

# Supplementary Material for: Factors influencing the time required to don thermal protective immersion suits correctly

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This document presents supplementary material for Azizpour, et al., [S1] relating to the experimental donning trials, the experimental methodology employed in the study, the packaging of the thermal protective immersion suit (TPIS), the participant questionnaire and the response to the participant questionnaire.

## S1: The Trial Procedures

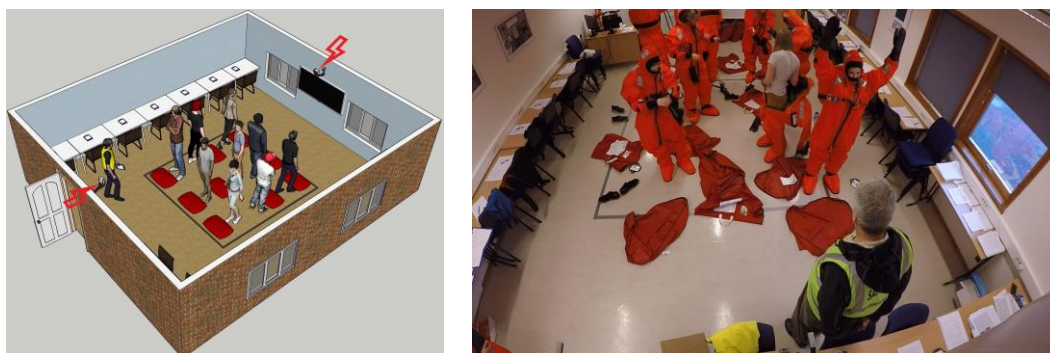
The donning trials were conducted at two shore-based facilities, the ARCOS safety centre in Tromsø and the ResQ safety centre in Haugesund. In total, 84 volunteers participated at the ARCOS safety centre and 24 at the ResQ safety centre. Upon the arrival of the participants at the trial location, participants went through a registration process which included completing the pre-trial questionnaire and consent form, and participants were then given a group safety briefing. At registration, each participant was issued a unique identification number which was used to track their performance. Participants were also instructed to remove coats and jackets and to leave all personal belongings behind, prior to being escorted to the trial area.

During the registration process, the air temperature within each test facility was noted and was found to be in the range of 18 ° to 22 °C. Once the registration process was completed, participants were escorted to the trial location and positioned within a square area of 3m × 3m marked on the floor. To ensure that the minimum space requirement in SOLAS was met (0.35 m<sup>2</sup>/person) [S2], a maximum of 15 participants were allowed to don the TPIS inside the aforementioned area although in practice, the number of participants in the square varied between 1 to 13 persons at a time (see Figure S1). The TPIS within its carry bag was placed on the floor in front of each participant. Once the participants were positioned, a member of the trial team set the scene for the trial and provided the trial instructions using a pre-defined script. Participants were instructed to imagine that they were at sea on board a passenger ship sailing in polar waters and the evacuation alarm had just been sounded. The participants were told that they had to don the suit as quickly and as correctly as possible so that they would be ready to safely evacuate the vessel. The task would start once the instructor yelled “GO” and the end point was defined as the time that the participant raised their arms above their head, indicating that they had completed the task and donned the suit as best as they could (see Figure S1b).

Prior to starting the trials, a sub-group of randomly selected participants were shown a two-minute instructional video demonstrating the correct donning procedure. In total 19 participants were shown the video demonstration. The donning process was undertaken by a professional instructor demonstrating how to unpack a brand-new suit and don it quickly and correctly. This

sub-group consisted of 10 male and 9 female participants aged between 18 to 72 years.

In addition, written instructions (provided by the manufacturer) were available to all participants through a laminated sheet located prominently on the suit carrying cover (see Figure S3). Participants were not permitted to read the instructions prior to the start of the trial. The participant’s donning performance was recorded throughout donning trial using two GoPro Hero cameras (frame rate of 25 FPS). The cameras were positioned to capture the performance of participants in two opposite directions (see Figure S1). A range of quantitative and qualitative data was collected during the trials through video footage and questionnaires. Demographic data and information relating to prior experience of the participants were collected through the pre-trial questionnaire while qualitative data concerning the participants perception of the ease of donning and suggestions to improve the TPIS design were collected through a post-trial questionnaire (see Figure S4). Quantitative data concerning donning correctness and speed of donning was collected through analysis of the video footage.

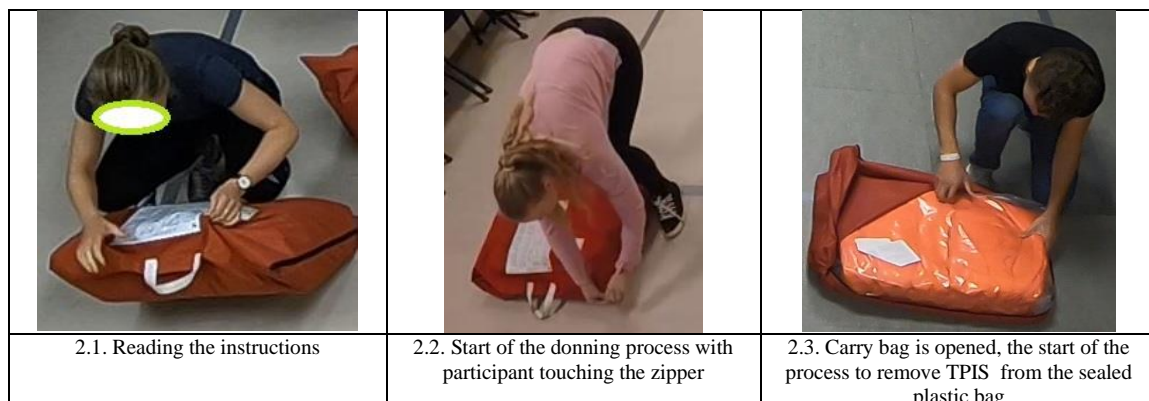


(a): Location of cameras and participants

(b): View from one of the cameras

Figure S1: Position of cameras and participants in the 3m x 3m square in the room

Presented in Figure S2 are example frames extracted from the trial video footage highlighting important behaviours noted during the donning trials. The images demonstrate examples of participant behaviour as they read the instructions (Figure S2.1), unpack the TPIS (Figure S2.2 to Figure S2.4) and attempt to don the suit (Figure S2.5 to Figure S2.15).



		
2.4. End of removing TPIS from the plastic bag	2.5 Donning while seated on the floor	2.6. Participant looking at others for guidance while attempting to don
		
2.7. Participant preparing long hair prior to donning hood	2.8. Removable neoprene gloves	2.9. Adjusting internal length straps
		
2.10. Pulling up the zipper	2.11. A participant wearing glasses attempting to pull up the zipper over the chin area	2.12. Adjusting wrist straps
		
2.13. Chest buckle (undone)	2.14. Ankle straps correctly adjusted	2.15. End of donning process

Figure S2: Examples of participant behaviour during donning trials

Prior to the start of the experiments, an application for ethical approval for the research was sent to the Norwegian Centre for Research Data (NSD). All appropriate measures were taken to ensure the safety and anonymity of participants. Participation in the trials was completely voluntary and the participant could withdraw from the trials at any time.

**S2. TPIS donning instructions**

Presented in Figure S3 are the instructions for the TPIS which can be found on the packaging for the TPIS.

Type / Design / Dessin P55002  
 Universal / Universal / Meðalsstær 8  
 Hæðir / Height / Hæð: 140-200 cm  
 Vægi / Weight / Þyngd: 50-100 kg

**VIKING**

SOLAS Redningsdragt  
 SOLAS Immersion Suit  
 SOLAS Björgunarbúningur

**Brugervejledning**

1. Tag hovedbeklædning og fodtøj af.
2. Tag dragten på - benene først.
3. Tag hæften på.
4. Justér stropperne indvendigt i dragten for tilpasning af dragtens længde.
5. Luk frontlåsene.
6. Sæt D-ringen i karabinhagen foran på brystet.
7. Tag hænderne på.
8. Spring i vandet med benene først. Sørg for at ligge på ryggen.

**Veðligeholdelse**

EFTIR BRUG Í VANDIÐ

1. Dragtinn skal alltaf skyllast í ferskvæni á útvendri hliði.
2. Dragtinn hænges til tæru og udluftes på en breð þöjle.
3. Når dragtinn er fullstændigt tær, kan den pakkes ned eller opbevares på en breð þöjle.

**PAKNING AF DRAGT**

1. Læg dragten fladt på gulvet. Åbn låsen.
2. Læg fødderne op til ærmerne. Bøj hæften ned.
3. Læg ærmerne over hæften.
4. Fold dragten sammen.
5. Læg dragten i emballagen.

**INSPECTION**

1. Standard pakkeðe dragter: Dragtinn bær minimum checkes mánaðlegt í henhold til IMO MSC/Circ. 1047. Ved dette mánaðlige eftersyn skal frontlåsinn smæres með veðlagte smøremiddel.
2. Dragter pakket í lufttæt emballage: I.h.t. IMO MSC Cir. 1047 skal dragtinn checkes mánaðlegt. Þá Producentens anbefaling MSC Cir. 1047, hvis emballagen checkes mánaðligt og embalgan er intakt og lufttæt. Hvis der siver luft ind i emballagen, kan dragtinn inspicerast som en standard dragt eller sendes til en autoriseret servicestation for ompakning.

**SERVICE OG REPARATION**

Dragtinn bær minimum eftersyn þvert 3. ár í henhold til IMO MSC/Circ. 1114. Reparationer bær foretugas på en godkendt servicestation.

**SÆRLIGE FORHOLD**

Ekstra slitdage kan forekomme ved brug af dragtinn om bord på en gummibåt með skridsikre bundbræðder. Undersög den derfor omhyggeligt eftir brug, og send den om nødvendig til en godkendt servicestation. Dragtinn opbevares kallið, mærk og tært - líkka í minningradar.

**INSTRUCTIONS for Use**

1. Remove hood and footwear
2. Don the suit - legs first.
3. Put on the hood.
4. Tighten the foot straps.
5. Zip the front zipper.
6. Fit the D-ring into the snap hook across the chest.
7. Don the gloves.
8. Jump into the water - feet first. Turn onto your back.

**Maintenance**

**AFTER USE**

1. Rinse the exterior of the suit in fresh water.
2. Hang the suit to dry on a wide hanger and air it.
3. When the suit is thoroughly dry, pack it or keep it on a wide hanger.

**PACKING THE SUIT**

1. Place the suit flat on the floor. Unzip.
2. Fold the feet and legs up into the sleeves. Fold the hood down.
3. Place the sleeves across the hood.
4. Fold up the suit.
5. Place the suit into the bag.

**INSPECTION**

1. Standard packed suits: The suit should be checked at least once a month, in accordance with IMO MSC/Circ. 1047. At the time of this monthly overhaul, the front zip must be lubricant with the enclosed lubricant.
2. Suit packed in a sealed airtight poly bag: Acc. to IMO MSC Cir. 1047 the suit should be checked monthly. It is the suppliers recommendation that if the airtight packing is checked monthly and found to be intact and not leaking air, the guidelines of IMO MSC Cir. 1047 are fulfilled. If the airtight bag is leaking air, the suit can be checked lika a standard suit or send to an authorized servicing station for repacking.

**SERVICE AND REPAIR**

The suit should be inspected at an approved servicing station at least every third year in accordance with IMO MSC/Circ. 1114. Repairs should be carried out by an approved servicing station.

**SPECIAL CONDITIONS**

Wear and tear may occur when working on board rubber boats with non-skid floor boards. So check your suit carefully after use and if necessary hand it in for inspection at an approved servicing station. Store the suit in a cold, dark and dry place - in temperatures above freezing.

**APPROVAL**  
 Council Directive 96/98EC on Marine Equipment.

**Notkunareglur**

1. Taktu af þér höfuðfátnað og farðu úr skófatnaði.
2. Farðu á búninginn - skáfmarnar fyrst.
3. Settu á þig hettu búningssins.
4. Spennu reismarar um skikkán búningnum svo þær þróa.
5. Lokaðu remlásinn um hálsinn.
6. Komdu D-lagada hringnum fyrir á gikknum þversum um hlystina.
7. Farðu á hanskana.
8. Hoppaðu í vatnið með fætturna á undan. Liggðu á bakinu.

**Viðhald**

**EFTIR NOTKUN**

1. Hreinsaðu búninginn úr atundverðu með freinu vatni.
2. Hengdu búninginn til berris á stóru herbratré svo lofti um hann.
3. Þegar búningurinn er orðinn alveg má pakka hann niður, eða láta hann hanga á herbratré.

**HVERNIG LEGGJA Á BÚNINGINN?**

1. Leggdu búninginn sléttan á gólf. Opnaðu remlásinn.
2. Þrjúttu skáfmarnar upp að ermum leggðu hettuna niður yfir búið.
3. Leggdu ermarnar yfir hettuna.
4. Þrjúttu búninginn saman.
5. Leggdu búninginn í pokann.

**EFTIRLIT**

1. Staðal pakkaðir búningar: Athugið búninginn í það minn sinni í mánuði í samræmi við MSC/Circ. 1047.
2. Búningar pakkaðir í lolaða lofatageymslupoka: Samkvæmt umbóðsbréfi í Cir. 1047 skal athuga þjó búninga mánaðlega. Þá til máli framleðandans af umbóðir séu heilar og þá nauðsynlegt að uppfylla IMO MSC Cir. 1047. Ef lo umbóðir hafa verið björð eða senda hann til skoðunar víðurkennðri skoðunarst.

**ÞJÓNUSTA OG VIÐGERÐ**

Búninginn verður að send hjá vörkennðu þjónust minnsta þrjúttu hvert ár í við IMO MSC/Circ. 1114, að láta fara fram hjá við þjónustuveri.

**SÉRSTAKAR AÐSTÆÐUR**

Slit og eyðileggingar geta fyrir þegar umnið er um B gummibátum með skrid botnflöjum. Eftir slíka m að athuga búninginn og ef þörf krefur að skoðunar hjá við þjónustuveri. Ge búninginn á k þurrum stað m frostmarki.

**SAMPYKKT**  
 Tillskipun 96/98EC

0200

Figure S3: The donning instruction which was laminated on the suit carrying cover and available to all participants

### S3. Participant post trial questionnaire.

On completion of the trial, participants were requested to complete a short questionnaire designed to identify their previous experience in donning TPIS and also their experience of donning the TPIS during the trial (see Figure S4).

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Date: \_\_\_\_\_  
No: \_\_\_\_\_

**ARCEVAC Questionnaire – Putting on the survival suit**

As part of the research component of the exercise that you just participated in, the ARCEVAC team would greatly appreciate if you could complete the following questionnaire. Your contribution to this research will improve passenger safety and survivability in the extreme conditions associated with evacuation in Polar waters.

Please note that there are NO right or wrong answers, we want your honest opinion to all the questions.

Please check  a single answer for each question, unless instructed otherwise.

Once completed please return this questionnaire to a member of the research team.

1) Have you worn this type of survival suit before? Yes  No

2) How easy was it for you to put on the survival suit?

Very difficult   
Difficult   
Neither difficult nor easy   
Easy   
Very easy

3) Would you have found it easier to put on the survival suit if:

a) You were given verbal instructions? Yes  No  Don't Know   
b) You were shown a visual demonstration? Yes  No  Don't Know   
c) Someone physically assisted you? Yes  No  Don't Know   
d) Some other aspect, please explain: \_\_\_\_\_

4) Imagine you were at sea and experiencing rough conditions. Do you think this would have an impact on how quickly you could put the survival suit on?

No influence   
Would increase time slightly (less than double)   
Would increase time significantly (more than double)   
Don't know

Any other comments: \_\_\_\_\_

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Date: \_\_\_\_\_  
No: \_\_\_\_\_

5) Do you think wearing the survival suit will have an impact on your ability to walk along a corridor?

Yes   
No   
Don't know

6) Do you have any suggestions as to how to improve the survival suit? For example, changes to the design that could make it easier to put it on?

\_\_\_\_\_

7) Please feel free to write any additional comments:

\_\_\_\_\_

Please return this questionnaire to a member of the research team.

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Figure S4: Post-trial questionnaire used in donning trials

#### S4. Importance of the donning error associated with shoe removal.

To quantify the impact of background and randomised variables (see Table 4 in [S1]) on the probability of removing shoes (PRS), binary logistic regression [S3] was used. Only the preparation time, PT ( $x_1$ ), method of instruction ( $x_2$ ) and experience ( $x_3$ ) were found to be significant. Furthermore, as previously suggested, video instruction (VI) had the most significant influence on PRS while experience (E) was the second most significant variable. In addition, duration of the preparation time also appeared to have significant impact on the PRS. The result of the log-logistic regression ( $R^2 = 23.5\%$ ) is presented in Eq. S1) while presented in Table S1 is the description and effect of the significant variables according to their corresponding coefficient in Eq. S1).

$$PRS = \frac{1}{1+e^\gamma}, \text{ where } \gamma = 1.27 - (0.15 * x_1) - (3.7 * x_2) - (1.07 * x_3) \quad (S1)$$

Table S1: Contributing factors and change in the PRS given one unit increase in each of the influencing variables (when all other variables are fixed)

Variable	Coefficient	Standard Error of Coefficient	Increase in PRS per unit increase of $x_i$ when all $x_i$ initially set to 0	P-value
$x_1$	-0.15	0.07	Approximately +3% per second preparation time	0.03
$x_2$	-3.7	1.1	+70% with Video Instruction	0.001
$x_3$	-1.07	0.46	+22% with donning experience	0.02

From Eq. (S1), a group of people exposed to written instruction (WI) ( $x_2 = 0$ ), with no experience (NE) ( $x_3 = 0$ ) and a PT of  $x_1 = 0$  s (i.e., insufficient time to read instructions) will

have a PRS of 22% ( $PRS = \frac{1}{1+\exp(1.27)} = 0.22$  from Eq. (S1)). However, if the same group has a PT of 10 s (i.e., has more available time to read the instructions), then they are expected to have a PRS of 56% ( $PRS = \frac{1}{1+\exp(1.27-1.5)} = 0.56$ ). Furthermore, to achieve a 95% probability of removing their shoes, the WI group with NE requires at least 28 s preparation time.

The variation of PRS with preparation time for various groups as determined by Eq. S1 is depicted in Figure S5. As can be seen from Figure S5, for a given preparation time those with WI and NE always have a lower PRS on average than those with VI and NE. For a PT of up to 20 s, the PRS for the VI and NE group is considerably larger than that for the WI and NE group. While having experience improves the PRS for the WI group, the improvement is marginal. The same caveats should be noted when interpreting S5 as those for Figure 8 in [S1]. Furthermore, for the VI group none of the participants has a preparation time of greater than 2 s and so the curve is essentially a model extrapolation (hence shown as a dashed line). However, Figure S5 shows the considerable advantage of VI for those with NE in terms of ensuring that participants remove their shoes prior to donning.

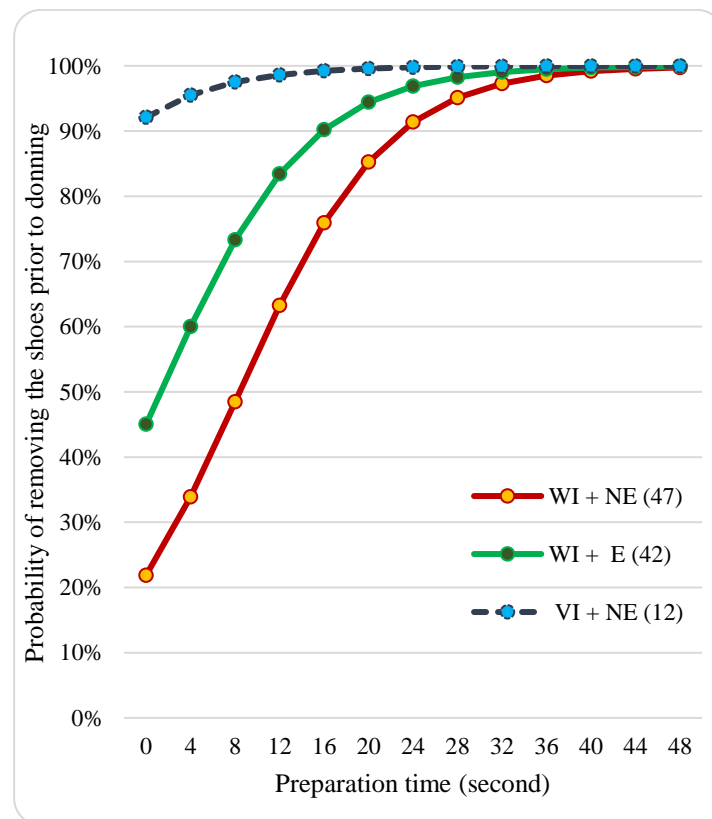


Figure S5: Probability of removing shoes prior to donning as a function of preparation time for various methods of instruction and experience

Concerning the impact of WI on the propensity for participants to remove their shoes prior to donning, it is assumed that participants will read the written instructions during the preparation phase. As described in Section 4.3 of [S1], the average time spent in the preparation phase was short, being only 2.3 s, with a range from 1 s to 35 s, with most participants merely glancing at the instructions placard prior to beginning to open the carry bag. Nevertheless, all participants had the opportunity to read the written instructions and so could have read the instructions prior to attempting to don the TPIS. Furthermore, we cannot judge the level of thoroughness of the reading, or the level of comprehension achieved by those who may have read the instructions. All that can be determined with certainty is the amount of time each participant spent during the preparation phase. It could be argued that this type of behaviour is typical of how many people

tend to respond, with few attempting to thoroughly read instructions prior to operating a new device, especially if the operation of the device appears intuitive, e.g., putting on a pair of coveralls. Thus, the results relating to the performance of the ‘written instruction’ group could be argued to be representative of reality.

### S5. Participant post trial questionnaire.

Following the trials, 108 participants completed the post-trial questionnaire, representing a 100% completion rate. Question 1 related to establishing whether the participants had prior experience of donning a TPIS, the results of which are discussed in [S1]. Questions 2-5 were closed questions related to the experience of the participants while donning the TPIS while questions 6 and 7 were open questions.

The first question relating to the donning experience concerned the ease of donning (see question 2 in Figure S4). The vast majority of the male participants (47.9% or 34) said that the TPIS was Easy/Very Easy to don, with only 18.3% (13) suggesting that it was Difficult/Very Difficult (see Table S2). This is in contrast to the female participants, the majority (37.8% or 14) of which suggested it was Difficult/Very Difficult with only 18.9% (6) saying it was Easy/Very Easy (see Table S2). The difference between the male and female response was determined to be significant using a Kruskal-Wallis test (P-value = 0.004). These results are consistent with the observations that the net donning time (NDT) was related to gender, with males donning the TPIS some 29% quicker than females on average (see [S1], section 4.3). This is further supported through a Mann-Whitney test that showed that those who found the suit Easy/Very Easy to don managed to don the suit significantly faster than those who found it difficult to don (P-value < 0.001).

Table S2: Response to question 2 related to ease of donning

Influence / Gender	Very Difficult	Difficult	Neither Difficult nor Easy	Easy	Very Easy
Males	1.4% (1)	16.9% (12)	33.8% (24)	42.3% (30)	5.6% (4)
Females	2.7% (1)	35.1% (13)	43.3% (16)	16.2% (6)	2.7% (1)
Total	1.9% (2)	23.2% (25)	37.0% (40)	33.3% (36)	4.6% (5)

The second question relating to donning experience concerned the method of instruction and enquired if verbal, visual or physical instruction would have been helpful during the donning process (see question 3 in Figure S4). Approximately 80% (88) of participants felt that a (live) visual demonstration would have been helpful and almost two thirds (66.4% or 71) felt that verbal instructions during the donning process would have been helpful, while half (50% or 54) suggested that physical assistance would have been helpful (see Table S3). In each case, females were more in favour of the additional method of instruction than the males.

Table S3: Response to question 3 related to alternative methods of instruction

Method of instruction	Gender	Yes	No	I don't know
Verbal instruction	Males	64.8% (46)	21.1% (15)	14.1% (10)
	Females	69.4% (25)	16.7% (6)	13.9% (5)
	Total	66.4% (71)	19.6% (21)	14% (15)
Visual demonstration	Males	76.1% (54)	5.6% (4)	18.3% (13)
	Females	91.9% (34)	2.7% (1)	5.4% (2)
	Total	81.5% (88)	4.6% (5)	13.9% (15)
Physical assistance	Males	46.5% (33)	40.8% (29)	12.7% (9)
	Females	56.8% (21)	24.3% (9)	18.9% (7)
	Total	50% (54)	35.2% (38)	14.8% (16)

The high rate of request for additional methods of instruction reflects the inherent difficulty experienced by the participants in donning the TPIS. Furthermore, the higher proportion of females requesting the additional method of instruction reflects the greater difficulty experienced by females in donning the TPIS – which is reflected in the longer donning times experienced by females. This suggests that in practice passengers should not be left to their own devices to don the TPIS, additional instruction over that provided by the written and video instruction is desirable.

The donning trials were conducted in ideal laboratory conditions, without the impact of a pitching deck or adverse vessel orientation (heel or trim) that could be expected in an emergency situation. Participants were asked about their opinion of whether their donning performance would be likely to be negatively impacted by such adverse conditions (see question 4 in Figure S4). Virtually all the participants (95.3% or 103) thought that their donning time would be increased, with almost half (48.1% or 52) suggesting that their donning time would increase significantly, i.e., more than double (see Table S4). This opinion reflects the inherent difficulty that the participants experienced in donning the TPIS.

Table S4: Response to question 4 related to participant perception of impact of rough weather on the donning performance

Influence / Gender	Increase significantly (more than double)	Increase slightly (less than double)	No influence	I don't know
Males	40% (28)	53% (38)	4.3% (3)	2.7% (2)
Females	64% (24)	36.0% (13)	0% (0)	0% (0)
Total	48.1% (52)	47.2% (51)	2.8% (3)	1.9% (2)

Participants were also asked about their opinion concerning whether they felt that wearing the TPIS would impact their walking speed (see question 5 in Figure S4). Virtually all the participants (78.5% or 84) thought that the TPIS would impact their walking speed, with more females (86.5%) than males (74.3%) believing that the suit would have an impact (see Table S5). This is probably due to the ill-fitting nature of the one-size fits all TPIS and the poor fitting of the footwear associated with the suit (see response to questions 6 and 7 below). It is also worth noting that the perception of the participants is supported by experimental analysis, where wearing a TPIS of the type used in the donning trials reduced walking speeds by 6.1% at 0° of heel, increasing to a reduction of 24% at 20° of heel [S4]. Furthermore, females were more severely affected than males, with the reduction in walking speeds for females being 6.8% more severe than that for males at 0° of heel [S4].

Table S5: Response to question 5, participant perception of the impact of the TPIS on walking speed

Gender	Yes	No	I don't know
Males	74.3% (52)	20% (14)	5.7% (4)
Females	86.5% (32)	8.1% (3)	5.4% (2)
Total	78.5% (84)	15.9% (17)	5.6% (6)

In addition, participants were requested to suggest how the TPIS design could be improved (see question 6 in Section S3) or if they had any other comments concerning the TPIS and the donning process (see question 7 in Section S3). Their responses are collated and summarised below. These comments provide useful insight into issues concerning the design of the particular TPIS tested that detrimentally impacted donning and which should be addressed to improve donning ease.

**(a) Issues associated with the hood**

The TPIS hood is designed to cover the whole neck and head including ears, forehead, cheeks, and jaw. The hood has a rubber seal which sits around the face. Female participants with long hair commented on the difficulty of tucking their hair into the hood while men commented on the



difficulties with the face seal. 18.9% of females struggled with tucking their hair in the hood while this was not issue for any of the male participants.

**b) Issues associated with the gloves**

Many participants commented that they struggled putting on the gloves due to the friction between their skin and the inner layer of the gloves.

**c) Issues associated with ankle straps and TPIS shoes**

Due to the universal size of the TPIS design, the suit shoe is very large. The ankle straps are intended to keep the shoe in place. However, participants (particularly females) commented that as the shoe was too large, their feet would easily slip in the shoe while walking, creating a misstep hazard. Furthermore, participants commented that the Velcro fasteners were inadequate, often coming undone and getting entangled, potentially creating a trip hazard.

**d) Issues associated with the zipper**

While the zipper appeared to be a familiar and easy device to operate, it proved challenging for many of the participants particularly females. 19.7% of males struggled with pulling up the zipper while 37.8% of the females struggled with pulling up the zipper. Participants had difficulty in manipulating the zipper tracker and often had to bend at the abdomen to locate the tracker due to the bunching of the suit material. From the video analysis it appeared that participants had difficulty in pulling the tracker and sealing the suit when in this semi-bent position. Furthermore, video analysis suggested that participants experienced difficulty in pulling the tracker to seal the suit if the zipper threads were not aligned (see Figure S2.10). In addition, participants noted that it was difficult to pull the zipper over their chin due to the tight fit of the face seal (Figure S2.11).

**e) Issues associated with the wrist straps**

The wrist straps are required to tighten the rubber seal around the wrists. Two straps were provided on each sleeve. One for tightening the wrist rubber seal and the second to secure the gloves. Participants found it too complex as the Velcro on the straps kept tangling up, causing inconvenience during donning. Even though it was not clear in the written instruction that the hand straps needed to be fastened (see Section S2), many of the participants fastened the wrist straps by intuition. About 47% of males and 32% of females failed to fasten the wrist straps.

**f) Issues associated with the inside straps**

Due to the universal size of the TPIS design, the suit had two internal straps (located on each side) enabling the wearer to adjust the length of the suit. Participants who did not adjust the size of the suit using the internal straps, complained that the suit was too large which adversely impacted their mobility. Some of those who adjusted the length of the suit using the internal straps, commented that the bunched fabric around their gusset and thigh made walking difficult. Many of the participants also commented that the internal straps were not easy to see and in low light conditions would be almost impossible to locate. Participants suggested incorporating a reflective patch on the straps to make them more visible.

**g) Issues associated with the donning instructions**

Donning instructions were in Danish, English, and Icelandic together with instructions for maintenance, packaging, service, and repair as well as inspection, all on a large single page secured to the TPIS carry bag (see Section S2). Participants commented that the donning instructions were difficult to identify and read due to the small font size, small pictograms, and large amount of irrelevant material. They also noted that the need to remove shoes prior to donning was not highlighted and felt that this should be emphasised.

## References

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