Safety At Sea
Lifejackets and Buoyancy Aids

Seafish Report No.420

June 1993

Sea Fish Industry Authority

Seafish Technology

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[1] RGIT - Robert Gordon Institute of Technology

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Summary

Each year some twenty to thirty deaths occur by drowning in the UK fishing industry and it is believed that the regular wearing by crew members of a lifejacket, or a suitable buoyancy device, when working on deck, would reduce this needless loss of life.

In order to be able to recommend effective products to the industry, an investigation has been conducted into the suitability of the items that are currently available. The investigation has included, tank tests at the Robert Gordon Institute of Technology (RGIT) Survival Centre and acceptability trials by fishermen.

The products assessed were:-

- Work vests
- Body warmer type buoyancy aids
- An oilskin top incorporating a buoyancy device
- Single chamber lifejackets
- Twin chamber lifejackets, DTp (UK) approved
- Worksuits with survival capabilities
- Buoyant thermal undersuits

From the tank tests, it was evident that, although many items gave a good level of buoyancy, the position of the buoyancy did not ensure that an unconscious casualty would be in a face upwards positions. Indeed, only those items that can be described as being lifejackets can be recommended since they do have the necessary righting properties to turn an unconscious casualty.

Acceptability trials by fishermen considered factors other than life saving abilities. Factors such as a buoyancy device must be:-

- easy to wear and unrestricting
- free of snag points which may catch in netting
- suitable to wear with sea gear
- suitable for both winter and summer use
- damage resistant and durable
- easy to clean
- able to tolerate water splashes and spray
- easy to repack/maintain
- at an affordable price

Considering the available products, in the light of the above, only the single chamber, automatic lifejacket largely meets the requirements and also, has the ability to support an unconscious casualty. Fishermen, who have tried these single chamber lifejackets, have generally found them to be quite acceptable but, concern has been expressed that the large meshes of monofilament tangle nets may snag on the lifejackets. A suggestion, made by fishermen in the southwest, was that the lifejacket should be incorporated into the braces of the bib and brace oilskin trousers which they all wear. This concept of incorporating a buoyancy device into the oilskins worn by fishermen has much to recommend it and it is concluded that this will be the most acceptable means to achieve the wearing of buoyancy devices by the majority of fishermen.

1. Introduction

Each year some twenty or more fishermen die in the UK fishing industry. Almost all the deaths occur by drowning and are the result of sudden vessel loss; collision, capsize or being overwhelmed. In addition, three or four people also drown as a result of the seven, on average, man-over-board incidents which are officially reported each year. Many non fatal man-over-board incidents are simply not reported.

The regular wearing by crew members of a lifejacket or a buoyancy aid when working in exposed conditions would reduce this needless loss of life.

2. Object

To investigate the various types of lifejackets and buoyancy aids that are currently available in order to be able to recommend suitable products to the fishing industry.

3. Methods

3.1 A desk study to gain information from magazines, exhibitions and direct contact with manufacturers.

3.2 Practical tests to ensure that the products, particularly the buoyancy aids, do give a reasonable degree of protection to a wearer, weighted down with sea gear.

3.3 Acceptability trials conducted by fishermen wearing the items whilst carrying out their day to day work at sea.

4. Statutory Requirements

As from the 15th February 1988, every fishing vessel, including those under 12 metres, must carry a life-jacket for every person on board, plus at least one extra jacket. Two extra if there are more than 10 persons. All life-jackets must be approved by the Department of Transport and must be equipped with a whistle, an approved light, retro-reflective material and a ring or a loop to facilitate rescue. They must be marked "PERSON OF 32KG OR MORE" and have the words "DOT (UK) APPROVED" or DTp (UK) APPROVED on them.

Inflatable life-jackets must have two inflatable compartments, each equipped with a device for automatic inflation on immersion. Manual activation for each compartment must be provided, also a means of inflating each compartment by mouth.

The above is a summation of the major points and does not list all the requirements.

Important If a life-jacket or buoyancy aid is chosen, for regular day to day use, which is not DTp approved then it must be carried in addition to DTp approved lifejackets.

5. Background

The statutory requirements restrict ones choice to only those lifejackets that are DTp approved. These fall into two types: Inherently buoyant and inflatable.

Inherently Buoyant: These jackets are filled with a buoyant material such as kapok or foam which results in a quite bulky but totally reliable and effective lifejacket at low cost. Because of their bulk they are too cumbersome and restricting to work in, but every fishing vessel carries them in order to comply with the statutory requirements.

Inflatable: As previously stated, to gain DTp approval an inflatable lifejacket must have two inflatable chambers each equipped with automatic, manual and oral means of inflation. Because these jackets are quite compact they can be worn whilst working. Very few, if any, fishermen carry this type of lifejacket on their vessels presumably because of the relatively high cost, around £150 or more and the need to have the jacket serviced every twelve months.

As a general rule, fishermen show reluctance to consider the wearing of any form of lifejacket or buoyancy aid, DTp approved or otherwise. Reasons given are:

It will be too restricting.
It will snag in netting.
It will be too hot or uncomfortable.
It will get very dirty.
It will be easily torn or damaged.

All of these have some validity but perhaps other reasons are:

Possible ridicule by other fishermen.
Putting the jacket on and off will be too much bother.
A failure to appreciate the need to wear something which will keep one afloat.

The present situation is that all fishing vessels carry inherently buoyant lifejackets to comply with the statutory requirements for life-saving appliances. However these lifejackets are intended for abandon ship purposes only and cannot realistically be worn whilst working. DTp approved inflatable lifejackets which are suitable for use when working are not usually found on fishing vessels.

Consequently, almost all fishermen fail to wear any form of life preserver when they are working on deck and are exposed to the risk of falling or being knocked overboard. Typically, the lifejackets that the vessel carries are stored in a locker or a spare bunk and in the event of sudden vessel loss: capsize, collision or being overwhelmed, the lifejackets are not immediately accessible.

It is considered that lives are being needlessly lost by the failure of fishermen to wear any form of buoyancy device that would keep one afloat to be rescued.

Various products are now available which can be considered for use by fishermen in addition to DTp approved lifejackets which are a legal requirement for abandon ship purposes.

6. Products Tested

The products fall into three categories:

Buoyancy aids.
Worksuits with survival capabilities.
Lifejackets.

In selecting the various items, the criterion has been that it must be suitable to be worn by a fisherman whilst carrying out his normal working operations.

6.1 Buoyancy Aids

These have largely been developed for the water sports industry and most comply with standards, set by the British Marine Industries Federation (BMIF). Typically they provide a minimum buoyancy of 8.2kg (18 lbs) for the adult sizes but the small sizes may only provide 6.4kg (13 lbs) suitable for persons weighing between 38-64kg(6-10 stones).

In general terms they are in the form of a vest or a waistcoat which has a filling of buoyant foam. A zip fastener closes the front of the vest with a belt to secure it at the waist.

Two exceptions to this style of buoyancy aid are an oilskin top and body warmer both of which have an inflatable bladder incorporated into the garment. A CO_2 cylinder inflates the bladder when it is manually triggered.

6.2 Worksuits with Survival Capabilities

These are waterproof working suits which have a buoyant thermal lining built in. They may be in the form of a one piece all over suit or separate jacket and trousers. The suits are designed to give a high level of buoyancy and to insulate the wearer against the cold. Typically they are equipped with a belt, a lifting ring, reflective panels and a whistle.

A recent development, aimed at the fishing industry, is to make the buoyant thermal lining into a separate garment to be worn underneath normal oilskins.

6.3 Lifejackets

Only the inflatable types of lifejacket have been selected as it is judged that the inherently buoyant types are simply too bulky to be seriously considered for use whilst working.

Inflatable lifejackets must be considered in two categories: DTp approved and non DTp approved.

6.3.1 DTp approved Inflatable Lifejackets

As previously stated in section 4 "Statutory Requirements", inflatable lifejackets must have two inflatable compartments, each equipped with a device for automatic inflation on immersion. Manual activation for each compartment must be provided, also a means of inflating each compartment by mouth. The lifejacket must be equipped with a whistle, and approved light, retro-reflective material and a ring or loop to facilitate rescue.

These lifejackets are designed as a pouch which is worn over the wearers chest. The pouch extends upwards in the form of a halter collar around the neck. A waist belt and back straps secure the lifejacket firmly in place.

6.3.2 Non DTp Approved Inflatable Lifejackets

Many manufacturers produce single chamber lifejackets that have a minimum buoyancy of 15.9kg (35lbs). Whilst not complying with the DTp requirements for lifejackets those single chamber items are widely used in many commercial and sporting fields.

Typically, the lifejacket is in the form of a halter which is worn around the neck and extends at both sides down the wearers front. Back straps and a waist belt retain the lifejacket on the wearer. Inflation is achieved by via a CO_2 cylinder which is activated either manually or automatically.

Manual versions have a pull cord which the wearer tugs to activate inflation. Automatic versions incorporate a device which activates inflation within a few seconds of immersion in water. This automatic device is always in addition to a pull cord to facilitate manual operation. Both versions, manual and automatic have a mouthpiece for oral inflation.

7. Tank Testing

One of the foremost centres in Europe for survival training, with particular expertise in the development and testing of lifejackets, is the RGIT Survival Centre Ltd. in Aberdeen.

RGIT were asked to observe each of the products in their test tank and to express an expert opinion on their "life saving qualities". Two RGIT staff members took part in the assessment, one in the water wearing each item in turn and one on the tank side making visual observations.

Although the test tank was equipped with wave making facilities, it was decided to conduct the assessment in still water conditions as this best demonstrates the degree of buoyancy provided by the item being considered. Whenever appropriate, the lifejacket or buoyancy aid was worn either over or underneath an oilskin top and trousers as would be worn by the typical fishermen. A shirt, jeans, socks and Wellington boots were also worn to make the assessment relevant for fishermen.

The assessment procedure for each item was as follows:

The item was donned by the tester and any straps or belts were adjusted to ensure a good secure fit.

The tester stepped from the tank side into the water, a height of approximately 0.8 metres.

By relaxing, the tester allowed his body to assume a position in the water as determined by the supplied buoyancy.

A vertical position was the adopted as per a conscious person.

Lying face down, as per an unconscious person, was then attempted.

From the observed performance and the opinions expressed by the experienced RGIT staff, notes were compiled on the life saving qualities of each product. (Measurements of freeboard or angles in the water were not attempted, as the demand on tank test time would have been excessive).

8. Test Tank Results

The following statements describe the performance observed for the differing types of products.

8.1 Work Vests *(see fig.1)*

Five different models of work vest were assessed. All were found to be very easy and unrestricting to wear and ideal for wearing underneath oilskins. However, their performance in the water varied.

As one would expect, the models which had the greater bulk i.e. more foam material, gave increased buoyancy. When considering a conscious casualty most of the models gave adequate buoyancy which resulted in vertical floatation with a reasonable level of freeboard for the wearers mouth. Two models had reduced levels of buoyancy and hence the freeboard was low.

When simulating the unconscious casualty, all the models, with the exception of the 'Tayco' buoyancy vest, displayed a slight tendency for the wearer to tilt face down. None of the work vests had the ability to right an unconscious casualty.

8.2 Body Warmer Type Buoyancy Aids *(see fig.2)*

Two versions of this type of buoyancy aid were tested, both from the same manufacturer. Externally the garment is a smart, nylon fabric full length waistcoat or 'body warmer', as are worn by many fishermen, particularly skippers who favour them for use in the

wheelhouse. However, in addition to being an attractive item of clothing, the garment also provides buoyancy by either; a buoyant foam lining, as in one version, or by a CO_2 gas inflated bladder, as per the second version. The inflatable version can not be worn underneath oilskins as it is not possible to reach the lanyard to activate inflation, nor to reach the mouth piece to inflate orally.

Of the two versions the foam lining model performed the best. A reasonable level of buoyancy was given but there was a definite tendency for the wearer to tilt face down when simulating an unconscious casualty.

The inflatable version gave less buoyancy which resulted in a low freeboard. However, the wearer was supported in a vertical attitude without the tendency to tilt forward. Oral 'top-up' of the bladder was difficult as this required the wearer to place his face underwater to reach the mouthpiece. Much of the increased buoyancy gained by the oral top-up was lost since, without a belt to restrain it, the garment floats up above the wearers shoulders.

8.3 Oilskin Top *(See fig.2)*

This is a buoyancy aid which has been specifically designed for the fishing industry. It consists of a perfectly standard oilskin jacket but with an inflatable bladder incorporated across the shoulders and down the front sides. A CO_2 cylinder inflates the bladder when the wearer rips off the 'velcro' attached flap on the outside of the jacket. A mouth piece is provided for 'topping-up' or oral inflation.

In use the performance was good in many respects;

The wearer was held vertical in the water
Head support was given
There was no tendency to go 'face-down'

However, the level of buoyancy provided by the 12gramme CO_2 cylinder was minimal and hence the freeboard of the wearers mouth was low. Oral 'topping-up' improved the freeboard to a quite satisfactory level.

Simulation of an unconscious casualty resulted in the oilskin top exhibiting reasonable righting qualities but these were limited by the modest level of buoyancy.

8.4 Single Chamber Lifejackets *(See fig.3)*

Lifejackets from three different manufacturers were tested; two automatic and one manually activated.

All of the lifejackets were easy to don and could be worn over oilskins. A crutch strap, supplied for use with one of the lifejackets was not used as it was considered unlikely that the average fisherman would bother to wear the strap.

In the water, all of the lifejackets gave a very similar level of performance. Each one is specified to give a minimum buoyancy of 16kilogrammes (35lbs) and this resulted in very good floatation with a high level of freeboard. The head was well supported with the face in an upwards position.

The unconscious casualty simulation showed that all of the lifejackets had good righting properties. In each case the wearer was quickly brought from a face-down to a face-upward position.

8.5 DTp (UK) Approved Inflatable Lifejackets *(See fig 4)*

Two versions of these twin chamber lifejackets were assessed, each from a different manufacturer.

Both lifejackets were easy to don and could be worn on top of oilskins.

In the water, the performance of each lifejacket was excellent. Indeed, as each chamber on its own is designed to give sufficient righting force and buoyancy to correctly support the wearer, the two chambers combined gave quite exceptional buoyancy.

In accordance with DTp (UK) requirements, the lifejackets are equipped with an automatic light, reflective panels, a whistle and a lifting becket or strap. An optional attachment for both lifejackets was a spray hood with a transparent visor which will protect the face of the wearer from waves and spray and decrease the heat loss from the head.

8.6 Worksuits with Survival Capabilities *(See fig.5)*

These suits are available either as a one-piece suit or a jacket and trousers combination. Both options, as supplied by a leading manufacturer, were assessed, including a one-piece suit from a rival manufacturer.

The suits proved to be very easy to put on and were quite unrestricting. Oilskins were not worn as the suits are designed to be waterproof working clothes.

A prime function of these suits is to protect against the cold. In a survival situation, the period of time before hypothermia is suffered will be greatly extended by the thermal properties of the buoyant foam lining. It should be noted that our assessment made no attempt to consider thermal properties, only the level of buoyancy was assessed.

In the water, both of the one-piece suits exhibited similar performances. The level of buoyancy was very good and resulted in the wearer floating in a horizontal attitude. However, simulation of an unconscious casualty showed that it was possible to float either face-up or face-down.

With the suit comprising of a separate jacket and trousers, each possible combination was considered as follows:-

Jacket and Trousers - As per the one piece suits, very good buoyancy but the unconscious wearer could float face-down.

Jacket only - A reasonable level of buoyancy was given, the wearer floating vertically in the water. However, for the unconscious casualty the floatation position would tend towards face-downwards.

Trousers only - Again, a reasonable level of buoyancy was given, floating the wearer in a horizontal attitude. This was quite satisfactory for a conscious casualty, but the unconscious casualty may well float face-downwards.

8.7 Buoyant Thermal Undersuits *(See fig.5)*

These are a new development by a leading manufacturer of floatation suits and are designed to be worn underneath outer clothing, such as overalls or oilskins. The garments are available either as a one piece suit or as a separate jacket and trousers and are marketed as "Workability Suits".

The suits are constructed using a buoyant thermal foam material which is contained in a nylon fabric. Zip fasteners make the suits very easy to put on or take off. A hood, of the same construction as the suit, is available to be worn as an inner lining of ones oilskin hood. A special feature of this hood is an inflatable bladder in the back section which can be orally inflated by the wearer to increase the buoyancy supporting the head and thus give the mouth extra freeboard. The inflation tube from the hood extends to locate inside the collar opening of the wearers oilskin, such that it can be reached for oral inflation if the need should arise.

For the assessment tests the hood was not used, as it was considered that it was unlikely that fishermen would wear the hood, other than in exceptional circumstances, i.e. very cold conditions. Again, it should be noted that the thermal properties were not assessed.

Performance in the water of the buoyant undersuits, when worn underneath the oilskin jacket and trousers was very similar to the worksuits as described in the previous section. With the two piece version (jacket and trousers) all possible combinations were assessed, again, with similar results to the worksuits. These can be summarised as follows:-

One Piece Suit - Good buoyancy, floatation in a horizontal attitude but could float face-up or face-down.

Jacket and Trousers - As above

Jacket Only - Reasonable level of buoyancy but tendency to go face-down.

Trousers Only - Reasonable level of buoyancy but tendency to go face-down.

9. Acceptability Trials

To date only a limited amount of work has been achieved in carrying out acceptability trials. Work commenced in January 1992 when freezing weather conditions made it an ideal time to assess the qualities of the worksuits. It was planned to continue the acceptability trials using the various buoyancy aids, but when tank tests were carried out, at RGITSC during February 1992, it was evident that many items would not be suitable if the wearer became unconscious. Indeed, only those items which can be defined as being lifejackets were considered suitable because they do have the righting properties to bring an unconscious casualty into a face-upwards condition.

In view of the limitations with respect to unconscious casualties, acceptability trials with all items except lifejackets were discontinued. The following reports on the work that had been achieved to date.

9.1 Worksuits with survival capabilities

The buoyant thermal lining of the worksuits makes them ideal for people who have to work in cold and exposed conditions. To best take advantage of the properties of the suits, the crew on an open fishing coble, working in freezing conditions during the month of January, was chosen to assess the garments.

The vessel was the "CRIMOND H", a 9.8m long coble skippered by Mr. Jim Haxby, of Filey in Yorkshire. At the time of the assessment Skipper Jim Haxby and his two crew-members, James Haxby and Bruce Jenkinson were engaged in both gill net and pot fishing operations.

The garments tried by the three men were:

Mullion X 4 one-piece suit
Mullion jacket and trousers combination
Cosalt Cormorant one-piece suit

Each man selected a suit and wore that suit each day during the normal course of fishing, for a one week period. The comments of the crew-members are summarised as follows:-

All three men were very impressed with the ability of the suits to keep them warm in freezing weather conditions. Normally, the men would wear extra layers of clothing to attempt to combat the cold. However, the thermal properties of the suits kept them comfortably warm without the restricted feeling that one has when wearing additional jumpers, etc.

The suits were worn without oilskins over them. It was not considered necessary to wear oilskins as the suits are waterproof, but from the experience gained, an apron to keep the dirt off the suit would be worthwhile.

No problems were experienced with netting snagging the suits. This is a potentially dangerous problem which fishermen are very much aware of, as a gust of wind can easily blow the light monofilament netting against the man's clothing during the high speed shooting operation.

One quite severe test for the worksuits, unique to beach launched cobles, is the need for the crew-members to wade in the sea when manoeuvring the vessel onto its wheeled cradle in order for it to be dragged up the beach by a tractor. Normally the men rely solely on their thigh boots to keep them dry but quite often, a wave rising above the top of their boots, or splashes from waves will result in the men becoming extremely wet. Wearing the worksuits, the crew-men were able to stay warm and dry whilst working in the breaking waves to locate the cradle under the vessel.

Two criticisms were made:

> The hood of the Cormorant suit was a little small. If it had extended further over the face it would have given more protection.
>
> The washing instructions for the worksuits stated "do not machine wash". Consequently the suits must be hand washed which requires the use of a bath tub, as the average kitchen sink is far too small. Drying the suits, after washing, may take quite a prolonged time.

Summation

All the crew-men were very impressed with the suits and found them ideal for the cold weather conditions. However, they all expressed the opinion that for the majority of the year the suits would be too hot to be able to work in.

9.2 Buoyant Thermal Undersuits

These are recent development by Mullion Manufacturing and are being marketed by the company as a 'Thermarine Workability Suit'. They are available either as a one-piece suit, or as a separate trousers and top. Skipper Peter Watkinson and his crew-man Philip Pagan on the 9.8m fast netter/potter "OSPREY" from Bridlington assessed the suits for a period of one week, again in very cold weather conditions.

Both men expressed the opinion that the suits were excellent. They were comfortable to wear, unrestricting, extremely warm and one could wear whatever one wished in the way of outer-clothing. The buoyant properties of the undersuits were considered very desirable by the men who both had a strong awareness of the need to wear something that would keep one afloat in an emergency. Unfortunately, both men expressed the opinion that the suits would be too hot to allow physical work in all but cold weather conditions.

9.3 Inflatable Lifejackets

Skipper Ian Taylor of the Bridlington vessel "MY CHARON", a 38ft 'Aquastar' design,

which is engaged in both gill netting and angling parties agreed to assess various lifejackets. He and his crewman Ken Marshall wore the lifejackets whilst carrying out their normal work of gill net fishing.

The items tested and wearers comments are as follows:-

9.3.1 Lifeguard 'LG1168' DOT (UK) Approved
This is a twin chamber automatic lifejacket equipped to comply with the Department of Transport requirements. It is designed in the form of a chest pouch which extends up around the neck as a halter collar. A waist belt and back straps secure the lifejacket on the wearer.

This lifejacket was used by the skipper of the "MY CHARON" who immediately found that the lifejacket was tight to pass over his head when putting it on. Also, he found the fit around the neck restricting due to his roll neck jumper and the collar of a heavy jacket.

A particular problem, perhaps unique to the "MY CHARON" but not necessarily so, was that the bulk of the lifejacket on the skipper's chest made it difficult for him to sit in the helmsman's chair without the lifejacket fouling the wheel. As a consequence, the jacket was worn for only a short period before removing it.

9.3.2 Crewsover 'Seafire Solas' DOT (UK) Approved
This also is a twin chamber fully automatic lifejacket that complies with and exceeds the Department of Transport requirements. It is designed to have additional buoyancy to be able to turn an unconscious casualty into a face upwards attitude even if the person is wearing a survival suit.

This lifejacket also was found to be tight to pass over the head and was tight around the neck. The tightness was made worse by the need for the wearers oilskin hood to be inside the collar of the lifejacket.

The crewman persisted with the lifejacket for two hours before deciding that it was too uncomfortable to wear all day long.

9.3.3 Single Chamber Lifejackets
The particular model tried by the crewman on the "MY CHARON" was the 'Perrys Lifestyle' equipped with automatic inflation and a safety harness. However, single chamber lifejackets of similar basic design are available from several manufacturers and in general terms, the following comments apply to all single chamber inflatable lifejackets of the halter style.

The lifejacket was easy to put on, despite being worn on top of thick clothing and oilskins. It was found to be lightweight and unrestricting to wear and was happily worn throughout the whole day whilst shooting and hauling nets and whilst handling the catch etc.

This positive response to the single chamber inflatable lifejacket has also been received from various other fishermen who have been given the opportunity to try them. In all cases the fishermen found that the lifejackets were unrestricting and

of no hinderance in their work.

10. Discussion

In considering a suitable lifejacket/buoyancy aid for use by fishermen it is important to make a distinction between lifejackets for abandon ship purposes and lifejackets/buoyancy aids which are intended for use as personal protection whilst working on deck.

By regulation every fishing vessel must carry DTp (UK) Approved lifejackets as part of the life saving appliances specified for that size of vessel. The lifejackets are designed for abandon ship purposes and accordingly they must meet or exceed specified standards of construction and performance. Standards such as:

- after demonstration, a person can correctly don it within a period of 1 minute without assistance;
- it is capable of being worn inside out or is clearly capable of being worn in only one way and, as far as is possible, cannot be donned incorrectly;
- it is comfortable to wear;
- it allows the wearer to jump from a height of at least 4.5 metres into the water without injury and without dislodging or damaging the lifejacket.

It shall have sufficient buoyancy and stability in calm fresh water to—

- lift the mouth of an exhausted or unconscious person not less than 120mm clear of the water with the body inclined backwards at an angle of not less than 20° and not more than 50° from the vertical position;
- turn the body of an unconscious person in the water from any position to one where the mouth is clear of the water in not more than 5 seconds

Other standards relate to the construction materials, flammability, lifting ring or loop, reflective tapes.

In addressing the need to find a suitable buoyancy device that can be worn by fishermen whilst working on deck various factors have to be considered. In some instances these factors are different to those which are important in lifejackets intended for abandon ship situations. A buoyancy device for the fishing industry must be:-

- easy to wear and unrestricting
- free of snag points which may catch in netting
- suitable to wear with sea gear
- suitable for both winter and summer use
- damage resistant and durable
- easy to clean
- able to tolerate water splashes and spray
- easy to repack/maintain
- at an affordable price
- generally acceptable

Not listed is the most important factor:

It must have life saving capabilities.

10.1 Life Saving Capabilities

As can be seen from the tests in the tank at the RGITSC the performance of the items varied considerably. The DTp (UK) APPROVED lifejackets are the best choice. However, in view of their relatively high cost and the discomfort and restriction which may be experienced when wearing them all day long, they are unlikely to be voluntarily adopted by fishermen. Items, such as work vests or body warmers, which probably would be readily worn by the majority of fishermen, do not provide the level of life saving qualities that one would desire. Hence, there is a need to find a balance between lifesaving capabilities and user acceptability.

In considering such a balance it is vital that a minimum level of life saving ability is achieved.

"What is a minimum level?" This is obviously a question for discussion but, in the opinion of those people involved with this study, any buoyancy device for use by fishermen must have the potential to save an unconscious casualty. This opinion is supported by the number of incidents in which fishermen are knocked overboard and are unconscious in the water. Furthermore, even though the person may be conscious on entering the water, the effects of hypothermia will eventually render them into an unconscious state. Indeed, it may only be a matter of minutes before this occurs, dependant on water temperature.

The potential to save an unconscious casualty requires that the device or garment has:

sufficient buoyancy to adequately support the wearer in the water and that the buoyancy is positioned such that the wearer will be turned into a face upward position with the head supported.

Such a buoyancy may be achieved by the use of inherently buoyant material or, as is most likely, by inflatable chambers. If inflatable chambers are used, then it is essential that automatic activation devices are fitted.

10.2 The Fisherman's Requirements

The general reluctance of fishermen to consider the wearing of any form of lifejacket or buoyancy aid has previously been mentioned in section 5. However, since we have been talking to fishermen about lifejackets and displaying them at fishing exhibitions we have detected an increased willingness to consider wearing something that may well save their lives. From discussions with fishermen various requirements are essential if a buoyancy device is to receive wide acceptance by the industry.

10.2.1 Ease of Wearing

For a fisherman to be able to wear a buoyancy device, whilst performing the many

varied tasks in fishing, it is vital that the device is easy to wear and unrestricting. It needs to be lightweight and of minimal bulk. It must be suitable to be worn when wearing sea gear and easy and quick to put on and take off again. In the winter the man will be wearing thick clothing and hence the device must accommodate this without restriction. Conversely, in the summer, the man may be working "stripped to the waist" and again the device must be comfortable to wear without chaffing, particularly around the neck.

10.2.2 Free of Snag Points

Perhaps the greatest concern expressed by the fishermen, when contemplating the wearing of a lifejacket, is the possibility of netting or ropes snagging on the lifejacket and dragging them into machinery or overboard. This is a very real danger when working gill or tangle nets which have large meshes that can easily snag on buckles and buttons etc. When shooting the nets in windy conditions it is not uncommon for the wind to blow the nets against a mans body such that they drag across his clothing.

In recent years, netting has become a favoured fishing method for perhaps the majority of the smaller vessels and hence any buoyancy device for fishermen must be suitable for use with tangle nets. Less likely to create problems with snags are trawling and potting, but even so, the possibility of netting or ropes fouling should not be overlooked. A particular concern with many of the existing inflatable lifejackets is the possibility of a snagging underneath the belt between the lifejacket and the wearer. Relocating the belt to the very bottom of the lifejacket would guard against this possibility.

10.2.3 Wear Resistance and Toughness

Fishing is a tough business both on men and machines but, especially so on sea gear and clothing. How long a set of oilskins will last is often a question of luck, or rather, ill luck in coming across something that snags and tears them. This may be the end of a wire projecting out of a splice, the sharp corner of a fitting on the vessel or even the spur of a dogfish. Any buoyancy device for fishermen must be designed to withstand similar treatment. Obviously, with inflatable devices it is essential that they are not punctured and hence a really tough outer cover is required.

Buoyancy devices which are worn across a man's chest may face possible damage through the wearer leaning over the vessels gunwhale top in order to pick up the cod end lifting becket or retrieve dahns etc. Aside from abrasion from the rail, the pressure or bending forces created by the man's weight may damage the mechanism of inflatable devices.

10.2.4 Easy to Clean

One task which a fisherman can expect to perform several times a day is gutting fish. This inevitably results in his oilskins becoming covered in blood and bits of fish gut which can simply be rinsed away using the deck wash hose. Any buoyancy device will also become similarly soiled and hence it is essential that it can also be rinsed clean. Wipe clean fabrics will be desirable since, in addition to fish offal, they are liable to be soiled by grease, mud, tar and rust stains from wires etc.

10.2.5 Reliability

Automatic inflation devices rely upon a soluble bobbin which dissolves in water thereby allowing a spring loaded plunger to pierce a cylinder of CO_2 gas thus inflating the lifejacket/buoyancy aid. Although well proven and effective in operation these devices may be prone to false activation when stored in damp conditions.

A buoyancy device for use by fishermen must be able to cope with rain, spray and quite copious splashing from the deck wash hose. Therefore special provision must be made to guard against unwanted inflation. This may simply mean ensuring that the crew hang items up to drain correctly after they have become wet. Possibly, it will be necessary to change the soluble bobbin every few months. Alternatively, extra shielding may be required with moisture absorbing materials to keep the bobbin dry to ensure long term reliability.

10.2.6 Servicing

It is desirable that the design of the buoyancy device is such that it can be easily tested and repacked by the individual fisherman. Replacement cylinders and soluble bobbins must be made widely available in order that the fisherman can ensure that his own buoyancy device is in sound working order.

It can be argued that the buoyancy device should be returned to an authorised repair department to be checked by a competent person, as is required for DTp APPROVED inflatable lifejackets. However, this would not be favoured by many fishermen who may find the delay and expense troublesome. The buoyancy device is viewed as being a personal aid which will be in addition to DTp approved lifejackets. As such, the buoyancy device will be free of regulations, but even so, it is in the interests of both manufacturers and users that it can easily be maintained in effective working order. This can be best achieved by adopting a design which offers easy repacking with clear instructions along with inexpensive and freely available spares.

10.2.7 Price

"Price is not important when compared to the loss of a persons life". This statement can always be made when discussing the life saving equipment. However, in the context of a buoyancy device which is to be voluntarily purchased and used by the majority of fishermen, then the price is of great importance. It is of course true that some fishermen will fully appreciate the value of a buoyancy device that can be comfortably worn whilst working and hence, they will be prepared to pay the price for their own safety. Unfortunately, the vast majority of fishermen are not yet fully convinced of the need to wear a personal buoyancy device and would view a high price as justification for not using one. In our recent contacts with a wide variety of fishermen only a few thought that they would be prepared to spend £70-£80 on a single chamber inflatable lifejacket.

This reluctance to spend even modest sums of money on an item that may save their lives can and will be overcome by positive publicity and enthusiasm. Gaining acceptance by one group of fishermen will almost certainly lead to acceptance by other groups, thus eventually, resulting in widespread use of personal buoyancy devices.

10.3 Consideration of Available Items

In the light of the proceeding requirements it will be useful to consider the various items tested in order to identify which best suits the needs of fishermen. Approximate prices are given in order to give a comparison of cost but actual prices may vary considerably with different suppliers.

10.3.1 Work Vests: (Approximate price £23-£45)
Although the life saving capabilities were insufficient for an unconscious casualty, the concept of a work vest does offer a buoyancy device that is easy to wear and is unrestricting. It can be worn underneath sea gear and is sufficiently unobtrusive to be worn all times, whether in the wheelhouse or on deck.

10.3.2 Body Warmer Type Buoyancy Aids: (Approximate price £45-£60)
Again, although the life saving qualities are considered inadequate, this type of aid does find favour with fishermen because it is an attractive garment to wear and is particularly suitable for use in the wheelhouse.

10.3.3 Oilskin Top: (Approximate price £60-£70)
This item fulfils many of the desired requirements.It is unrestricting to wear, free of snag points, hard wearing and easy to clean. Although the level of buoyancy provided is minimal, the positioning of the buoyancy is such that it attempts to support the wearer in a correct attitude in the water. If the level of buoyancy can be substantially increased and automatic inflation included, then the oilskin top would have the potential to save the life of an unconscious person.

Perhaps the biggest potential advantage of a buoyancy device which is incorporated into an oilskin top is that; whenever the fisherman puts on his oilskins he is also putting on a life saving device. However, in warm weather conditions when the oilskin top may not be worn, the life saving device will also not be worn.

10.3.4 Single Chamber Lifejackets: (Approximate price £70-£90)
When equipped with automatic inflation these lifejackets do have the potential to save the life of an unconscious casualty. They have a good level of buoyancy and the necessary righting properties to turn the wearer into a face upward position. They are lightweight and comfortable to wear, without restriction and can be worn on top of whatever clothing is desired. Hard wearing outer covers are available to protect the inflation chamber but it may be necessary to add a PVC or similar coating to enable the lifejacket to be easily rinsed clean. Whilst many fishermen would have few concerns about the lifejackets snagging on fishing gear, fishermen working tangle nets have expressed an opinion that problems could be experienced with the fine monofilament and large meshes of their nets.

10.3.5 DTp UK Approved Inflatable Lifejackets: (Approximate price £150-£180)
Unquestionably, these lifejackets offer the best performance in terms of life saving capabilities. They are suitable for use whilst working but may prove to be restricting around the neck when worn on the top of oilskins. They are reasonable

free of snag points but the "velcro" fastenings which hold the lifejacket in its packed form may not prove to be totally effective after several months of use on deck.

Because these lifejackets are DTp approved they can be used to fulfil the dual purposes of abandon ship and personal buoyancy device. However in such cases they must be serviced by an authorised agent every 12 months.

10.3.6 Worksuits: (Approximate price £120-£150)
These suits are quite widely used in the offshore industry and also on some of the bigger fishing vessels operating in cold conditions where the thermal buoyant lining of the suits is ideal. Unfortunately, for the average UK fisherman the thermal lining makes the suit too hot to be worn whilst carrying out physical effort in all but extremely cold weather conditions.

An important advantage of the thermal properties of these suits is that they will combat the onset of hypothermia which becomes a vital factor if one is in the water for any length of time. The buoyancy level given by the suits is high but regrettably an unconscious casualty will not be correctly supported in the water and may well float face downwards.

10.3.7 Buoyant Thermal Undersuits: (Approximate price £80-£100)
These are ideal for cold conditions, they can be worn with whatever outer clothing one desires and they will combat hypothermia. Unfortunately, for most of the year the average UK fisherman may find them too hot to work in and most importantly, they are not suitable for an unconscious casualty.

10.3.8 Comment
From the foregoing brief appraisals of each item, it is fairly apparent that the only item which satisfies both the criterion of supporting an unconscious casualty and largely meets the fishermens requirements, is the single chamber, automatically activated, inflatable lifejacket. It compares well in most respects as follows:

Good lifesaving capabilities
Lightweight and easy to wear
Can be worn with all types of clothing
Suitable for both winter and summer use
Available with hard wearing outer covers
Reasonable priced

Areas of concern are:
Keeping the lifejacket clean
False activation
Snagging on gear and fittings

These areas of concern do not represent insurmountable problems and indeed many fisherman would find that they posed no difficulties whatsoever.

Keeping the lifejacket clean can be improved by the use of a wipe clean material for the outer cover. False activation can be avoided by sensible treatment of the lifejacket, especially if the manufacturers add moisture absorbing protection around the activation mechanism.

The problem of snagging on gear has yet to be proved. Until the lifejackets have been in use in the various types of fishery for a reasonable period of time, it is not possible to say definitely whether a snagging problem exists. Opinions given by fishermen who have used the lifejackets whilst carrying out potting and netting, express little concern about snagging. However, fishermen working tangle nets in the southwest refused to try the lifejackets because they believed that there would be a dangerous possibility of the netting snagging on the lifejacket.

Thus, although it can be concluded that the single chamber inflatable lifejacket offers the best, currently available, personal buoyancy device that can be recommended to the majority of fishermen, those who are working tangle nets and similar may well reject such lifejackets. A suggestion made by a group of southwest fishermen was that a buoyancy device should be incorporated into the bib and brace oilskin trousers that are worn by the majority of fishermen.

10.4 Buoyancy Devices Incorporated into Working Clothing

The concept of incorporating a buoyancy device into the oilskins worn by fishermen has much to recommend it:

- When putting on his oilskins the man, with no conscious effort, will also be putting on a lifesaving device.

- A fishermen normally wears his oilskins regardless of the weather conditions, whereas a separate lifejacket would probably be only worn on those occasions when the weather was bad.

- At the present time, lifejackets are perceived by many in the fishing industry as being non macho. A lifejacket incorporated into normal sea gear will be far more acceptable to the industry.

- A buoyancy device in built into oilskins would be protected from the damage that an external lifejacket would receive.

- Provided that the exterior of the garment can remain relatively un-altered, then the buoyancy device will not introduce the risk of netting and gear snagging on it.

Disadvantages of the concept are as follow:

- Oilskins often become torn and damaged but as they are relatively inexpensive it is quite economic to replace them as required. The addition of a buoyancy device will significantly increase the cost.

- Typically the sea gear used by fishermen consists of a two piece suit: bib and brace oilskin trousers with a jacket or a "gagoule" type oilskin top. The location of the buoyancy device poses a problem as follows:

  If the device is located in the oilskin top then it is likely that in warm dry weather conditions the top will not be worn and hence the buoyancy device will also not be worn.

  Incorporating the device as part of the bib and braces of the oilskin bottom would resolve the problem of the top not being worn. However, it will be difficult to ensure that there is sufficient space to allow an inflation device to function correctly when the oilskin top is being worn.

Despite the above disadvantages, the concept of a life saving device as part of the normal working clothing perhaps offers the most acceptable way to achieve wide spread use of buoyancy devices by fishermen.

The oilskin top, as featured in our tests, fulfilled many of the necessary requirements and it is quite feasible that with a little development work it could be made totally satisfactory. By the addition of expansion pleats in the chest and shoulder area it should be possible to install a much larger inflation bladder and this, coupled with automatic activation, would make the item suitable for the unconscious casualty.

As suggested by fishermen in the southwest, the concept of a life saving device incorporated into the bib and braces of the oilskin trousers would appear to be quite feasible. Indeed, the halter design of a single chamber lifejacket does lend itself to forming the braces of such a garment. It would also appear feasible that the buoyancy device could be made removable such that it can be interchanged when the oilskins become damaged.

Whether an inflation device as part of the trousers would work effectively when an oilskin top was being worn, is a question that must be resolved. Perhaps the top can be designed to expand or possibly press stud or zip fastenings can release to accommodate the inflated bladder. It may well be sufficient to just simply use a larger sized oilskin top.

Even if it proves impossible to develop a successful jacket and trousers combination, the development of buoyancy devices in both garments is worthy of achievement as fishermen will then have the choice of selecting one or the other, as they see fit. The oilskin top with buoyancy device for winter or wet weather conditions and the trousers with buoyancy device for summer use only.

11. Conclusions

11.1 Of the various products, that are currently being offered as personal buoyancy devices, only those items that can be described as being lifejackets can be recommended for use by fishermen. Although many items, such as work vests and body warmers, are

attractive and easy to wear they lack sufficient buoyancy and the righting capabilities to support an unconscious person in a face upward position.

11.2 The ability to correctly support an unconscious casualty, in a face upward position is viewed as being a necessary requirement, both because of the number of occasions when men are knocked overboard and are unconscious on entering the water but also because hypothermia can quickly cause a person to lapse into an unconscious state.

11.3 Aside from adequate life saving capabilities, a buoyancy device needs to have features which make it suitable for use in fishing, features such as being:

free of snag points;
unrestricting;
hard wearing;
easy to clean etc.

11.4 In considering the existing products available, in the light of fishermen's requirements, it is apparent that the single chamber inflatable lifejacket is the most suitable item. However, although this type of lifejacket may be suitable for many fishermen, opinions have been expressed that it may not be totally snag free.

11.5 Items that may well prove to be more acceptable to the fishing industry than lifejackets are oilskin clothing items which incorporate a buoyancy device. An existing oilskin top with an inbuilt buoyancy aid is worthy of further development and the concept of bib and brace trousers which have a buoyancy device that forms the braces is also very promising. We would positively recommend the the concept of the bib and brace trousers since these are likely to be worn at all times. Whereas, the oilskin top will not always be worn.

Figures

PERRY-HARISHOK
'Allsport'

PERRY-HARISHOK
'Bubble Vest'

TYCO
'Buoyancy Vest'

CREWSAVER
'Industrial Buoyancy Aid'

PERRY-HARISHOK
'Work Vest'

WORK VESTS **Fig.1**

GUY COTTEN
Behring Flotation Waistcoat

GUY COTTEN
Skipper Flotation Waistcoat

GRUNDEN'S
Stormy Seas Jacket

FLOTATION WAISTCOATS AND OILSKIN TOPS **Fig.2**

ASPLI *'A36'*

PERRY
'Lifestyle'

AIR SAFETY PRODUCTS
'Challenger
Commercial Fishermens'

CREWSAVER
'Crewfit'

REMPLOY
'Commodore II'

SINGLE CHAMBER INFLATABLE LIFEJACKETS **Fig.3**

LIFEGUARD *LG 1168*
Twin Compartment Auto Lifejacket

CREWSAVER
Seafire Solas
Twin Chambered Automatic Lifejacket

DTp (UK) APPROVED INFLATABLE LIFEJACKETS **Fig.4**

MULLION
2 Piece Suit

COSALT
'Cormorant Suit'

MULLION
'Workability' Under Suit

MULLION
x 4 Suit

BUOYANT THERMAL WORKSUITS **Fig.5**