EXPERIMENTAL PROGRESSIVE FLOODING OF TWO SEA KAYAKS

1. Fore and Aft Bulkheads (Nordkapp)

2*.* Confluent Hull with Safety Cockpit (Sea Tiger)

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Foreword

The following report was written in August 1989 and completed that September in order to provide a BCU (British Canoe Union) working party of that time with some hard data. Secondly it was intended to act as a stimulus to the BCU to carry out further testing. At that time I was not aware, and am still not aware, of any other formal kayak testing of this kind prior to these tests.

Serious omissions from this report were three important situations that were not photographed, one with the Sea Tiger and two with the Nordkapp.

The first is that the Sea Tiger shown in photograph 11 subsequently resumed a level attitude once vacated by the paddler due to the fixed buoyancy blocks in the bow and stern. From this condition it was recovered (emptied of almost all hull water) by the 'Hatches Off' recovery method.

The second and third omissions are those logically following photographs 25 and 30 where the Nordkapp was flooded completely in either end compartment. The logical progression would have been to photograph the same condition as the Sea Tiger in Photograph 11, that is, with the addition of a flooded cockpit, as would be expected to happen in an actual flooding incident. This was not done on the day of the testing as it would have taken too much time because recovery would only have been possible with diffculty by towing the kayak ashore for emptying.

Unlike the 'Hatches Off' recovery, there were not then and are not at this time of writing in 2007, any feasible, proven methods for emptying the flooded compartment of a bulkheaded kayak at sea which do not involve additional ancillary equipment such as pumps.

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Summary

Two kayaks were loaded in calm conditions with progressive measured quantities of sea-water and photographed each time. The kayaks used, a Nordkapp and a Sea Tiger, represent different approaches to buoyancy and safety strategy.

These are respectively

(1) a compartmented hull and

(2) a confluent hull.

The results, in the form of a sequence of photographs, show the differences in trim and loading of the two designs and allow some comparisons to be made between them. Some observations are included, and some general points made. It is concluded that fore and aft trim of a compartmented design is more easily altered by water entering the hull; that fixed inherent buoyancy is an advantage; and that, in the event of cockpit flooding, the Sea Tiger cockpit design is likely to present fewer problems to the paddler.

Further tests are recommended, involving a number of paddlers in open-water conditions.

Introduction

In recent years, there has been debate and disagreement concerning safety properties of different kayak designs.

There are two main areas of controversy - structural strength and buoyancy strategy.

Structural strength, or fail-safe design, is important in kayaks used in conditions such as white-water rivers, where kayaks can be broken or wrapped around obstructions and paddlers trapped.

Buoyancy strategy is especial1y important in open water or the sea, where buoyancy failure is potentially very serious.

This experiment attempts to provide some quantitative data on two different buoyancy strategies which represent contrasting approaches to safety design in the U.K.

The first kayak is representative of the contemporary standard U.K. approach, where the hull is divided in to three compartments by two bulkheads. Access to the fore and aft enclosed compartments is usually by means of some form of watertight hatch.

The second kayak has a confluent hull (that is, a hull space not subdivided into separate compartments). The hull is fitted with a separate enclosed cockpit various1y known as a Safety Cockpit, Pod Cockpit, or Rigid Sea Sock. The controversy concerning buoyancy strategy revolves around the question which is safer - a confluent hull with a safety cockpit, or a compartmented hull with an open cockpit?

Criticism of the confluent hull design has implied that, in the event of a leak developing, the hull would admit more water than a sub-divided hull, where water ingress would be limited to the leaking compartment only, leaving the remaining compartments to provide flotation.

An important consideration is the destabilizing effect of water movement within the hull. This effect might be expected to be greater in a single confluent hull space than in a kayak with its hull divided into smaller compartments.

This aspect could not be tested objectively in this experiment. In the experiment reported here, measured amounts of sea water were introduced into two test kayaks. The results are presented mainly in the form of photographs. Their implications are discussed in a separate paper, attached.

Aims and objectives

The purpose of this test was to assess and record the effect on the sea kayaks tested of introducing measured amounts of sea water in to the hull and cockpit spaces.

The test was carried out in flat calm conditions and therefore no conclusions can be reached regarding handling in waves.

Test equipment

Nordkapp HM: Serial No. 3083/KCS: fore and aft watertight compartments accessed by hatches (fore, Henderson screw type; rear, metal cam closure). Cockpit section separated from compartments by internal bulkheads. No inherent fixed buoyancy.

1987 SEA TIGER: confluent hull with no partitions, accessed by two 7" V.C.P. rubber hatches. Cockpit: enclosed fibreglass shell permanently bonded to the deck and sealed off from the hull space known as a Safety Cockpit, pod Cockpit, or rigid sea sock. Internal buoyancy blocks fitted at bow and stern.

Bathroom scales; lead weights; measuring bucket ; 15mm bore flexible siphon tube; camera.

Procedure

Paddler weight was made up to 11 1/2 stone (c. 75 kg.) by lead weights placed in front of the seat of the test kayak.

The test kayak was filled with measured increments of sea water and photographed from the port side each time, to record loading and trim. A clip-board recording date, paddler weight and litres of added water, was fastened forward of the cockpit and incorporated in each photograph.

An Ottersports flat blade (ABS plastic) paddle was used. No spray deck was worn by the test paddler.

Results

Photographs of the test kayaks were taken in the order listed, and are labelled and referred to as P 1, P 2, etc.

The legends on the clip-board can be read on the negatives, but do not show on the photograph scans with this report.

Observations

The Sea Tiger maintained an even fore and aft trim until a loading of 160 litres (P9). The Nordkapp became noticeably out of trim with small amounts, 20 litres, of water in either end (P15, P26).

When the stern compartment of the Nordkapp was flooded, the cockpit was very close to sea level. This occurred with 75 and 88 litres in the rear compartment. The Sea Tiger reached a similar situation when 200 litres were present in the hull. During the test, the Sea Tiger cockpit flooded at this stage, and the kayak settled at about 250 degrees from the horizontal, with the paddler still sitting in the cockpit (P 11). NO comparable photograph was obtained for the Nordkapp i.e. with cockpit, plus one or other compartment, flooded. P 11 is therefore NOT equivalent to P 30.

The Nordkapp had no inherent fixed buoyancy, and therefore fore and aft compartments were not flooded simultaneously, as there was a danger of the kayak sinking altogether.

The Sea Tiger is capable of containing more water in the stern half, because of the presence of the Safety Cockpit fore. As a result a stern-down trim became noticeable at 160 litres and above (P 9, P 10, P 11). The Sea Tiger Hull with 200 litres added was not fully flooded. The volume of 200 litres is equivalent to a standard cast iron bath filled to the overflow rose.

Comparison between cockpit volumes (litres)

	Nordkapp	Sea Tiger
	(Open cockpit space between bulkheads)	(Enclosed Safety Cockpit)
No paddler	163	95
+ paddler	120	40
+ paddler, cockpit water adjusted to equal sea level	88	17

Test sequence and results summary (5/7/89)

Kayak	Added sea-water (litres)	Position in kayak	Condition / remarks
Sea Tiger	0	Hull space	Even trim
	20	ditto	ditto
	40	ditto	ditto
	60	ditto	ditto
	80	ditto	ditto
	100	ditto	ditto
	120	ditto	ditto
	140	ditto	ditto
	160	ditto	Slight stern down
	180	ditto	Stern down
	200	ditto (+ cockpit)	Safety cockpit fills when reverse paddling (attitude 25 degrees)
Nordkapp			
Serial 3083/KCS	0	Fore compartment	Even trim
	20	ditto	Bow down
	40	ditto	Bow down
	59.5	ditto	Bow down, stern out
	62	Ditto (flooded)	Bow down, stern out
	20	Aft compartment	Stern down
	40	ditto	Stern down
	60	ditto	Stern down, bow out
	75	ditto	Stern down, bow out
	88	ditto flooded	Aft deck awash
	20	Cockpit	Even trim
	40	ditto	Even trim

	60	ditto	Even trim
	80	ditto	Even trim
	100	ditto	Slight bow down
	120	ditto (flooded)	Slight bow down
	88	ditto, siphoned to equal sea level	Even trim
Sea Tiger	40	Safety Cockpit (flooded)	Slight bow down
	17	Siphoned to equal sea level	Even trim

General Points

In the consideration of the possible safety consequences following flooding of any part of a kayak, it seems reasonable to assume the following:

1. That air will leak through the deck system somewhere i.e. past hatches, fittings, deck/hull or deck/safety cockpit joins - the kayak may not be new;

2. That a spray-deck continually or frequently awash will admit water in to the cockpit space eventually. Given these assumptions, then a leak in the fore or aft compartment of a double-bulkhead kayak will lead to f1ooding of the cockpit volume and, if buoyancy is absent, as in the test bulkhead kayak, then the kayak will take up a vertical attitude in the water.

Conclusions

Small amounts of water, 20 litres, were capable of producing uneven fore and aft trim in the Nordkapp. Fore and aft trim in the Sea Tiger was much less sensitive to water loading.

Lack of inherent buoyancy in the Nordkapp is a potentially dangerous feature in that the kayak is capable of (1) assuming a vertical position in the water if cockpit and one compartment are flooded, and (2) sinking altogether if both fore and aft compartments are holed. Inherent fixed buoyancy should be fitted to open-water kayaks as stated in Part 5.1, BS MA 91: Part 2: 1981 - Specification for Safety Features of Canoes, British Standards Institution.

The after half of a Sea Tiger can contain a greater weight of water than the forward half (P 10) due to the presence of the Safety Cockpit. The fixed buoyancy aft should be increased to compensate for this imbalance.

Considering cockpit flooding - the use of a Safety Cockpit will present fewer problems, and therefore lesser consequences, for the paddler.

Further comparative tests in rougher sea conditions should be carried out. Unfortunately objective tests of kayak performance will be difficult to devise. The paddler and sea conditions introduce variables that could make isolated experiments inconclusive. However, if the same simple exercise were performed by a sufficient number of paddlers, then it is quite likely that a clear trend would emerge.

Some thoughts and comments on kayak flooding experiment

The current controversy between Safety Cockpits and bulkhead systems concerns safety. Prior to discussing the results of the flooding experiment and their implications, it is first necessary to define safety in kayaking terms. (See Appendix A.)

In summary: in sea kayaking, safety equals control - that is, control of

(1) Lateral stability;

(2) Directional stability ;

(3) Ease and speed of recovery

It follows that control is facilitated if achieving (1), (2) and (3) above requires the minimum strength and skill from the paddler.

None of the aspects of kayak control listed above were tested in the flooding experiment described in the preceding report. However, the results do have implications for the control of all three aspects.

Author's experience: In the following comments, some subjective impressions are included. It must be remembered that subjective impressions will vary between individuals, especially with different strength and skill levels. I have paddled a kayak with Safety Cockpit since 1983 and have nine summer seasons of experience of instructing beginners and novices in conventional sea kayaks and, latterly, Sea Tigers with Safety Cockpits. All my paddling is done on the sea, mostly in an area with strong tidal streams. My experience paddling a Nordkapp is limited. In the following comments P 1, P 2, &c., refers to photographs in the preceding report "Experimental progressive flooding of two sea kayaks".

1. Lateral stability

In the experiment the test kayaks were paddled about 15 metres to and from the measuring bucket and turned through 180° on each occasion . My subjective impression of lateral stability was that the Sea Tiger did not feel close to the point of imminent capsize except with 200 litres in the hull and the cockpit flooded (P 11). The Nordkapp felt least laterally stable with 60 litres and above in the cockpit area. Objective tests on lateral stability have been carried out in the U.S.A. (Ref. 1). The results are not easy to relate to subjective feel and are expensive to obtain.

Conventional kayaks lose lateral stability when the cockpit area is flooded. Maintaining an upright position in this condition can require great skill. An example occurred in May1989 on an S.C.A. organised double crossing of the

North Irish Channel (Ref. 2). One paddler in a borrowed Nordkapp sustained a leak where the outlet hose from the pump was connected to plastic outlet fitting, situated at gunwale level. The paddler capsized about one mile off Cushendun, despite being a skilled surf canoeist . He had lost lateral stability owing to the quantity of water taken into the cockpit area during the eight hour passage from the Mull of Kintyre. Proponents of the bulkhead system maintain that the kayak can be paddled with the cockpit space flooded. It may be that the proportion of the volume of the cockpit flooded is critical. The results of P 20 and P21 indicate that a cockpit leak in an unladen Nordkapp would result in the cockpit volume flooding to approximately 2/3 of its total capacity with the paddler present.

In the flooding test with t h e Nordkapp, Lateral stability was felt to be affected when 40 litres of sea water were present in the fore compartment (P 23), and there was sufficient space to allow the water to slop from side to side. This effect on lateral stability disappeared once the compartment was total1y flooded (P 25). The same effect may apply to the flooded cockpit area - so that the condition in P 20 may be more stable than that in P 21. Measurement of lateral stability was beyond the scope of the flooding test reported here.

Confluent Hull Flooding

Reported incidents involving flooding of the confluent hull of a kayak fitted with a Safety Cockpit are rare. One such is that of a paddler who sustained a leak in a Sea Tiger in difficult seas off Anglesey in May 1988 (Ref. 3). The weight of sea-water taken into the hull space eventually led to a loss of directional stability. However, it would seem from the report of the incident that at no time was lateral stability compromised. The paddler was wearing an efficient spray-deck, and the Safety Cockpit apparent1y did not flood. Lateral stability was sufficient to permit the paddler to hold his paddle in a vertical position to attract the attention of an S. A. R. helicopter. It would seem that the kayak was loaded with equipment either lightly, or not at all.

Safety Cockpit Flooding

It is my experience with a Safety Cockpit that lateral stability is not noticeably affected when a loaded kayak is paddled in waves with the cockpit filled with sea - water (Ref. 4). The flooding experiment showed that the Safety Cockpit of the Sea Tiger contained one third the volume of water of the Nordkapp cockpit (40 litres and 120 litres respective1y).

2. Directional Stability

The trim of a kayak will affect its directional stability in a wind. A bow-down trim will commonly cause a kayak to take up an up wind course. Conversely, a stern down trim will commonly cause a kayak to take up a down wind course when paddled forward (Ref. 5).

The fact that a bulkhead kayak becomes marked1y out of trim with small amounts of water either fore or aft implies that directional control will be lost at an early stage following the development of a leak. The worse the sea and the wind conditions and/or the damage or leak to the compartment, the sooner this will happen.

By contrast, the confluent hull allowed even distribution of the weight of water fore and aft in the test Sea Tiger, resulting in the kayak maintaining an even trim to a loading of about 140 litres (approximate1y 140 kg or 309 lb). Provided the movement of this water with in the hull is suitably restricted, it seems reasonable to conjecture that, given equal loading or rate, say, of leak, in the case of a bulkhead kayak and one fitted with a Safety Cockpit, the paddler would retain control of direction for longer in the kayak with confluent hull than one subdivided into the conventional three compartments. This comparison will be difficult to measure objective1y in open sea conditions.

Experience, however, seems to support the above argument. One paddler in 1988, en route from Skye to Harris in western Scotland, noticed his kayak (Mk 1 Sea Tiger with confluent hull and Safety Cockpit) becoming slow to respond and sluggish towards the end of the passage. Unlike the Anglesey incident mentioned above (Ref. 4), which also involved a Sea Tiger, the kayak was fully laden for an expedition. On landing the equipment inside was found to be buoyed up against the hatch by the volume of water inside the hull. The paddler estimates that his kayak contained 10 or 12 gal (U.K.), or approximately 45 to 55 litres of water, taken in via an unnoticed leak at the gunwale caused by mechanical damage (Ref. 6). I have no direct experience of the effects on directional stability of leaks in a bulkhead kayak. However, when instructing beginners and novices on the sea (Ref. 7), I frequently make use of weights loaded fore and aft to adjust the trim, thus causing the kayaks to run in the direction required. This has been found to be very effective with the test Nordkapp, Sea Kings, and an Anas Acuta. On one occasion, a strong, skilled paddler (a staff member accompanying a course of teenagers) was unable to deflect his stern-heavy Sea King from a down wind to a beam wind course and required the assistance of a tow to maintain a beam course. Trim adjustment was not possible at the time.

The results of the flooding test show that on1y a small amount of water in the fore or aft compartment of a long bulkhead kayak is sufficient to alter the trim. In my experience, the weight near the stern or bow required to alter the directional balance of the conventional kayaks mentioned above is of the same order as that represented by 10 to 20 litres of sea-water.

3. Ease and Speed of Recovery

No attempt was made in the flooding test to assess ease and speed of recovery of the two kayaks. It is my experience with conventional bulkhead kayaks that the difficulty of recovery rises rapid1y out of proportion with increase in wind speed and wave height. Any comparative assessment of ease and speed of recovery must take this aspect in to account. There have been public demonstrations of a method of emptying a Sea Tiger with a complete1y flooded hull space. This method was used with the test kayak but was not entirely successful because the front buoyancy became detached. This fault has been rectified in more recent Sea Tiger models and I have demonstrated the recovery at sea in calm conditions with a more recent production Sea Tiger than the test kayak. The equivalent recovery in a bulkhead system would be the emptying of a complete1y flooded fore or aft compartment, with the cockpit also flooded. I am not aware of any standard recommended method which does not employ pumps or other mechanical bailing devices for such a recovery.

An incident occurred on the Jersey Kayak Club's Round Ireland expedition (Ref. 8) when one paddler sustained a leak through the stern hatch. His companions were unable to empty the compartment at sea, and a forced landing had to be made. In a situation when either the fore or aft compartment became flooded, as in P 25 and P 30 and the paddler came out of the kayak, causing the cockpit to flood, then a "Cleopatra's needle" condition might be expected. In retrospect, the equivalent condition to P 11 (Sea Tiger; 200 litres of water in hull; cockpit filled) should have been tested with the Nordkapp also - (1) with fore compartment and (2) with stern compartment flooded and with cockpit flooded and paddler occupying seat in each case.

One point worth noting is that both recovery methods recommended with the Sea Tiger (i.e. to empty the Safety Cockpit and to empty both hull and cockpit) require the recovered craft to be taken no more than half way across the rescuing kayak. In the T X or Rafted T X recovery, conventional kayaks require to be taken completely across the rescuing kayak or kayaks and then tilted on the opposite side in order to drain all the water from the cockpit. This manoeuvre requires additional strength and sometimes additional skill from the rescuer, while the paddler awaiting recovery is sometimes required to move round to the opposite side of the rescuing craft in order to assist with the emptying of the flooded kayak. All of which requires extra time, skill and strength.

Surging of trapped water

The term "Free Surface Effect" has appeared in the press (Ref. 9) but was not defined. It is assumed here that the term refers to the destabilizing effect of the momentum of a free-moving body of water in any of the compartments of a kayak.

In a fore and aft plane, this effect was noticeable with 40 litres in the fore compartment of the Nordkapp. The trapped water could be heard slapping against the bulkhead and the abrupt change in momentum was felt as a jerk as the kayak was paddled forward. The same amount of water in the stern compartment did not have as great an effect. The magnitude of fore and aft surge felt with 40 litres (fore) in the Nordkapp seemed equivalent to the Sea Tiger with between 60 and 100 litres in the hull space.

With the Sea Tiger, no abrupt jerk was felt as trapped water surged fore and aft inside the hull against and past, the Safety Cockpit. Fore and aft surging felt less as the volume increased in the Sea Tiger beyond 120 litres and up to 160 litres of sea water in the hull space (P 7 to P 9). Similarly in the Nordkapp, once either fore or aft compartments became filled (59.5 litres fore, P 24, and 75 litres aft, P 29).

Safety is relative. It is my belief that safety is enhanced if the equipment requires the minimum strength, and minimum skill, from the paddler. This also applies where part of the equipment fails, such as in the event of a leak to the kayak. A common feature throughout the current debate seems to be the lack of objective information, both qualitative and quantitative. It is in this area that official canoeing bodies can take a leading part, to provide a viewpoint independent of manufacturers' bias and/or vested interest.

4 September 1989

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APPENDIX A.

SAFETY DEFINITION.

In general SAFETY equals CONTROL.

In kayaking terms, if the paddler is in control of his craft, then he is also in control of his surroundings and destiny. As control is lost, the risk increases of going in an undesired direction, or capsizing. The paddler's survival becomes more and more subject to chance factors outside his influence, and he enters a potentially unsafe realm.

For a paddler in a kayak, there are two aspects of the activity he seeks to control:

first, staying upright in the kayak, as opposed to upside down in the water and

second, travelling in the right direction.

Capsizing a kayak is relative1y easy, and common1y occurs.

In such a situation, control equals the restoration of the paddler to his craft, either by his own effort, or with assistance. Obvious1y, control is facilitated, and safety enhanced, if this can be achieved with the minimum of strength and skill required from the paddler or his rescuer(s).

In summary: SAFETY equals CONTROL

In Sea Kayaking terms,

control of: -

1. Lateral Stability
2. Directional Stability
3. Ease and Speed of Recovery

1, 2 and 3 should require the minimum strength and skill from the paddler.

5/7/89 Flooding Test Sea Tiger

Paddler Plus Weights: 11.5 St / 75 Kg

Water in Hull: 0 litres

Sheet 1/11


5/7/89
Flooding Test
Sea Tiger
TIGERTU
CULLIPOOL
Paddler Plus Weights: 11.5 St / 75 Kg
Water in Hull: 20 litres
Sheet 2/11

5/7/89 **Flooding Test** Sea Tiger

Paddler Plus Weights: 11.5 St / 75 Kg

Water in Hull: 40 litres

Sheet 3/11


5/7/89
Flooding Test
Sea Tiger
TIGERTU
CULLIPOOL
Paddler Plus Weights: 11.5 St / 75 Kg
Water in Hull: 60 litres
Sheet 4/11


5/7/89
Flooding Test
Sea Tiger
Paddler Plus Weights: 11.5 St / 75 Kg
Water in Hull: 80 litres
Sheet 5/11

Paddler Plus Weights: 11.5 St / 75 Kg
Water in Hull: 100 litres


5/7/89
Flooding Test
Sea Tiger
TIGERTU
CULLIPOOL
Paddler Plus Weights: 11.5 St / 75 Kg
Water in Hull: 120 litres
Sheet 7/11

Paddler Plus Weights: 11.5 St / 75 Kg

Water in Hull: 140 litres

5/7/89 Flooding Test Sea Tiger

Paddler Plus Weights: 11.5 St / 75 Kg

Water in Hull: 160 litres

5/7/89 Flooding Test Sea Tiger

Paddler Plus Weights: 11.5 St / 75 Kg

Water in Hull: 180 litres

Sheet 10/11

5/7/89 Flooding Test Sea Tiger

Paddler Plus Weights: 11.5 St / 75 Kg

Water in Hull: >200 litres

Sheet 11/11

5/7/89 Flooding Test Sea Tiger

Paddler Plus Weights: 11.5 St / 75 Kg

Water in cockpit: 17 litres (level)

Sheet 1/2

5/7/89 Flooding Test Sea Tiger

Paddler Plus Weights: 11.5 St / 75 Kg
Water in cockpit: 40 litres (full)

Sheet 2/2

5/7/89 Flooding Test Nordkap

Paddler Plus Weights: 11.5 St / 75 Kg

Water in cockpit: 0 litres

Sheet 1/8

Paddler Plus Weights: 11.5 St / 75 Kg

Water in cockpit: 20 litres

5/7/89 Flooding Test Nordkap

5/7/89 Flooding Test Nordkap

Paddler Plus Weights: 11.5 St / 75 Kg

Water in Hull: 60 litres

Sheet 4/8

Paddler Plus Weights: 11.5 St / 75 Kg
Water in cockpit: 80 litres

5/7/89 Flooding Test Nordkap

Paddler Plus Weights: 11.5 St / 75 Kg

Water in cockpit: 100 litres

Sheet 6/8

5/7/89 Flooding Test Nordkap

Paddler Plus Weights: 11.5 St / 75 Kg

Water in cockpit: 120 litres

5/7/89 Flooding Test Nordkap

5/7/89 Flooding Test Nordkap

Paddler Plus Weights: 11.5 St / 75 Kg

Water in forward compartment: 20 litres

5/7/89 Flooding Test Nordkap

Paddler Plus Weights: 11.5 St / 75 Kg

Water in forward compartment: 40 litres

Sheet 2/4

5/7/89 Flooding Test Nordkap

Paddler Plus Weights: 11.5 St / 75 Kg

Water in forward compartment: 59.5 litres (flooded)

5/7/89 Flooding Test Nordkap

Paddler Plus Weights: 11.5 St / 75 Kg

Water in forward compartment: full

Sheet 4/4

5/7/89 Flooding Test Nordkap

5/7/89 Flooding Test Nordkap

Paddler Plus Weights: 11.5 St / 75 Kg

Water in aft compartment: 40 litres

Sheet 2/5

5/7/89 Flooding Test Nordkap

Paddler Plus Weights: 11.5 St / 75 Kg

Water in aft compartment: 60 litres

Sheet 3/5

5/7/89 Flooding Test Nordkap

Paddler Plus Weights: 11.5 St / 75 Kg

Water in aft compartment: >75 litres (flooded)

5/7/89 Flooding Test Nordkap