditching procedures and survival equipment use.

He had about 8,000 hours logged pilot time and some 400 open-sea landings and takeoffs. He was one of a kind—a great Commanding Officer who loved life, his family, airplanes, the sea, story telling, and a good cigar.

I can fondly remember as a copilot having a right hand full of throttles, left hand wrestling with the yoke, feet pumping up and down on the rudder pedals, squirming with body English, trying to keep that big Mariner straight on rough water after splash-down, and then glancing CAPT Mac in the copilot's seat. There he sat, nonchalantly smoking his cigar.

*CDR Ken Bilderback, USCG (Ret.)*