

Auxiliary Joint Surface/Air Operation

Saturday 25 August 2007

After-Action Report

Submitted to

Sector North Carolina
Stations Wrightsville Beach & Oak Island

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References:

Operations Plan: <http://www.seapath.com/faq/>

Search Pattern: <http://www.seapath.com/faq/sncsarpattern.pdf>

Photos: <http://www.seapath.com/faq/sarxafteractionreport25august2007/>

Overview:

The exercise took place, as scheduled, on 25 August 2007 with aircraft N792JH and OPFAC 35190 in the Atlantic Ocean off Station Oak Island.

Weather and Sea Conditions:

The winds on the surface were less than 5 kts and the seas were 1' or less. Airborne weather was visibility 6 nm and ceiling 2500' AGL. Winds aloft were 285T @ 4kts. There was high haze but the overall visibility was excellent.

2JH flew the pattern (9nm legs – 1nm track spacing) at 500' and 120 kts.

35190 ran a VS pattern with 1 nm legs.

Targets:

8' inflatable bright blue-hulled inflatable “raft” with a white bottom, below.



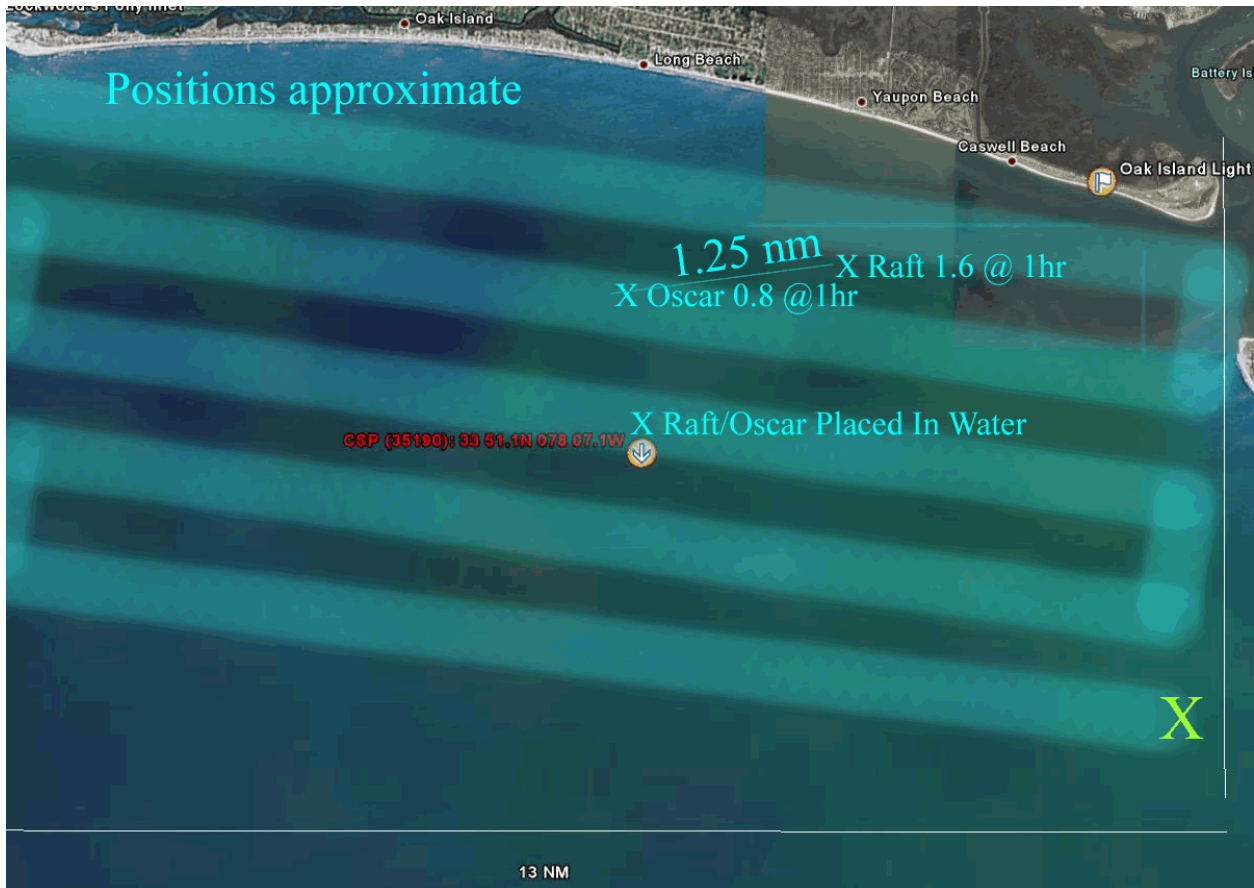
“Oscar” was essentially a floating but weighted “Mustang”. Note that this was an **all-orange** target that floats in a prone position with most of its surface area visible. A conscious PIW would float with only a head and perhaps shoulders above the water. An unconscious PIW would float almost awash.

35190 had previously placed the raft in the water and Oscar in the water alongside the raft and not tethered to the raft at a location unknown to **2JH**. The location of the targets was in close proximity to AR 420, McGlammery Reef.

There was an artificial aspect to the exercise for **35190** since they both placed the targets and then ran a search pattern to find them again. And, since they placed a datum in the water and ran their first leg down-drift, they re-sighted the targets on the third leg of their VS. In future exercises, a different boat will place the targets at a location unknown to both the surface and air participants.

Raft:	Set 1.6 nm	Drift ~045°
Oscar	Set 0.8 nm	Drift ~350°
Divergence	1.25 nm	~080°

In only one hour, the raft and Oscar had moved very dramatically, and on substantially divergent paths with Oscar separated from the raft by 1.25 nm. Recall that the seas were essentially flat and the wind was very light. The figure below shows the location of the targets when they were placed in the water and their positions when recovered, after approximately one hour of drift time. Green X” marks the CSP for the aircraft pattern.



Communications:

VHF communications among 35190 and 2JH were excellent. The two vehicles were within eyesight of each other throughout the exercise. Managing radios on the aircraft was a challenge with a handheld VHF-FM for marine communications, cabin earphones for intercom, and ATC radios and microphones. For example, only the radio operator could hear 35190’s messages.

Station Oak Island announced the exercise at low power on channel 16 and requested boaters in the area to not interfere with the targets in the water.

Aircraft **2JH** announced the beginning of the exercise, on channel 83A with a request that stations refrain from communications on channel 83A during the SAR-X.

Both these requests were honored by all participants.

Narrative:

At the conclusion of a routine Cape Fear River Patrol for **2JH**, the SAR-X began at approximately 1030 as **2JH** moved toward the CSP south of Bald Head Island.

35190 had begun their VS pattern at approximately 1030 and **2JH** entered its pattern at 1100. **2JH** had entered the waypoints for all the legs of its creeping line into one of the aircraft's two Garmin 530GPSs and the aircraft autopilot was engaged to fly the pattern.

Visual search toward the south was very difficult due to haze and glint off the surface of the ocean. Viewing conditions toward the north were excellent. The configuration of the aircraft (twin engine, low wing) restricted search field of view compared to a high-wing aircraft. **35190** was easily visible and identifiable to the aircraft from any location within the search area. In addition, essentially any white-hulled boat was visible, when looking north, in the area west from the mouth of the Cape Fear River, over Station Oak Island to Lockwood's Folly Inlet and then south to the latitude of the **2JHs** CSP.

The first west-bound long leg (9 mile) was complete. The autopilot took the aircraft off the end of the leg, made its right 180 turn and overshot the waypoint that was the beginning of the second long leg (9 nm to the east). The autopilot continued to fly toward the correct track and had settled the aircraft essentially exactly on the second leg by the 1 nm point on this second long leg. The aircraft completed this second long leg (to the east), turned north and west and began the third long leg.

At the beginning of this third long leg an observer called out a possible target at 4:00 on the starboard side. The pilot rolled the aircraft to the right and made a circle and the target was identified as a 20+' outboard center console boat. This right circle was continued and rejoined the third long leg. At roughly the mid-point of this third long leg, an observer spotted a target by seeing a white "patch" on the water. Circles toward and around this target confirmed that it was the "raft". Interestingly, the only visible portion of the target was the white bottom. The "sides" of the inflatable were a bright blue color but were nearly invisible to the spotters. There were several passes made over and around this target to verify our identification. Since a target directly beneath the aircraft could not be seen, it required some maneuvers by the aircraft to put the target into a position from which it could be seen. At this time, it was also established that the raft's "passenger" was not aboard.

Throughout the exercise, both the aircraft and the vessel were reporting the completion of their legs. Communication between the boat and the aircraft were excellent.

A position of the target was estimated and passed to 35190 who moved to recover the target.

The problem now was: where is “Oscar”? The presumption was that Oscar was probably in the reasonable vicinity of the target vessel (and frankly we all knew in the back of our minds that Oscar wasn’t likely to be *too* far from 35190) and we began what became essentially a rounded-off expanded square pattern, although it wasn’t planned in terms of orientation or “leg” lengths.

At 120 kts at 500’ it was a first and obvious priority to keep the airspeed up as turns were made. After a series of these maneuvers, with the aircraft remaining in the vicinity of the confirmed raft but expanding outward, a candidate “oscar” was sighted off the starboard side of the aircraft and then lost. Interestingly, it was the PIC who first spotted Oscar over his right shoulder and out the windows in the center of the aircraft. More maneuvers regained the sighting of oscar and several observers also spotted it.

First estimates of the position of oscar were made and after a few more confirmations of oscar’s position, that lat/lon was sent to 35190 who made their way toward that position. 2JH also provided a course of 220° 35190. The aircraft remained in the vicinity of Oscar, made further refinements to the lat/long and observed that 35190’s course seemed too far to the east. There was a conversation to adjust 35190’s course and 35190 arrived at Oscar and retrieved it. 2JH verified that Oscar was recovered and RTB.

From the time at the CSP until Oscar was retrieved was on the order of 40 minutes. In those 40 minutes and within an area 9 nm by 4 nm 2JH flew a distance of 80 nm. Two of the planned long legs were actually completed. The “raft” target was rather prominent with its white bottom. If its bottom had been the same bright blue as its “sides” it would have been much more difficult to see. Oscar was located and lost a dozen times. If there had been white caps, we might have never found Oscar. And, while the GPS knew where 2JH was located, the crew relied greatly on the presence of the coastline to the north as a reference to our location and orientation.

Comments and Observations

Overview:

As we have recorded our observations and comments, guard against inadvertently concluding that the observations we made represent a limitation on the skills that were either exhibited or will be further developed with more practice throughout our series of increasingly demanding exercises. Practical experience by the crew with the array of sophisticated avionics in this particular aircraft would produce a quickly advancing ability to fly these missions quite precisely, while also allowing us to better manage the inevitable *ad hoc* nature of them.

This is an emerging skill set, and we need to delicately manage our credibility as we tune those skills. This mission placed the most demanding set of conditions to date.

Precision:

The Pattern generated by SNC consisted of waypoints given to us in degrees, minutes, seconds, and tenths of seconds. To enter these waypoints in that format to a GPS route whose format is degrees and decimal minutes, while airborne becomes quickly .. challenging. And, we would think quite undesirable. One convention might be to simply omit seconds entirely. The worst effect would be that the waypoints were randomly slightly south and slightly east of the calculated waypoints.

The pattern generated by SNC specified a course of 281° for the major axis. As we quickly learned, running the pattern isn't difficult *until* a potential target is spotted and attention turns to identifying that target.

If the candidate isn't the target, there is a dilemma concerning what to do now to return to a methodical search. In **2JH**, the autopilot would have returned us toward the next scheduled waypoint after we eliminated any candidate target, but that might not have been the best solution.

If a pilot/navigator on a less automated aircraft decided to resume that current pattern, it would be far simpler to begin steering a cardinal heading of 270° for what would be estimated as the remaining time of that leg than to intercept the original (incomplete) leg. For hand flying, with set, it is almost certainly more consistent to fly a crab angle based on a cardinal heading. When the pattern is shown on the chart, it appears that the 281° major axis orientation of the pattern placed the long axis closely along the gentle arc of the coastline to the north. If so, that orientation to the coast isn't especially useful. Perhaps a "rule" of "if it's within 15° of a cardinal value, use the cardinal" if its within 15° of a "quarter" value (045° etc) round to the quarter value. etc. Of course, in **2JH** with its navigation system and autopilot, merely returning control to the autopilot from anywhere within the search area would have had the aircraft return to the waypoint that was "next" when the initial diversion began.

As long as statistically valid coverage is maintained, it isn't terribly important how precise the starting point is, as long as the pattern can be flown methodically.

If the vehicles had been on routine patrol and were diverted to a distress situation and then were provided with search planning results by SNC, it isn't practical to send the detailed waypoints to the aircraft via radio. It also isn't practical to expect the aircraft crew to chart a pattern from a CSP and courses. The most they could deal with would be a CSP, a leg(s) length, and a course expressed in easy-to-calculate values.

There is one area where precision *is* important: the position of the confirmed target.

It is very difficult to adjust rapidly changing lat/lon (at 120 kts) to an offset target from your own position. It took some time to reach an estimated position of oscar and that estimate was probably not very precise, just because of the conversion and distance estimation problems. In poor visibility condition, and with a small boat as rescue vessel, the precision of the position reported is vital. In this case, 35190 was on a calm ocean and has a flying bridge and outstanding visibility.

Situational Awareness:

Running the pattern was a precision effort .. until a target was identified. From that point on, it is an ad-hoc effort. The division of effort among the crew and a steadfast refusal to become diverted by unfolding events is essential. The crew of 2JH exhibited just such discipline, but it is a trap that could easily ensnare. If the candidate target turns out to be the desired target, then the mission may be close to complete and a continuing search pattern is no longer relevant. But for this exercise, we had one fruitless diversion, one successful location of the specified target but the real difficulty was presented when the human cargo of the target was not aboard. For the record, planning for this SAR-X specifically did not include instructions for operation after the target was found, even though placing Oscar in the water and NOT ON the target WAS part of the plan. This transition from one target to a second one was specifically to be addressed in the exercise, without warning. Its importance became quite clear. And, also for the record, the crew of 2JH did a superb job of adapting to the situation they encountered with a very small oscar in a very big ocean.

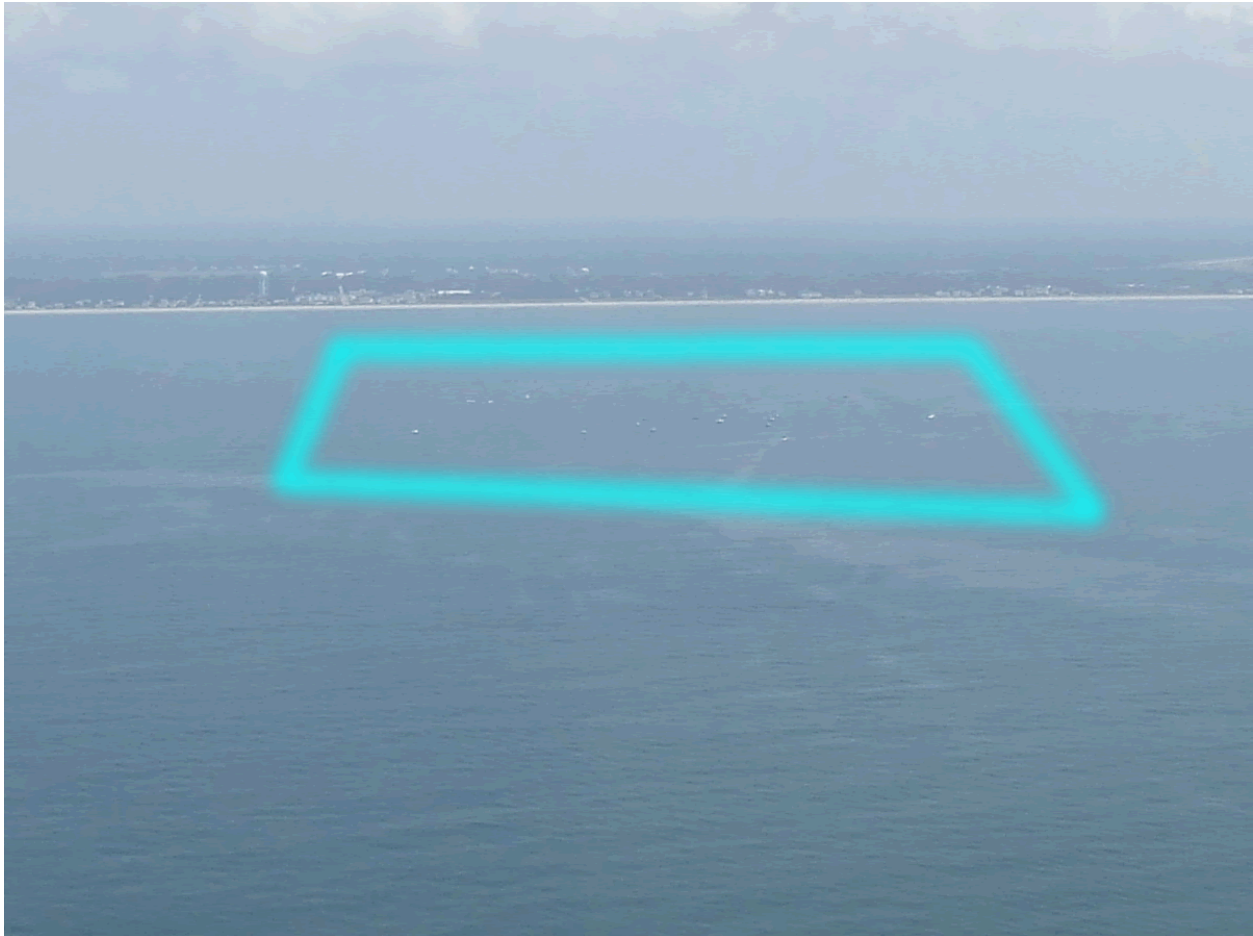
Search Visibility

Visibility from the aircraft was remarkably good to the north, as the photos at the reference illustrate. Most were taken without a zoom and are a good representation of what the eye sees. However, this photo below shows visibility toward the south.



Only targets that were very close to the nearest point of observation (depressed angle) from the aircraft could have been seen from the aircraft on its eastward legs. It would be interesting to fashion aircraft patterns that consider atmospheric conditions and sun angle.

This photo below, by contrast, shows visibility looking to the north. This photo was taken from the first (southernmost) long leg looking to the north. Notice the large number of boats in the area of the Yaupon Beach fish haven.



One issue of interest is the effect on visual search performance of aircraft speed. To date, aircraft with pattern speeds of 90 kts and 120 kts have been used. Others may have a different opinion, but it didn't seem to me that much was lost at the 120 kts speed. If I could see it at all, I could identify it very quickly. However, color and contrast and abnormal shapes are critical. The bright blue hull of the dinghy target was very difficult to see while its white bottom was very easy to see. It was very difficult to spot Oscar. And remember that these were ideal conditions: no wind, no waves, an all-orange target. Subsequent exercises can explore the tradeoffs among altitude, speed, detection range, coverage etc.

Conclusions and Recommendations

Conclusions:

1. The two radio calls requested in the Operations Plan for this mission were very effective.
2. An SRU equipped with a GPS that does not have a geographic view of the area that is large enough to see easily, is at a great disadvantage, once a candidate target is spotted. It would be very difficult to maintain a spatial orientation within the search area and among the various objects within that area. Running the patterns is not difficult.
3. Continued opportunities exist to pre-brief the Watches at the Stations and at Sector. The large volume of traffic among the exercise participants provides ample information to the Watches concerning their guard duties for the players.
4. An aircraft and a surface OPFAC can work very well together and must do so to both find and then to rescue distressed persons. In the absence of new information, very little outside aid or direction is required by the participants.
5. It is not difficult to request and receive Sector North Carolina search planning results, and those results are very useful. If done on-the-fly certain communications procedures will need to be developed to transmit search planning results to the SRUs.
6. The unique characteristics and equipment of the specific vehicles available is a prime determinant of the nature of the pattern, the search area, and the number of vehicles required to provide a high likelihood of a successful search. There are no aspects of this mission that are beyond the safe employment of selected Auxiliary vehicles and crews. For this exercise we employed a highly sophisticated twin-engine aircraft with 5 crew persons and a 35' heavy-weather capable surface vessel. While adjustments would be made as needed, the auxiliary possesses vehicles with characteristics that are well suited to SAR situations that may develop.
7. Exercises of this nature, performed jointly and separately by the surface and air fleets, are necessary to developing a high skill level and well-practiced crews.
8. Set and drift, even on apparently very calm days, can quickly produce very large search areas. Similarly, set and drift acting on the search vessels themselves is likely to produce many unproductive pattern evolutions.
9. Finding a PIW may take a very long time, if the sea conditions are less than benign.

Recommendations:

1. Adopt a standard format for lat/lon positions for these exercises. Recommend degrees and decimal minutes. If decimal minutes and seconds are produced, recommend that seconds be simply omitted.
2. Explore the formats that Sector's search planning software can produce for external interface to chart plotter software.
3. Continue these exercises and involve all the aircraft potentially available for these missions and a select group of surface vessels and their crews located strategically throughout the two AORs.
4. Consult with Sector North Carolina SAR experts to develop and then exercise the ad hoc procedures to be flown when an existing pattern is interrupted by unknown targets that are found not to be the search objects.

5. Ask Sector to appoint a focal point for all our Auxiliary SAR-X planning and operations.
6. Conduct a series of exercises with Station Oak Island and Station Wrightsville Beach serving as SMC.
7. Develop a standard auxiliary protocol that can be employed on a no-notice basis when both a boat and an aircraft are in the vicinity of each other, consistent with other mission demands.
8. Convene a meeting of the participating units to review the exercises to date and discuss future operations.