

# Technology Frontier

News Bite on PolyU's Innovation

## One-size-fits-all Lifejacket Novel design to safeguard lives of young and old at sea

To enhance marine safety, the Marine Department proposed to amend the regulations earlier so that local vessels are required to provide suitable lifejackets to all passengers including children. In addition, the department commissioned PolyU to design a one-size-fits-all lifejacket for both adults and children. The resulting ISO-certified lifejacket developed by the Institute of Textiles and Clothing has been accepted by the government as a product that fulfils regulatory standard. As the two-year transitional period of the new amendment regulations will end in December 2021, a spike in demand for the universal flotation device is expected in the near future.



Dr Allan Chee-kooi Chan

In the past, the law stipulated that children's life vests needed to account for 5% of a marine vessel's passenger load. But there was no restriction on the percentage of passengers under the age of 13 on a vessel, meaning even if the vessel operator adhered to the legal requirement, not every child on board was guaranteed access to a suitable lifejacket. To enhance safety during events at sea, the Marine Department proposed to amend the regulations so that all local vessels must carry on board suitable lifejackets in the quantity of not less than the vessels' licensed capacities, and commercial vessels carrying more than 12 passengers must have on board infant lifejackets in the quantity of not less than 2.5% of their licensed capacities. Children passengers are also required to wear

lifejackets at all times during major events at sea. The new amendment regulations came into effect in December 2019. When the two-year transitional period ends, all applicable vessels must comply with the new requirements.

### Universal lifejacket for adults and children

However, there is no way to know the number of children that board a vessel in advance. How can a vessel operator make sure all children have access to a suitable lifejacket? A one-size-fits-all lifejacket could take the guessing out of these sea journeys. In light of this, in 2014, the Marine Department commissioned PolyU to design a common lifejacket suitable for both adults and children. After two years of hard work, Dr Allan Chee-kooi Chan, then Associate



The front and back design of the one-size-fits-all lifejacket



The one-size-fits-all lifejacket is suitable for anyone aged two and above.

Professor of the Institute of Textiles and Clothing, and his research team successfully developed a lifejacket suitable for anyone aged two and above, weighing up to 300 pounds, including pregnant woman. Later, the government accepted the lifejacket as a product that fulfils the regulatory standard and provides better protection to all passengers travelling on local commercial marine vessels.

### Criteria for ISO certification

The design of the one-size-fits-all lifejacket was based on a regular adult-sized yoke-type lifejacket for emergency use. Dr Chan and the team tried to modify the design so that it would fit a child snugly. He explained, "To qualify for the international standard ISO 12402-4:2006 for personal floatation devices, there are four criteria to fulfil. Firstly, a user can put the lifejacket on within one minute; secondly, it is designed to keep the user's face up in the water; thirdly, it can turn the user safely on his back within 10 seconds in water; and lastly, it should fit a child comfortably without moving around or being too loose."

Dr Chan and his team thus used three straps to secure the lifejacket on a child user: a Velcro neck strap to narrow the neck opening and to keep a child's head high above water, a crotch strap to prevent the lifejacket from riding up, and a waist strap to tighten the lifejacket around the body. Furthermore, a collar was added to provide support for the wearer's neck and head. The foam blocks on both sides of the lifejacket are of different thickness. The

resultant difference in buoyancy can turn the user on his back in water.

### Rigorous testing

Then came the testing stage to verify if the lifejacket held up to the requirements. First off, all materials used must adhere strictly to ISO requirements on safety and physical strength. The product must also be manufactured to prescribed quality standard. Human subject tests followed and as Dr Chan figured, he himself was the easiest subject to recruit. "I can't swim. That made me a suitable candidate to test a life-saving device for swimmers and non-swimmers alike. Therefore, I put the lifejacket on and jumped off a mariculture raft in front of a camera. I also recruited children to try it in a swimming pool. We were pleased that it did fulfil all four ISO requirements." After professional tests at Wuhan Maritime Institute in the Chinese mainland and Fleetwood Nautical College in the U.K., the lifejacket was granted ISO certification.

In April 2019, the Marine Department officially accepted the one-size-fits-all lifejacket to be a product that fulfils the regulatory standard. And two marine equipment companies have already obtained the licence to manufacture and sell it. According to the Marine Department, there are about 1,300 commercial passenger vessels in Hong Kong that need about 70,000 to 80,000 lifejackets. The government has introduced a subsidy scheme for ship owners to procure the one-size-fits-all lifejackets. As the two-year transitional period of the new legislation will end in December 2021, a surge in demand is expected in the near future.