

# lifejacket crotch straps and reliability of flares: some evidence

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## Background/context

The DoT Recreational Safety Equipment Familiarisation and Testing Day (3 Feb 2016) stimulated much valuable discussion, two topics in particular – the need for crotch straps on lifejackets, and the reliability and safety of pyrotechnics. I have looked through the marine incident reports in my archives (just a tiny proportion of all such reports) and documented any relevant evidence below. I draw to your attention two points to consider before reading further:

- a) The reports are all about incidents on offshore sailing yachts because this is my particular area of interest. Whilst I have no reason to believe this biases the findings, it must be borne in mind that the circumstances on other vessels may result in different outcomes.
- b) Many of the findings below refer to incidents involving safety harnesses. They are included for two reasons; firstly, harnesses are often integrally combined with lifejackets, and the reports do not always state whether a combined system or just a harness was being worn (however, most harnesses purchased after the 1990s are combined with a lifejacket); secondly, the need for crotch straps on harnesses has many similarities with the need for crotch straps on lifejackets. The main difference is the source of the upward pull (buoyancy in a lifejacket, gravity in a harness).

With these qualifiers in mind, I suggest that the reports below provide compelling evidence for the value of crotch straps, and very concerning evidence on the unreliability of flares. Do you agree? Read on and make up your own mind.....

## Crotch Straps

### 1979 Fastnet Yacht Race

Three reports were received of bodies being sighted or recovered floating face down in the water although a life jacket was being worn. In one instance the wearer's head appeared to have slipped out of the collar and the life jacket which was then attached only by a waist tie had slipped round to the wearer's back. It is not known whether this jacket, of a make which conforms to BS3595, was put on correctly in the first place. The post mortem carried out states that the wearer died of exposure, not drowning, so it is likely that up until the time of death the life jacket did provide adequate buoyancy. However, authoritative comment on the incident by the rescuers indicates that there is some doubt as to whether the British Standard Specification is totally effective as it contains no requirement for a positive retaining strap for the collar.

**Source:** 1979 Fastnet Yacht Race Enquiry, RYA and RORC, 1979.

## 1998 Sydney to Hobart Race

“25 individuals ended up in the water after knockdowns or large waves washing over boats. Of these, three people experienced problems with harnesses pulling off over their heads. One harness was integrated with a wet weather jacket and the jacket as well as the harness was pulled over the crew’s head. The remaining two were separate harnesses.” (Section 6.4.2). Note that section 9.6.3 reports that “four harnesses slipped over people’s heads while in the water and being lifted”

**Source:** Report of the 1998 Sydney to Hobart Race review committee. Cruising Yacht Club of Australia, May 1999.

## 2008 ISAF Crotch Strap Working Party.

In 2008, the International Sailing Federation (ISAF) Special Regulations Sub-Committee established the Crotch Strap Working Party (CSWP). The initial purpose of the CSWP was to review any deficiencies in the lifejacket harness crotch and thigh straps experienced during the 1998 Sydney to Hobart Race<sup>7</sup> and to determine requirements for inclusion in the OSRs. Those requirements are promulgated at OSR Sub-sections 5.01.1.b and Section 5.02.5. The committee disbanded in 2012.

**Sources :** Lion incident MAIB report 4/2012, sections 1.12.3 and 2.10.4.

And ISAF Special Regulations CWP Nov 12 meeting minutes, accessed from [http://www.sailing.org/tools/documents/SPSC7bCrotchStrapWP-\[13780\].pdf](http://www.sailing.org/tools/documents/SPSC7bCrotchStrapWP-[13780].pdf) 20 Feb 16

## UK registered small commercial sailing vessel - November 2007

“Four crew members went forward to carry out a sail change. They were connected to the yacht by long tethers and were all wearing lifejackets. As the headsail was being secured, it fell into the water. During its recovery, a large wave carried one of the crew over the side and left him dangling waist deep in the water. The yacht was hove to but the remaining crew were unable to heave the MOB back on board. A short time later, the MOB slipped from his lifejacket and fell into the water. Fortunately, he was recovered unharmed. The lifejacket waist strap and crotch strap were found to have released during the recovery attempt. “

**Source:** Lion incident MAIB report 4/2012, section 1.18.2)

## 2011 Lion incident

“As the helmsman concentrated on keeping the yacht as upright and steady as possible, the recovery team fought hard to keep the skipper’s head above water. However, as they tired, he repeatedly slipped under the surface. After about 8-9 minutes of frustrated effort, the mast man suggested using one of the spinnaker halyards to lift the skipper. They attempted to locate the skipper’s lifejacket harness tether attachment loop (see Section 1.12.1) but were unsuccessful because of the yacht’s motion and because the skipper was partially

hidden by the flare of the bow. The mast man, who was now managing the recovery, decided to clip the halyard directly to the skipper's tether. The skipper was lifted partially clear of the water and was grabbed by the recovery team as his lifejacket started to slip up his body. The team managed to keep the skipper's torso on the deck and hold onto his legs but, despite their best efforts, they could not pass him under the lower guard wire. The skipper wore his own Spinlock Deckvest 150 Pro Sensor lifejacket. The lifejacket was of the auto5 and manual inflation type with an integral safety harness. It was manufactured in May 2008; the lifejacket's integral safety harness complied with European Norm (EN) 1095/International Organization for Standardization (ISO) 12401, and the lifejacket complied with EN 396/ISO 12402-3.

The lifejacket harness was fitted with individually adjustable, contoured thigh straps with side-release buckle fasteners. The straps were designed to help prevent the lifejacket, when inflated, from "riding up" the torso of a person in the water.

Following the accident it was noted that the thigh strap side release buckles were easily unclipped under straight load tension, and especially so under rotational load. Straight pull load tests showed that the left and right thigh strap buckles released when a load of 20 kilogram-force (kgf) and 40kgf was applied respectively. It is understood from the lifejacket manufacturer that the buckles should withstand a 50kgf load before unfastening.

On inspection following the accident, the lifejacket, harness and thigh straps were found to be in good condition with no obvious damage to their components.

The attachment loop on the front of the integrated lifejacket safety harness waist strap is designed to attach a tether/safety line. The waist crotch and/or thigh straps are designed to prevent the lifejacket riding up the torso of a person in the water so that the optimum torso and head elevation is achieved.

The effectiveness of the lifejacket and, in particular its lifting loop for manual recovery, is largely dependent upon its correct adjustment. A correctly adjusted integrated lifejacket safety harness should be capable of lifting a person from the water using the lifting loop without being significantly displaced. Many publications, including those of the RYA, RNLI, MCA and lifejacket manufacturers highlight the importance of correctly adjusting the lifejacket harness, including crotch/thigh straps."

**Source:** Report on the investigation of a fatal man overboard from the Reflex 38 yacht *Lion* 14.5 miles south of Selsey Bill, West Sussex 18 June 2011. MAIB report 4/2012.

## 2012 Port Fairy Race

"Five of the crew inflated their Personal Flotation Devices (PFD), clipped together using their safety harness tethers and entered the water. The last two stepped off as the boat sank beneath them shortly before midnight. One crew member had not inflated his PFD or clipped on and this was sorted out with some difficulties in the water. They endeavoured to form a 'survival huddle' as taught on Yachting Australia's Safety and Sea Survival Course (SSSC) but this proved too difficult in the sea conditions as they were thrown against each other by the waves. Instead, they clipped together in a line, whilst endeavouring to keep their backs to the sea and hold the boat's EPIRB and the 4 PLBs that had been activated above the water.

Several of the PFD crotch straps were not tight enough, causing difficulties for the wearers. None of the PFDs had spray hoods and the survivors swam as necessary to keep their back to the wind. The helmsman's foul weather jacket's hood was caught under his PFD. His

lifejacket appeared unable to support his weight but this could have been a result of a loose crotch strap. This meant he had to tread water to try and keep his face clear of the water. This accelerated his loss of body heat and was very tiring.

<The rescuing boat developed a > technique to approach to windward, stop the boat beam onto the sea and let it drift down onto the survivors, adjusting position so that the survivors arrived at the transom step where they could be assisted into the boat. In a series of such manoeuvres the 6 survivors were hauled to safety.

Report recommendations:

- Strongly encourage crew to purchase PFD with a spray hood
- A properly adjusted PFD harness, in particular, a tight crotch/thigh strap(s) is very important to prevent the PFD's riding up, placing the survivor's face close to or below the surface of the water."

**Source:** ORCV Internal Inquiry into the Melbourne to Port Fairy Yacht Race, 14th Aug 2012

## Safety and reliability of flares

### 1979 Fastnet Yacht Race

Did Any Flares Fail to Ignite?	
Yes	12 5%
No	48 20%
No Answer	175 74%

**Source:** 1979 Fastnet Yacht Race Enquiry, RYA and RORC, 1979.

### 1998 Sydney to Hobart Race

"Eleven yachts launched pyrotechnics. Five of these experienced problems. In three cases it was a direct result of the lack of knowledge/experience in deploying such devices. Four claimed the flares would not light."

**Source:** Report of the 1998 Sydney to Hobart Race review committee. Cruising Yacht Club of Australia, May 1999.

### MoB on Pastime 2006

"*Pastime* carried a standard set of distress flares. This consisted of four parachute flares, six hand-held flares and two orange smoke floats. Problems were encountered in setting off the flares because the owner could not read the instructions clearly. It was dark, and he could not find his glasses. This was not the time to be reading the operating instructions for the first time, and although he could remember how to launch the parachute flares, he had

more difficulty with the hand-held flares. He could not ignite two of them, and disposed of them overboard. He also sustained slight burns to his hands when setting off the flares.”

**Source:** Report on the investigation of the loss of one man overboard from the sailing yacht *Pastime* English Channel 17 March 2006. MAIB Report 25/2006.

## Sailing instructor incident 2006

Perhaps the most famous flare-induced injury occurred in April 2006, when sailing school proprietor Duncan Wells was shot in the abdomen and badly injured by a faulty in-date flare while filming a programme on their correct deployment. He spent nine months in hospital, four of those in ICU, and six weeks in a coma.

Source: [http://www.boatingbusiness.com/news101/boatbuilding/safety/mca\\_in\\_distress\\_over\\_flares#sthash.QAlaHFK7.dpuf](http://www.boatingbusiness.com/news101/boatbuilding/safety/mca_in_distress_over_flares#sthash.QAlaHFK7.dpuf)

## 2012 Port Fairy Race

“On Inception the crew attempted to fire a parachute flare; the flares were different to those they had trained on and they had difficulty making out the instructions in the darkened cockpit. The first two attempts failed, the flares went into the sea; the third flare was launched successfully.”

**Source:** ORCV Internal Inquiry into the Melbourne to Port Fairy Yacht Race, 14th Aug 2012

## Brisbane training centre 2014

On 2 March 2014 a training centre in Brisbane used dummy flares in a classroom and informed the students that the flares were dummies. In addition, they deconstructed a live rocket flare – a practice that had been in place there for some years. The flare in the rocket case had been removed, but they omitted to deactivate the flare rocket igniter. The parts (less the flare itself ) were passed around the class one at a time. The last person in the group received all the pieces and then elected to re-build it and fire it. The rocket body igniter was then activated. No one was injured but the ceiling was damaged, illustrating the kind of injury that could have occurred.

**Source:** RYA “Wavelength” newsletter Dec 2014 issue

## Unidentified training centre, 2014

A training centre was using out of date flares for the practical element of a course. After the first flare was lit with the firing mechanism, subsequent hand held flares were lit sparkler-style by placing the lit one against the end of the unlit one. Unfortunately, one student held his flare loosely and by the wrong end. Once lit, it propelled itself into a car park. Again, luckily, no-one was injured.

**Source:** RYA “Wavelength” newsletter Dec 2014 issue.

## Safety courses and presentations, WA 2010 – 2014.

I have attended 3 flare demonstrations run by professionals using in-date flares; roughly one third of the flares failed to ignite .

## **Fremantle Sailing Club flares familiarity evenings.**

When the Cruising Section used to organise flare demonstrations in conjunction with Fremantle Sea Rescue, many participants would bring their own flares of varying vintage. We had no injuries recorded but many of them ignited in a way that could cause burns (mainly through the flare burning through the side of its canister rather than out of the top).