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Advanced Technology Evaluation of Occupational Health Dynamics QuantiFit2® Virtual Operator System

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Final Report

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14. ABSTRACT
711 HPW/RHBAF evaluated the Occupational Health Dynamics (OHD) QuantiFit2® Controlled Negative Pressure (CNP) stand-alone (virtual operator) gas mask fit-testing system to assess user interface and evaluate whether human behavior during the self-guided protocol would negatively affect results. The evaluation was performed at Mansfield-Lahm ANGB on 5-8 August 2022. AFMSA/SG3PB is considering implementing the OHD QuantiFit2 stand-alone system as a quantitative fit (QNFT) alternative to the TSI M41 PATS Mask Fit Tester. Demonstrations resulted in over 79 – 86% passing fit-factors using the stand-alone system. The QuantiFit2 stand-alone system appears to allow personnel to successfully fit-test themselves for a majority of individuals, with the option available for BE assistance for those that are unable. Finally, 711 HPW/RHBAF has no objections regarding the Air Force's developing policy of implementing the stand-alone QuantiFit2 system for M50 gas mask fit-testing.

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1.0 SUMMARY

The Air Force Research Laboratory's (AFRL) Force Health Protection Section (711 HPW/RHBAF) was requested to conduct an independent, third-party evaluation of Occupational Health Dynamics' (OHD) QuantiFit2® automated stand-alone (virtual operator) gas mask fit-testing system. The purpose of the assessment was to assess its user interface and evaluate whether "human behavior" during the self-guided fit testing protocol would negatively affect results.

711 HPW/RHBAF evaluated the QuantiFit2 stand-alone system during the 5-7 August 2022 drill weekend at Mansfield-Lahm Air National Guard Base (ANGB),OH. Twenty-nine of the 35 participants fit-tested passed with a fit factor over 1000 for the M50 gas mask using the self-guided system. The average time to successfully complete the testing was just under 7 minutes. All 35 participants were able to pass using the QuantFit2 (self-guided or proctored). Feedback from the participants was overwhelmingly positive.

711 HPW/RHBAF did not observe any reason why participants (self-guided and proctored) that obtained a passing fit factor over 1000 should not have passed. There were no indications that participants negatively affected the results. The self-guided system was able to provide effective instructions for each member to properly perform the fit-test protocol. All passing participants properly donned appropriately-sized masks and successfully performed all aspects of the approved fit-test protocol. 711 HPW/RHBAF has no objections regarding the Air Force's developing policy of implementing the QuantiFit2 virtual operator system for M50 gas mask fit-testing. Some suggestions for improvement are listed below and provided with more details at the end of the report.

- Add an option to retest using a different size mask
- Add more auditory prompts at the beginning and during each individual fit-test step
- Add instructions for individuals to place their hands on their knees during the steps where they bend at the waist
- Standardize the video's volume and provide a capability to adjust it
- Add a mirror to the self-guided testing sites
- Consider sensors in future iterations to monitor head and body positions during each fit-test step

2.0 INTRODUCTION

Air Force Medical Readiness Agency's Bioenvironmental Engineering (AFMRA/SG3PB) established a strategic goal of Bioenvironmental Engineering (BE) Transformation, to include optimization and restructuring of BE programs. One target for optimization has been gas mask fit-testing. BE personnel have dedicated valuable manhours in support of DoD and AF readiness requirements for fit factor testing of military gas masks. However, there has been significant manpower spillage due to misplaced fit-test documentation, weight gain/loss and facial changes. In addition, there are time delays associated with room preparation as well as members not complying with requirement to not eat, drink, smoke or chew gum prior to testing. This time commitment has been especially difficult for Air National Guard (ANG) and Air Force Reserve Command (AFRC) BE personnel, who must dedicate valuable training time during limited activation hours to fit and document all respective personnel.

OHD had already approached AFMRA/SG3PB about their QuantiFit2 technology employing controlled negative pressure (CNP) to conduct gas mask fit testing. The QuantiFit2 Respirator Fit Test System is currently used in industry for fitting commercial masks to individuals in an employer's workplace respiratory protection program using an US Occupational Safety and Health Administration (OSHA)-accepted CNP Quantitative Fit Testing (QNFT) protocol. Although 'military unique' mask fit testing is not governed by OSHA, CNP QNFT being an OSHA approved method for industrial respirator fit-test suggests the technology has merits that warranted an evaluation for military application.

The testing and establishment of a 1000 fit-factor (FF) was validated in a 2019 study by the U.S. Army Combat Capabilities Development Command (CCDC), Chemical Biological Center, Test, Reliability & Evaluation Branch (TREB). In August 2021, Naval Sea Systems Command, Department of the Navy authorized the use of the QuantiFit2 Respirator Fit Test System using CNP fit test method technology to conduct QNFT of M50/M51/M53/M53A1 Masks, in lieu of the MK 46 Joint Service Mask Leakage Tester (JSMLT) or TSI M41 Protective Assessment Test System (PATS) following a protocol developed by OHD. This technology reduces time required to conduct gas mask fit-testing in comparison to the aerosol condensation nuclei counter (CNC) method currently employed. In addition, a self-guided system was developed with a goal of reducing over 70 percent (%) manhours spent on BE-led gas mask fit-testing. It was requested that 711 HPW/RHBAF conduct an observation as an independent third party during the 5-7 August 2022 demonstration at Mansfield-Lahm ANGB to evaluate efficacy and identify issues.

OHD went to five different bases to demonstrate and test their stand-alone QuantiFit2 system. In addition to Mansfield, they visited Tulsa ANGB in Tulsa, Oklahoma, Rosecrans ANGB in St. Joseph, Missouri, Grissom Air Reserve Base near Kokomo, Indiana, Travis Air Force Base in Fairfield, California, and Mansfield-Lahm ANGB in Mansfield, Ohio. They were accompanied by various members of AFMRA/SG3PB, ANG/SGPB and AFRC/SG3PB. 711 HPW/RHBAF observed the evaluations at Rosecrans and Grissom and was provided data from the Tulsa and Travis efforts. Figures 1 and 2 show the system set up as being demonstrated by one of the 711 HPW/RHBAF researchers.

Figure 1: Demonstrating the use of the OHD QuantiFit2 fit test system for a gas mask

Figure 2: Overall fit factor is displayed following the fit test

3.0 METHODS

AFMRA/SG3PB requested that AFRL observe OHD's evaluation in a third-party role. This beta testing provided a more real-world setting and any information gained by OHD would help prepare them to further develop the Quantifit2 device. In preparation for the final testing at Mansfield-Lahm, OHD sent teams to two different bases simultaneously on weekends in June and July 2022. The first weekend of beta testing was done at Tulsa and Rosecrans on 3-5 June. The weekend of 8-10 July, teams were at Grissom and Travis. The final evaluation was set up for 5-7 August 2022 at Mansfield-Lahm. Slight changes were made to the software and device set-up prior to and after the testing at each site. No changes were made to the individual fit-test exercises of the QuantiFit2.

The first beta testing weekend 711 HPW/RHBAF attended Rosecrans, groups of 1 or 2 individuals were led into a room and told they would be beta testing a device for gas mask fit testing. If the testing stopped due to a previously recognized and documented software error, the error was noted, system restarted, and the next individual would start their testing. If an unknown software error was encountered, details about the events prior to the issue were noted. Testing at Tulsa was run the same way.

711 HPW/RHBAF attended testing at Grissom for the second testing weekend. Prior to testing, it was decided to have individuals come in one at a time to make sure no one had exposure to the self-guided system prior to their testing. A decision was made to perform a proctored test after each self-guided version, regardless of pass/fail status. If a software error occurred, the participant would be allowed to complete the self-guided testing (after a restart, if necessary).

The final weekend of testing was conducted at Mansfield. The plan for the final test was to have each participant take the self-guided fit test. OHD would hand them a questionnaire after completion. It was decided that proctored testing would only be done for the participants that were unable to obtain a passing FF via the self-guided system. The purpose was to determine if any self-guided failures were due to personnel complication, such as requiring extra-small masks. A comparison of FFs between self-guided and proctored fit-testing was considered, but ultimately rejected in order to maximize participants in the self-guided evaluation and the study's focus being on determining if participants would negatively affect results due to their actions. For the first 15 participants, any failures were brought to an OHD representative to provide proctored fit-testing. After the first 15 participants, the decision was made to give the participants an option to try a different size mask, as the majority of fails were due to initially selecting the wrong size mask. The participant was not provided any other input (to include new size recommendations), in order to not introduce bias. If the participant failed a second time, they were sent to do a proctored fit test. Once completed, OHD would hand them a one-page questionnaire (Appendix A). Results from the questionnaire were compiled by 711 HPW/RHBAF and provided in the results section.

Video instructions guided individuals through prompts to enter their name and DoD identification (ID) number, select mask size, instructions on how hold their breath, clean mask,

don mask and information of what the fit test will look like. There were options to pause or go back in the instructions if needed. Figures 3-5 are representative screen shots of the instructions.

Figure 3: Screen image at test start

Figure 4: Screen image for mask selection

Figure 5: Sample instruction screen for mask preparation, cleaning, donning

There were five main steps to the gas mask fit-testing protocol using the CNP method. During each of the steps, the participant performed a sharp intake of air (Figure 6) then holds their breath for eight seconds while in one of five positions p (Figure 7). The five positions were: 1) looking straight ahead 2) looking up 3) looking down 4) looking to the left while bent at the waist, and 5) looking to the right while bent at the waist.

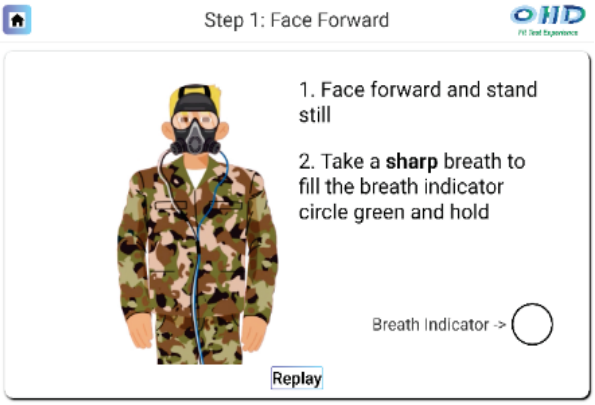

Figure 6: Example of step instruction

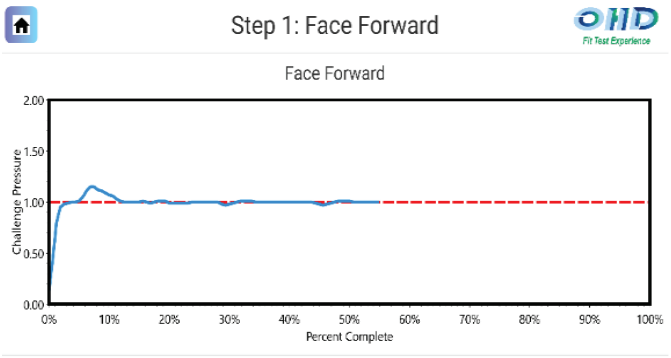

Figure 7: Display showing pressure changes during each step

Audio prompts help indicate when participant's breath was sufficient, when to relax and when to move on to the next step. These audio prompts were helpful when not looking at the screen. Participants were allowed three attempts at each step. An overall fit factor was provided on-screen at the end of testing, if passed. If they ever fail the third attempt of an individual step, they were informed that they were unsuccessful and instructed to visit their BE office for further assistance.

4.0 RESULTS AND DISCUSSIONS

There were 35 participants who used the stand-alone QuantiFit2 fit-testing system on 6-7 August, 2022. One member (#33) was not included in the results, as he was just provided a demonstration and had not participated in the full evaluation. Twenty-five of the 35 participants were able to successfully pass on their first attempt with a fit factor of 1000 or more. Four more participants were able to pass on their own with no outside input, other than the offer to try a different size if they wanted. The other six participants were able to pass with proctoring from one of the OHD representatives. The average recorded self-guided fit-test time was 6.9 minutes (Table 1).

Table 1. Summary of 6-7 Aug QuantiFit2 Fit-Test

Participant	Test type	Step 1	Step 2	Step 3	Step 4	Step
1	Self-guided					
2	Self-guided	X				
3	Self-guided	X				
4	Self-guided					
5	Self-guided	X				
6	Self-guided					
7	Self-guided	X				
8	Self-guided					
9	Self-guided					
10	Self-guided					
11	Self-guided					
12	Self-guided					
13	Self-guided					
14	Self-guided					
15	Self-guided	X				
16	Self-guided					
17	Self-guided					
18	Self-guided					
19	Self-guided					
20	Self-guided					
21	Self-guided	X				
22	Self-guided					
23	Self-guided			X		
24	Self-guided					
25	Self-guided					
26	Self-guided					
27	Self-guided					
28	Self-guided					X
29	Self-guided					
30	Self-guided	X				
31	Self-guided	X				
32	Self-guided					
33	N/A					
34	Self-guided					
35	Self-guided					
36	Self-guided					

This table provides is a summary of the fit-test results at Mansfield-Lahm ANGB.

Participants who passed are listed with their scores and completion times.

The unsuccessful attempts are marked at the step that they failed.

Participants 21, 23, 28, 30, 31 and 32 attempted a self-guided fit test using a self-selected different size mask.

Participants 2, 3, 5, 15, 31 and 33 were unable to pass using the stand-alone system and required OHD assistance to pass.

Time was not recorded for participant 13.

Each testing weekend proceeded with fewer complications. At Rosecrans, there were a few software issues that caused the system to freeze and prevent fit-testing. Those errors were fixed prior to the efforts in July. However, a new error was discovered that caused the system to freeze after it automatically entered "Sleep Mode" during an extended break. Mansfield had zero errors.

A concern was raised by AFMRA/SG3PB regarding a method for record keeping of fit-test results from unsupervised QuantiFit2 fit-tests. OHD provided 711 HPW/RHBAF with an Excel spreadsheet with the data of each successful fit-test. These data include mask size, individual fit-test scores, as well as overall fit-test score (Appendix B). BE personnel can access this information to create fit-test documentation for the service member's records.

711 HPW/RHBAF did not observe reasons why participants (self-guided and proctored) that obtained a passing fit factor over 1000 should not have passed. All passing participants properly donned appropriately-sized masks and successfully performed all aspects of the approved fit-test protocol. It is very difficult to obtain a passing score if there is even a slight break in the seal (e.g., twisted straps, hair breaking the seal-- even a paperclip as demonstrated by an OHD employee.

Self-guided passing rates of over 70% were obtained at each installation where evaluations were performed (Table 2). Instructions appeared to be clear and easy to follow for the participants, even for the many that were unfamiliar with fit-testing procedures. All passing participants were observed having performed the complete protocol correctly. Feedback from the BE community involved, as well as participants, was significantly positive (Table 3). The QuantiFit2 stand-alone system appears to allow personnel to successfully fit-test themselves for a majority of individuals, with the option available for BE assistance for those that are unable.

Table 2. Summary of Successful Self-guided Fit Test at Each Installation

Location	Total tested	Total passed (self-guided)	Unab comp
Rosecrans Air National Guard Base	23	19	3
Tulsa Air National Guard Base **	22	18	(
Grissom Air Reserve Base	24	19	(
Travis Air Force Base **	15	13	(

*Software issues ** Information from these bases were given to 711 HPW/RHBAF from OHD

Table 3. Summary of 6-7 Aug QuantiFit2 Fit-Test Questionnaire

1. Did you pass the fit test?				
Min	N/A	**Max**	N/A	**Aver**
2. Have you done fit testing before (Likely with if yes, 2.a please rate this experience compar				
Min	3	**Max**	10	**Aver**
3. How easy was the self-guided				
Min	8	**Max**	10	**Aver**
4. If you successfully completed the test how you that your mask will protect yo				
Min	5	**Max**	10	**Aver**
5. How clear were the instruction				
Min	6	**Max**	10	**Aver**
6. Overall, how was the self-guided exp				

5.0 CONCLUDING REMARKS

The QuantiFit2 stand-alone system provided passing FF values at 5 separate locations all above the goal of 70%. At Mansfield-Lahm, 29 of the 35 participants that were fit-tested passed with a fit factor over 1000 for the M50 gas mask using the self-guided system. The average time to successfully complete the testing was just under 7 minutes. All 35 participants were able to pass using the QuantFit2 (self-guided or proctored). Feedback from the participants was overwhelmingly positive**.**

711 HPW/RHBAF did not observe reasons why participants (self-guided and proctored) that obtained a passing fit factor over 1000 should not have passed. All passing participants properly donned appropriately-sized masks and successfully performed all aspects of the approved fit-test protocol.

Finally, 711 HPW/RHBAF has no objections regarding the Air Force's developing policy of implementing the stand-alone QuantiFit2 system for M50 gas mask fit-testing**.**

6.0 RECOMMENDATIONS

OHD provided a list of updates that they will make for the final stand-alone system (Appendix C). Based on the observations made while at Mansfield-Lahm ANGB, 711 HPW/RHBAF suggests the following additional improvements:

- Retest option: 711 HPW/RHBAF suggests adding an option to retest in a different size, if an individual fails the first time. The current system instructs the individual to contact BE for further assistance after failure. We observed that many individuals who initially failed did so because they chose a wrong size gas mask. Most individuals were uncertain of their size when presented an option, or their physical conditions changed (e.g., weight loss/gain) since the last time they were fitted. It is our experience that although there is a documented methodology for determining the best size, it is rarely implemented during gas mask issuing. Four of the 6 individuals passed when given an option to try a different size. Successful retests using a different size saves time for the individual and BE personnel, as well as increases confidence in the individual that their mask will protect them effectively.

- Auditory prompts during each fit-test step: Individuals may, at times, not be able to see the screen during one or more steps (e.g. looking up, looking to the side). Although there is an auditory prompt for successful or failed completion of each step, there are none for successful initiation or during the approximately 8 seconds of each test. 711 HPW/RHBAF observed a few instances when an individual did not successfully initiate a step and failed to realize it due their inability to see the screen. Auditory prompts during the test (e.g., “Good start”, “You’re halfway there”, etc.) will also be helpful to gauge progress when unable to see the screen.

- Instruct individuals to put their hands on their knees during Steps 4 and 5: 711 HPW/RHBAF observed a wide variation of how far individuals bent at the waist during steps 4 and 5 during testing. Although there is no recommended minimal angle, putting one’s hands on their knees provides individuals an easy reference point and easily gets them into a proper position for these steps.

- Provide uniform and adjustable volume for the video: The volume of the QuantiFit2 self-guided system changed during the instructions and procedures. However, this issue was already recognized and will be addressed in a final employable solution. Adding adjustment to the volume will help individuals hear the test in noisier environments.

- Mirror: 711 HPW/RHBAF observed that multiple individuals did not realize that their hair had interfered with their seal during the gas mask donning. This observation was consistent with reports from the other locations. Adding a mirror to the system will help individuals with their mask adjustments prior and during the testing.

- Adding positional sensors: 711 HPW/RHBAF suggests considering adding positional sensors (e.g., inertial measurement unit (IMU) sensors, imaging/video-based tracking systems, etc.) to the gas mask attachments used by the QuantiFit2 in later iterations. This capability could help ensure that individuals are obtaining and maintaining the appropriate head and body positions during each of the steps during unobserved, self-guided testing.

7.0 REFERENCES

Department of the Air Force. Air Force Medical Readiness Agency. (2022) *BE Strategic Guide-Reforming the Hive-Killer BEE 2021*.

Department of the Army, U.S. Army Combat Capabilities Development Command Chemical Biological Center. (2019) *Test Report For The Protection Factor Evaluation Of The Occupational Health Dynamics (OHD) Quantifit Respirator Tester.*

Department of Defense. (1991) *United States Joint Service Standardization Agreement for Factory Testing of Military Mask*

APPENDIX A - Image of Mansfield Questionnaire

Self-guided time_____ Passing score_____ If failed which step_____

Mansfield Quantifit Kiosk Questionnaire

1. Did you pass the fit test?
   a. Self-guided Yes No
   b. Proctored Yes No
   c. If no, do you know why? _____

2. Have you done fit testing before (likely with a PortaCount)? Yes No (skip to Question 3)
   a. If you answered yes, please rate this experience compared to before.

1	2	3	4	5	6	7	8	9	10
I need a Proctor				either test is fine					I prefer using the kiosk

3. How easy was the self-guided?
   a.

1	2	3	4	5	6	7	8	9	10
I don't understand Touchscreens				took time but I figured it out					completed without hesitation

4. If you successfully completed the test how confident are you that your mask will protect you?
   a.

1	2	3	4	5	6	7	8	9	10
Less than before I started				Not more or less					ready for a hazard zone

5. How clear were the instructions?
   a.

1	2	3	4	5	6	7	8	9	10
Not clear Lots of questions				glad I could pause and replay					Very clear no questions

6. Overall how was the self-guided experience?
   a.

1	2	3	4	5	6	7	8	9	10
Too hard To start				completed but I had questions					Easy no changes needed

7. If you participated in the proctored, do you feel you could pass the self-guided with the new information on how and why you did not pass the self-guided previously?
   a.

1	2	3	4	5	6	7	8	9	10
No, I need someone To fit me				Not sure I would need to try again					Absolutely

8. What changes would you suggest?_____
   _____
   _____
   _____
   _____
   _____

Proctored time_____ Passing score_____ If failed which step_____

APPENDIX B – Example of fit-test data pulled off QuantiFit2® (individual information removed)

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Protocol Name	MaskModel	Mask Type	MaskSize	Min Fit Factor	TestDate	TestTime	Quantifit ID	OverallFitFactor	Result	Step Number	Step Description	Step Fit Factor
2	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 7:26	86111409		Passed	1	Face Forward	1655
3	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 7:26	86111409		Passed	2	Face Up	1218
4	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 7:26	86111409	1958	Passed	3	Face Down	2513
5	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 7:26	86111409		Passed	4	Bend Over Look Left	4728
6	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 7:26	86111409		Passed	5	Bend Over Look Righ	1930
7	Military	Avon Protection M50	MIL	Small	1000	8/6/2022 0:00	8/6/2022 8:07	86111409		Passed	1	Face Forward	1904
8	Military	Avon Protection M50	MIL	Small	1000	8/6/2022 0:00	8/6/2022 8:07	86111409		Passed	2	Face Up	3509
9	Military	Avon Protection M50	MIL	Small	1000	8/6/2022 0:00	8/6/2022 8:07	86111409	2578	Passed	3	Face Down	4014
10	Military	Avon Protection M50	MIL	Small	1000	8/6/2022 0:00	8/6/2022 8:07	86111409		Passed	4	Bend Over Look Left	1951
11	Military	Avon Protection M50	MIL	Small	1000	8/6/2022 0:00	8/6/2022 8:07	86111409		Passed	5	Bend Over Look Righ	2721
12	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:22	86111409		Passed	1	Face Forward	5027
13	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:22	86111409		Passed	2	Face Up	3402
14	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:22	86111409	2710	Passed	3	Face Down	3321
15	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:22	86111409		Passed	4	Bend Over Look Left	1829
16	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:22	86111409		Passed	5	Bend Over Look Righ	1985
17	Military	Avon Protection M50	MIL	Large	1000	8/6/2022 0:00	8/6/2022 8:34	86111409		Passed	1	Face Forward	3341
18	Military	Avon Protection M50	MIL	Large	1000	8/6/2022 0:00	8/6/2022 8:34	86111409		Passed	2	Face Up	3487
19	Military	Avon Protection M50	MIL	Large	1000	8/6/2022 0:00	8/6/2022 8:34	86111409	3562	Passed	3	Face Down	2305
20	Military	Avon Protection M50	MIL	Large	1000	8/6/2022 0:00	8/6/2022 8:34	86111409		Passed	4	Bend Over Look Left	6488
21	Military	Avon Protection M50	MIL	Large	1000	8/6/2022 0:00	8/6/2022 8:34	86111409		Passed	5	Bend Over Look Righ	4359
22	Military	Avon Protection M50	MIL	Large	1000	8/6/2022 0:00	8/6/2022 8:41	86111409		Passed	1	Face Forward	3770
23	Military	Avon Protection M50	MIL	Large	1000	8/6/2022 0:00	8/6/2022 8:41	86111409		Passed	2	Face Up	3263
24	Military	Avon Protection M50	MIL	Large	1000	8/6/2022 0:00	8/6/2022 8:41	86111409	3012	Passed	3	Face Down	3531
25	Military	Avon Protection M50	MIL	Large	1000	8/6/2022 0:00	8/6/2022 8:41	86111409		Passed	4	Bend Over Look Left	4164
26	Military	Avon Protection M50	MIL	Large	1000	8/6/2022 0:00	8/6/2022 8:41	86111409		Passed	5	Bend Over Look Righ	1771
27	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:49	86111409		Passed	1	Face Forward	2936
28	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:49	86111409		Passed	2	Face Up	3902
29	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:49	86111409	2157	Passed	3	Face Down	1924
30	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:49	86111409		Passed	4	Bend Over Look Left	2196
31	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:49	86111409		Passed	5	Bend Over Look Righ	1341
32	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:59	86111409		Passed	1	Face Forward	1563
33	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:59	86111409		Passed	2	Face Up	7246
34	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:59	86111409	2386	Passed	3	Face Down	2105
35	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:59	86111409		Passed	4	Bend Over Look Left	3082
36	Military	Avon Protection M50	MIL	Medium	1000	8/6/2022 0:00	8/6/2022 8:59	86111409		Passed	5	Bend Over Look Righ	1930

APPENDIX C - OHD Scope of Work For Final Adjustments to Virtual Operator

YOUR PROTECTION OUR PRIORITY

OHD Scope Of Work Virtual Operator Initial Release Update for AFRL

8/8/2022

OHD will execute a video shoot and image shoot to finalize all videos and images for the virtual operator paths for implementation into the software in replacement of the current videos and images. There will also be slight changes in the operation and sequence as outlined below.

- Implementation of the updated videos and images in replacement of the current videos and images.
  - Optical insert videos are part of this update.
- Stabilization of the "Handshake" connection between software and QuantiFit2 after the computer goes to sleep or is left for hours of time.
- Elimination and stabilization of the "multi tap" bug (video skipping forward) identified during the final beta testing.
- Elimination and stabilization of the "breath indicator" test engagement bug.
- Addition of a sizing reselection flow after initial failed full test. This flow would only allow one retest and a second failure would direct the airmen to the BEE.
- Proctored Test Mode
  - In addition to Standard and Fit Test Mask mode, a "Proctored" test mode will be created. This mode would have the same operation up to the mask size selection. After a size is selected the sequence would go directly to the first step of the test and conduct a Military Protocol test from that point.
  - This mode is to allow a test operator or BEE to "Proctor" a test using the Virtual Operator and QuantiFit2 setup.
- "Test Mode" selection will be added on the initial setup, following daily verification, to allow the BEE or operator to setup the system in the deployment mode desired. Currently this is hidden behind the code to access the settings screen. The operator should setup the unit in the desired mode each time the system is deployed.

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LIST OF SYMBOLS, ABBREVIATIONS AND ACRONYMS

AFMRA/SG3PB - Air Force Medical Readiness Agency Bioenvironmental Engineering
AFRC – Air Force Reserve Command
AFRL - Air Force Research Laboratory
ANG – Air National Guard
BE - Bioenvironmental Engineering
CNC – Condensation Nuclei Counter
CNP – Controlled Negative Pressure
COTS – Commercial Off The Shelf
FF – Fit-Factor
IMU - Inertial Measurement Unit
JSMLT - Joint Service Mask Leakage Tester
OHD - Occupational Health Dynamics
OSHA - Occupational Safety and Health Administration
PATS - Protective Assessment Test System
QNFT – Quantitative Fit Testing