Attitudes to buoyancy : a comment on complacency

A recurrent theme throughout kayak instructional literature is a curious blindness to the obvious problem of onboard water taken in as a result of a capsize event or similar situation. One classic work on safety is “Sea Kayaker Deep Trouble, True Stories and Their Lessons from Sea Kayaker Magazine” (DT). The author’s combined experience is very considerable yet examples abound of the essential flaw in thinking – that of a failure to critically examine the root cause of the problem – the amount of inboard water.

The obvious answer never seems to surface, that is, to keep the water out in the first place by appropriate design of a minimum cockpit volume (MVC) – built in – not add-on.

Numerous methods are expounded to deal with a problem that can be avoided in the first place.

Buoyancy (DT p55) is discussed from a river perspective – what is needed to keep the boat afloat and support the paddler. With flotation buoyancy, one piece of advice given is to ‘See how quickly you can pump out your boat in the best circumstances and try to imagine how this might be affected by waves sweeping over the cockpit.’ Pumps at their simplest involve several working parts that might malfunction and are aftermarket add-on devices.

Why let the water enter in the first place?

When recovering a capsized kayak with an MVC it is not absolutely necessary to empty the cockpit. In this author’s kayak (a post-production Sea Tiger prototype) the cockpit volume is 95 litres. I normally have a 20 litre equipment bag in front of my feet and my body volume is 45 litres from the waist down.

So, if I sit in my flooded cockpit the maximum volume of water that can enter the kayak is approximately 30 litres. Such an amount of water makes the kayak heavier to paddle but does not destabilise it in either in roll or pitch – the water cannot move anywhere.

When unladen, an MVC kayak may typically take into the cockpit the order of 4 to 5 litres of water compared to 40 or more litres for a conventional kayak (Lamont & Carter 2004). I have helped a friend experience paddling with a swamped cockpit in her MVC Sea Tiger. She capsized and re-entered. We then had to scoop water from the sea into her cockpit to make the volume of water up to a ‘reasonable’ amount to have the experience of paddling in a cockpit swamped condition. She paddled quite happily into and out of a tidal stream with no difficulty.

‘A capsized kayaker who Eskimo rolls is still in the same conditions that capsized him or her in the first place, and with each roll will take on more water lessening the kayak’s stability.’ In subsequent discussion of this situation (DT p91, Self Rescues) at no point is this statement considered from the point of view of the basic problem of water entry and how to prevent it. At Plas y Brenin in 1983 Alan Byde repeatedly rolled a kayak equipped with an MVC and no spraydeck. After a dozen or so rolls there were about 10 litres in the cockpit (A. Byde, pers. comm.). Despite this clear demonstration no U.K. manufacturer felt the need to

modify their kayaks with extra cockpit buoyancy to emulate the obvious advantage of these design properties.
An account in DT by Eric Soares of a difficult situation in a borrowed 'Icefloe' kayak again reveals no questioning of the basic buoyancy design (p90 'Another Exposed Crossing'). In difficult seas he re-entered and rolled up but was unable to balance the cockpit swamped kayak. In Soares' account he speculates on the advantages of a 'sea sock' but never questions the basic kayak design even though he states that he would have preferred his surf ski '…with which I did not have to worry about water in the cockpit.'. The version of an MVC in the Sea Tiger and Puffin are rigid but in other respects are similar to a sea sock. A sea sock is an add-on extra with the added danger of flexible material and some have been known to cause leg entrapment.
In the 'Lessons Learned' section relating to this incident there is discussion of methods to re-enter to minimise cockpit water ingress – but no hint of a suggestion that a re-design to keep water out would have avoided the problem. Instead it is stated that 'Even though the Icefloe is 24 inches wide and equipped with bulkheads limiting water entry to the cockpit area…..the kayak remained too unstable.' One U.K. P&H 'Icefloe' measured out at 205 litres cockpit capacity which is the equivalent to a standard U.K. cast iron bath filled to the overflow rose (M. O'Connell, pers. comm.).
The obvious question is why was it too unstable? The water in the cockpit caused the problem so why not prevent it coming in by better design? If the bulkheads limit water ingress why not take that further? Why accept sub-standard safety performance equipment?

Irresponsible manufacture

Recovering a sunken kayak (DT p60) relates a method of emptying a kayak that has sunk at either one or both ends. This situation means a kayak that has no fixed solid buoyancy. Kayaks are products with which users take risks. Manufacturers who fail to provide solid buoyancy and thereby increase the risk for the user are irresponsible. Providing air bag buoyancy only, should not be considered adequate since these can easily be detached or punctured. It is strange that careful advice on how to empty a sunken or partly sunken kayak should be given at all. With responsible manufacture this is a situation that should never occur. Many production sea kayaks are marketed without solid buoyancy (secondary buoyancy) and rely on watertight compartments only (primary buoyancy). These are accessed by hatches that can and have failed.
In a recent U.K. publication, Ocean Paddler "Incident Management III" (Parkin 2007) the editor comments
"Even though most sea kayaks now come with watertight hatches and bulkheads a serious hole in either the front or back compartment will make the kayak almost unmanageable and you will have to displace the water before being able to paddle it effectively." He then goes on to describe an incident where the front compartment was holed and the kayak partly sunk. "I was part of an incident recently where a collison between two kayaks resulted in a

very large hole in the front of a kayak; the kayak was part of a rafted tow and instantly went down by the nose. The person towing the raft assumed a blown hatch cover and to lift the bow up asked the paddler to exit the cockpit , hindsight is a wonderful thing, he needed to get the nose up to confirm and deal with the missing hatch cover, but with the paddler in the kayak he couldn't. By getting the person out of the kayak the situation then went further downhill as the cockpit instantly filled and the kayak became unrecoverable." The word used is 'unrecoverable' that is, the craft could only be recovered with outside assistance from rescue organisations. This would not be the case with a confluent hull and solid end buoyancy. There was a clear acceptance of the situation and no suggestion in the article of the fact that the kayak had become unrecoverable due to a design deficiency such as lack of secondary buoyancy.

Leaky hatches and Flotation

In this section (DT p62), hull leaks are discussed with no sense of seeking a design solution. The author(s) seem and probably were at the time of writing, unaware of the experiments carried out by Lamont, Winning and Carter and of the safety design properties of the U.K. 'Sea Tiger' and Canadian 'Puffin'.

Several views are presented along with suggested pros and cons of each.

In the first, Dan Ruuska, designer and manufacturer of the Polaris II, is credited with maintaining that air bag buoyancy is better than bulkheads on the reasoning that bulkheads trap onboard water that can easily enter via hatches. While this is true, it is a fact that air bags provide a low buoyant to non-buoyant ratio i.e. less buoyancy than the space enclosed by bulkheads and air bags are more vulnerable to being punctured or left out altogether so that provision of them for primary buoyancy constitutes irresponsible manufacture in my view. This is amply illustrated by the story of Joel Rogers. In this incident (DT pp60-69, 'Sea Caves Arches and Narrow Passages') Joel's Polaris II filled with water irretrievably and became partly sunken, eventually *sinking completely* during an attempt to tow it ashore. In the 'Lessons Learned' comment on this incident the author acknowledges that Joel's kayak would have floated with bulkheads or pod cockpit but then goes on to say '..but I wouldn't dismiss float bags this easily; the previous two chapters describe instances of hatch failure.' This is misleading and may be a case of muddled thinking since Joel's sunken kayak involved float bags as primary buoyancy, while float bags used with bulkheads or pod cockpit designs would fulfill the role of secondary buoyancy, additional to the basic design (Secondary Buoyancy should always be solid).

The authors next examine bulkhead problems and removing trapped water. Provision of drain plugs from the end compartments into the cockpit are mentioned as a possible solution but the authors are clearly unaware of the advantages of a confluent hull with linked compartments and solid end buoyancy and the 'Hatches Off' recovery. Sea socks are again recommended despite cases of entrapment (A. Byde, pers. comm.). Sea socks are post production add-on accessories and only one of several, second-best attempts to remedy a basic design fault.

John Dowd is credited with stating '…moderately leaking hatches are potentially less disastrous than leaking airbags.' Why should leaking hatches prove disastrous? The Sea Tiger 'Hatches Off' recovery (Winning 1990) demonstrates clearly that with hatches in suitable positions, a confluent hull and solid end buoyancy, water in the hull can be removed relatively easily so that such a situation is hardly "disastrous".

'..second owners or friends often do not have the benefit of a manufacturer's or retailer's warning that the boat requires additional means of buoyancy or suggestions for securing this buoyancy to the kayak.' This statement illustrates perfectly the acceptance of irresponsible manufacture by the user. Since there is no legislation or other compulsion, coupled with the general ignorance of test reports, it is an acceptance that will continue with fatalities as a result. Why should boat designers be allowed to offer for sale craft that they know to be deficient in buoyancy?

Back up arrangements are then discussed without any questioning about their need in the first place being perhaps due to design deficiencies.

Finally the authors suggest that each buoyancy system's properties mean the user has to make '..an informed choice' – 'but what works best for someone else might not work best for you;' This implies that the laws of physics and hydraulics are not constants and that a better design is not possible. The solid end buoyancy, confluent hull and minimum volume cockpit, constitute a design solution that works for everyone in all the situations mentioned above. The 'informed choice' has not been possible in the past but is possible now with internet access allowing publicity that can no longer be blocked by manufacturers.

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