EFFECTS OF FACIAL HAIR IN OXYGEN MASKS

David G. Naber

Naval Air Development Center
Warminster, Pennsylvania

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NAVAL AIR DEVELOPMENT CENTER

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REPORT NO. NADC-72211-CS 29 DECEMBER 1972

EFFECTS OF FACIAL HAIR IN OXYGEN MASKS

FINAL REPORT
BUMED PROJECT NO. F51524005
ELEMENT 62755N, WORK UNIT 1004D

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SUMMARY

INTRODUCTION

This is a final report based on work performed under BUMED Project No. MF12.524005, Element 62711N, Work Unit 1004D of May 1971 entitled "Effects of Beard and Moustache Hair Worn by Naval Aircrewmen on Personal Oxygen Equipment". The objective of this project is to determine the existence of any actual or potential hazards of facial hair growth on Naval aviators using oxygen breathing equipment.

SUMMARY OF RESULTS

The study was composed of data compiled from questionnaires sent to Naval Flight Surgeons, laboratory tests on human subjects in altitude chambers, operating evaluation of the equipment and a literature search of related investigations.

Test data showed there is no conclusive evidence that beards and moustaches have caused serious injury or fire under normal circumstances, but undesirable conditions do exist due to facial hair. These conditions include the possibility of hair segments becoming lodged in mask valves which can make breathing difficult and communications difficult and noisy. Inboard leakage into the mask around the face seal can cause a high level of nitrogen which could induce a hypoxic state.

Every set of test results shows instability of breathing conditions that could be hazardous to the aircrewman.

CONCLUSIONS

It is quite evident that there exists undesirable conditions due to facial hair, although there is no conclusive evidence that beards or moustaches have caused serious injury or fire under normal circumstances. The instability of breathing conditions could be hazardous to the aircrewman or, at the least, cause uncomfortable and disturbing conditions which could affect the performance of the crewman in carrying out his mission. These potential hazards for injury and other possible distractions are deemed unacceptable risks for crewmen of sophisticated military aircraft. Therefore, it appears that the wearing of facial hair should be considered a potential hazard that could affect the safety and efficient operation of the aircraft.

RECOMMENDATIONS

It is recommended that all personnel engaged in flying activities, which necessitates the use of oxygen breathing equipment, be clean shaven on the area of the face where a mask seal is effected. Furthermore, all personnel should be made aware of the potential hazards generated by any type of facial hair while using oxygen breathing equipment.

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DAVID G. NABER

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13 ABSTRACT

The objective of this study is to determine whether or not hazards are associated with facial hair on Naval aircrewmen using oxygen breathing equipment. The study showed that undesirable conditions do exist because of facial hair, but there is no evidence of serious injury or fire occurring in aircraft because of hair growth. Indications are that hair segments could become lodged in a valve mechanism causing breathing difficulty and noisy communications. Also, face seal integrity is hard to maintain on facial hair. Each set of test results show instability of breathing conditions that could be hazardous to the crewman. Therefore, it appears that wearing facial hair should be considered a potential hazard that could affect the safety and efficient operation of the aircraft.

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14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
FACIAL HAIR						
PERSONAL O_2 EQUIPMENT						
COMMUNICATIONS INTERFERENCE						
FLAMMABILITY						

DEPARTMENT OF THE NAVY
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Reported by: D. G. Naber
D. G. NABER
Life Support High Altitude Systems Branch

Reviewed by: J. F. Kiefer
J. F. KIEFER, Head
Life Support High Altitude Systems Branch

D. A. Mancinelli
D. A. MANCINELLI, Supt.
Life Support Engineering Division

Approved by: H von Beckh
DR. H. VON BECKH
Director of Medical Research

Released by: L H Blackburn
L. H. BLACKBURN, CAPT, MC, USN
Director, Crew Systems Department

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B A C K G R O U N D

Present CNO (Chief of Naval Operations) directives permitting Naval personnel to wear beards and moustaches, within certain grooming guidelines, has generated objections in certain areas. This is particularly notable in the area of aviation where safety is a major consideration. Objective evidence of the effects of beards and other facial hair growth on safety, and the functional operation of life support equipment, must be established and presented to the CNO and the Surgeon General before modifications of current grooming policy can be effected throughout the Fleet.

It is necessary to determine the effects of beard hair segments acting as foreign bodies on the functioning mechanisms of the oxygen mask. Interference with these mechanisms could be detrimental to the safety of the aviator.

The effects of beards and moustaches on the integrity of the oxygen mask facial seal during breathing and speaking could cause discomfort to the aviator and adverse skin reactions. Interference with the integrity of the facial seal could give rise to inboard or outboard leakage of breathing gas to the aviator. Facial hair growth can also create a potential flammability hazard to the aviator because of the high concentration of oxygen present.

D I S C U S S I O N

To obtain a cross-section of potential problems of various oxygen breathing equipment, the HGU-20/P Helmet, Type I Smoke Mask, A-13A Breathing Mask and the Sierra 756 Breathing Mask were used in the evaluation.

The study was broken into separate test programs to take advantage of the expertise of various activities. The NAVAIRDEVCEN (Naval Air Development Center) investigated the medical problems, caused by facial hair growth, in the Fleet through the use of a Questionnaire Survey of Medical Problems forwarded to Naval Flight Surgeons. The evaluation of 284 questionnaires (Appendix B), by the NAVAIRDEVCEN's CSD (Crew Systems Department) (Mr. S. Winsko) shows five cases of minor medical problems reported. For the five cases reported, a total of two duty days for flying was lost by one individual. There were no reports of flight accidents arising from wearing facial hair.

The NAVAIRDEVCEN also investigated the effects of hair segments acting as foreign bodies in the functioning mechanisms of aviation oxygen

masks at altitudes up to 25,000 feet. Tests conducted by Dr. D. Dery at the NAVAIRDEVCEN/CSD's Bio-Astronautical Test Facility, located at the Philadelphia Naval Base (Appendix A), evaluating the effects of human hair segments on the oxygen mask mechanism, show that in no case did the hair segments cause a critical condition. However, three or more hair segments in the inhalation valves made, in most cases, breathing and communications difficult, although possible. On inhalation, there were no significant changes in mask pressure; but on exhalation, mask pressure increased up to 9.9 mmHg.

The NAVAEROMEDRSCHLAB (Naval Aerospace Medical Research Laboratory), Pensacola, Florida provided data on the mask facial seal integrity in relation to inboard mask leakage. The NAVAEROMEDRSCHLAB investigation was conducted by Lt. T. Cooper. Measurements (Table I) were taken on bearded subjects at points where facial hair actually contacted the face seal, using the A13A mask with Hardman suspension. The data presented in Tables II, III and IV are the result of the average of four runs, both at sea level and at 18,000 feet. All subjects, labeled "control", were non-bearded. Data obtained from these tests shows that there is high inboard leakage by subjects wearing beards. The alveolar nitrogen at 18,000 feet ranged from 14 to 26% for fine dense beards; to 55-70% for coarse, very dense beards. Normally, non-bearded subjects show no alveolar nitrogen.

Additional data was compiled through a literature search (references (a), (b) and (c)), that revealed data on the flammability of hair and hair preparations in high concentrations of oxygen, and also the influence of bearded subjects on face mask design. Messrs. O. Griffin and D. Langson (reference (a)), concluded that a full beard substantially increases the inward leakage of all the face masks used in the test; also, that large and bushy sideburns, sufficiently large to lie between the seal and the face, are likely to cause a substantial increase in leakage rates. Conclusions drawn by Mr. R. Durfee (reference (b)), show that combustion of hair can occur in an oxygen enriched atmosphere. The flame spread rate can be decreased by the reduction of hair length. Completely shaved samples of human skin will not undergo nap burning in 258 mmHg oxygen. Various salves, creams and lotions were found to prevent flame spread, but the extent of application necessary appeared to be greater than the amounts usually applied. Data from Dr. R. Dille, Mr. C. Crane and Capt. G. Pendergrass (reference (c)), indicates a large margin of safety exists in using hydrocarbon face, lip and hair preparation in the presence of low pressure 100% oxygen. Their presence upon the hands, which may come in contact with high pressure oxygen sources, probably constitute the chief hazard.

There is some indication that contamination with oily preparations will slightly increase the chance of ignition of solid materials.

REFERENCES

a. Griffin, O. G. and Langson, D. J. - "Influence of Face Mask Design on Operational Performance"; Safety in Mines Research Establishment, Dept. of Trade and Industry, Sheffield, England; Second Conference on Portable Life Support Systems, Ames Research Center, California - May 1971

b. Durfee, R. L. PhD - Report No. SAM-TR-68-130 entitled "The Flammability of Skin and Hair in Oxygen Enriched Atmospheres" of Dec 1968 Aerospace Medical Division (AFSC), Brooks AFB, Texas

c. Dille, R. J. MD; Crane, C. R. PhD and Pendergrass, G. E., Capt. - Report No. FAA63-27 entitled "The Flammability of Lip, Face and Hair Preparations in the Presence of 100% Oxygen" of Nov 1963; Civil Aeromedical Research Institute, Oklahoma City, Okla; National Technical Information Service - AD-602204

TABLE I

BEARD MEASUREMENTS

	CHEEK	CHIN	SUBJECTIVE
Beard #1	2.9cm	3.2cm	Fine/Dense
Beard #2	4.2cm	4.2cm	Fine/Sparse
Beard #3	5.5cm	7.2cm	Med-Fine/Very Dense
Beard #4	5.2cm	4.6cm	Coarse/Very Dense

TABLE II

INBOARD LEAKAGE AT SEA LEVEL

SUBJECT	NO. BREATHS TO MIN. N_2 (RANGE)	AVG INBOARD LEAK (%)	LEAKAGE RANGE (%)	STANDARD DEVIATION
CONTROL #1	18-32	3.8	2.5-4	
CONTROL #2	15-21	1.9	2-2.5	
CONTROL #3	19-25	2.6	2-3	
CONTROL #4	17-20	2.5	2-3	
BEARD #1	32-56	17.5	8-27	7.2
BEARD #2	19-34	23.7	19-44	3.5
BEARD #3	21-27	22.7	10-53	12.9
BEARD #4	25-42	45.6	28-59	10.8

MINIMUM ALVEOLAR N_2

	AVG N_2 (ALV.) (%)	N_2 (ALV.) RANGE (%)	STANDARD DEVIATION
CONTROL #1	1.0		
CONTROL #2	1.2		
CONTROL #3	1.5		
CONTROL #4	1.2		
BEARD #1	13.4	6-18	0.95
BEARD #2	18.0	17-18	
BEARD #3	18.6	6-45	12.5
BEARD #4	40.0	25-59	11.5

TABLE III

INBOARD LEAKAGE AT 18,000 FT.

SUBJECT	NO. BREATHS TO MIN. N_2 (%)	AVG INBOARD LEAK (%)	LEAKAGE RANGE (%)	STANDARD DEVIATION
CONTROL #1	15-17	4.7	3-5	
CONTROL #2	14-18	2.5	2-3.5	
CONTROL #3	20-23	3.6	3-4	
CONTROL #4	11-18	3.8	3-4	
BEARD #1	20-27	31.0	18-44	11.6
BEARD #2	20-22	24.0	20-29	3.2
BEARD #3	15-22	16.3	12-26	3.5
BEARD #4	21-31	67.5	57-78	6.9

MINIMUM ALVEOLAR N_2

	AVG N_2 (ALV.) (%)	N_2 (ALV.) RANGE (%)	STANDARD DEVIATION
CONTROL #1	3		
CONTROL #2	1		
CONTROL #3	2		
CONTROL #4	2		
BEARD #1	25.4	14-26	2.3
BEARD #2	17.0	16-25	0.9
BEARD #3	15.4	11-25	3.5
BEARD #4	58.3	55-70	5.8

TABLE IV

INBOARD LEAKAGE AT SEA LEVEL AND 18,000 FT
USING FORMERLY BEARDED SUBJECTS

NOTE: Subjects will be referred to by original designators.

SEA LEVEL

SUBJECT	NO. BREATHS TO MIN. N_2 (ALV.)	AVG INBOARD LEAK (%)	LEAKAGE RANGE (%)	STANDARD DEVIATION
BEARD #3	20-24	2.5	2-3	0.95
BEARD #4	6-10	9.0	6-12	0.6

18,000 FT.

BEARD #3	15-21	1.8	1-4	0.5
BEARD #4	6-8	9.6	8-10	1.3

A P P E N D I X A

NAVAIRDEVCEN BEARD STUDY

CSSA-DD
26 May 1972

MEMORANDUM
From: Dr. D. Dery (CSSA-DD)
To: Dr. E. Hendler (CSSA)

Subj: Beard Study

Encl: (1) Memo from CSLH/CSOI-5 to CSL of 18 Jun 71
(2) Tabulated results

1. Chamber runs per enclosure (1) have been completed.

2. Notation should be made of the following items:

a. The safety pressure runs were added to the design.

b. Sea level runs monitoring mask pressure were added to the design.

c. All runs were replicated once and the mean valves are presented.

d. Only the exhalation valve of the HGU-20/P helmet could be checked.

e. The minute volume when using the HGU-20/P helmet had to be determined by a different technic. O_2 consumption was determined by weighing the oxygen bottles before and after each test.

f. Only the exhalation valve of the smoke mask could be tested.

3. Several interesting points unrelated to the use of hair segments are:

a. The valve material and design, for the smoke mask, leave much to be desired. Improper installation is too easy, unnoticeable and causes relatively large leaks.

b. Subjective comments concerning the comfort of the Sierra 756 were negative. The "O" rings for valve installation are much too delicate.

c. We had two apparent hypoxia episodes with the HGU-20/P. The cause was undetermined, but, was probably related to the procedure of breath holding while donning the mask. One episode occurred with 6 hairs in the inhalation valve while the other occurred with none (0), so that valve leakage due to hair contamination could not be definitely incriminated.

CSSA-DD

Subj: Beard Study

4. In no case did the hair segments cause a critical condition. However, three or more hair segments (as placed) in the inhalation valves of the A-13 and the Sierra 756 made in most cases, breathing and communication difficult although possible.

5. On inhalation there were no significant changes in mask pressure. On exhalation mask pressures increased up to 9.9 mmHg. As a reference, mask pressures for pressure breathing at altitude go to 13-16 mmHg.

D. DERY

CSLH/CSOI-5
18 June 71

MEMORANDUM
From: Mr. J. Kiefer (CSLH)/Mr. S. Winsko (CSOI-5)
To: Mr. D. Mancinelli (CSL)

Subj: Experimental Design Study to Determine the Effects of Human Hair Segments on the Functioning of the Oxygen Mask Mechanism

Encl: (1) Experimental Design Study

1. Enclosure (1) is submitted to implement the Work Unit entitled "Effects of Beard and Moustache Hair Worn by Naval Aircrewmen on Personal Oxygen Equipment" of 21 May 1971.

J. KIEFER/S. WINSKO

Enclosure (1)

EXPERIMENTAL DESIGN STUDY

INTRODUCTION

Purpose: The purpose of this study is to determine the effects of hair segments acting as foreign bodies in the functioning mechanisms of aviation oxygen masks using the newly developed 756 Mask, the A/13, the Type I Smoke Mask and the HGU-20/P, at various simulated altitudes.

The data from this study will be used to objectively determine the existence and extent of actual or potential problem areas associated with facial hair growth when wearing various types of aviation oxygen masks.

METHOD

1. Subjects: The subjects for this study will be four (4) clean-shaven Navy Enlisted men medically qualified for service in the 9A12 Altitude Chamber.

Prior to the study, each subject will be examined to determine his current physical health and present suitability for use in the study. In addition, each subject will be given a series of familiarization sessions to acquaint him with the fit and function of the mask as well as the nature and purpose of the study.

2. Equipment: The principal equipment to be employed in this study will consist of the following:

a. A-13 Oxygen Mask
b. 756 Sierra Oxygen Mask
c. Type I Smoke Mask
d. HGU-20/P Oxygen Mask Helmet
e. Human Hair Segments
f. Bio-Astronautical Test Facility
g. Air Flow Meter Recording Equipment

PROCEDURE

1. Training: Before conducting the experiment, each subject will be given a series of familiarization sessions to acquaint him with the normal dynamic functioning of the oxygen mask he is to use during the experiment. The subject will also adjust the mask for his individual comfort of fit and practice donning and doffing the mask to develop economy of effort for subsequent tests. During the familiarization sessions each subject will be instructed on the nature and purpose of the study.

2. Experimental Design: This study will be conducted in two phases consisting of the following variables and levels:

a. Independent Variables

Chamber Altitude Ambient Air	Mask Type	
Sea Level, 10,000 Feet	A-13 Mask, 756 Sierra Mask	Phases I and II
15,000 Feet, 25,000 Feet	Type I Smoke Mask, HGU-20/P	Phase II only

Breathing Air	Human Hair Segments
- 100% Oxygen - Normal Breathing Air - O_2 Mixture With Diluter Demand Regulator - 100% Oxygen With Safety Pressure	0 to 6 Quantity at one location (.003" in diameter)

b. Dependent Variables

Breathing Air Flow Quantity: Defined as the difference between air flow quantity before and after the artificial introduction of the hair segments in each type of mask under each test condition for each subject.

3. Test Sequence: For this study, each subject will be assigned one type of mask to be worn for each of the 4 discrete chamber altitudes, from sea level to 25,000 feet. This sequence will be applied to each of the subjects until the study is completed for each of the two phases. Above 10,000 feet will be with 100% oxygen only.

This study shall be conducted in full compliance with established safety procedures and operating policies governing the use of the altitude chamber.

4. Experimental Task - Phase I:

a. Sea Level Ambient - Each subject will be seated in the altitude chamber and fit himself with his assigned mask. The subject will breathe 100% oxygen through his mask. After his breathing rate and volume has been established at a steady level he will be instructed to remove his mask and temporarily use a substitute mask. The experimenter will then take the subject's mask and position 2 human hair segments between the inhalation valve seat and valve body. The subject will then re-don his original mask and continue breathing; his breathing air flow volume will then be measured and recorded. This procedure will be repeated for additional hair segments,

positioned in increments of two, until the mask ceases to function or 6 hair segments have been used. The test will then be terminated, all hair segments removed and the mask will be tested to ensure normal function for subsequent tests.

The entire test procedure will then be repeated with the regulator on diluter demand and again with safety pressure.

b. 10,000, 15,000 and 25,000 Feet - The subject will be seated in the altitude chamber with his assigned mask pre-fitted and breathing pure oxygen. The chamber will be brought to altitude in accordance with standard operating procedure. After the chamber reaches the specified altitude and the subject's breathing rate and volume has been established at a steady level, he will be instructed to remove his mask and give it to the experimenter who will provide him with a temporary face mask to maintain his steady breathing level.

The experimenter will then position one human hair segment between the inhalation valve seat and the valve body. The subject will then redon his mask and continue breathing; his breathing air flow volume will then be measured and recorded. This procedure will be repeated for each additional hair segment, positioned in increments of two, until the mask ceases to function. The test will then be terminated, all hair segments removed and the mask will be tested to ensure normal function for subsequent tests at the next test altitude

The test procedure will then be repeated as indicated for sea level runs.

5. Experimental Task - Phase II: Using the same procedure of Phase I, with each type of mask, human hair segments will be positioned in increments of two in the exhalation valve only until the entire test series has been completed for the study.

MASK: A-13 SUBJECT: Heckman, William TMC

TITLE: Effects Of Hair Segments In The Inhalation and Exhalation Valves

PARAMETERS - V is volume in liters per minute; F is breaths per minute

					INHALATION VALVES					EXHALATION VALVES				
					ALTITUDE					ALTITUDE				
					SL	10	15	25	Remarks	SL	10	15	25	Remarks
100% O_2	NUMBER OF HAIRS	ONE LOCATION	6	V	9.0	6.8	6.4	6.4	When four or more hairs were used subjects frequently complained of breathing and communication difficulty.	9.4	6.5	7.0	3.8	No problems were encountered.
				F	8.0	7.0	10.:	7.0		6.0	6.0	7.0	6.0	
			4	V	6.3	7.7	6.5	6.9		5.8	6.0	5.6	3.0	
				F	8.0	9.0	8.0	9.0		6.0	6.0	8.0	6.0	
			2	V	7.0	6.1	6.0	5.7		5.8	6.5	6.0	5.7	
				F	6.5	6.0	7.0	7.0		6.0	6.0	7.0	6.0	
			0	V	7.8	6.6	6.5	5.3		6.8	5.2	5.6	4.6	
				F	9.5	6.5	7.5	7.0		6.0	6.0	6.5	7.0	
DILUTER DEMAND	NUMBER OF HAIRS	ONE LOCATION	6	V	7.5	7.0			As above	8.8	7.4			As above
				F	6.2	5.8				6.0	6.0			
			4	V	5.7	5.8				6.7	5.8			
				F	5.8	6.0				5.5	5.5			
			2	V	6.1	7.1				7.2	5.6			
				F	5.5	6.5				7.0	6.0			
			0	V	6.7	5.1				7.1	7.0			
				F	6.8	5.8				6.0	6.5			
SAFETY PRESSURE	NUMBER OF HAIRS	ONE LOCATION	6	V	9.9	8.2			As above	10.7	9.9			As above
				F	5.0	4.8				5.0	5.0			
			4	V	7.8	8.7				10.4	9.4			
				F	5.0	4.8				5.5	5.0			
			2	V	7.6	10.7				10.6	9.8			
				F	4.5	6.0				5.0	5.0			
			0	V	7.5	8.9				10.5	9.7			
				F	5.0	5.2				5.5	6.0			

Enclosure (2)

PEAK A-13 MASK PRESSURE ON INSPIRATION AND EXPIRATION

WITH HAIRS PLACED IN THE INSPIRATION VALVE (SEA LEVEL RUN)

		INSPIRATION	EXPIRATION	RESPIRATORY RATE (Breaths per minute)
NUMBER OF HAIR SEGMENTS	6	1.9 mmHg	7.2 mmHg	7.5
	5	2.3 mmHg	9.9 mmHg	5.0
	4	1.9 mmHg	1.7 mmHg	6.0
	3	2.4 mmHg	5.7 mmHg	6.0
	2	1.9 mmHg	2.9 mmHg	6.5
	1	1.9 mmHg	2.4 mmHg	6.0
	0	1.8 mmHg	1.9 mmHg	6.0

NOTE: The same test subject was used as for the regular A-13 tests. Values given are the mean peak pressures for five breaths.

MASK: Sierra 756 SUBJECT: Melko, Thomas HM3

TITLE: The Effects of Hair Segments In The Inhalation and Exhalation Valves

PARAMETERS- V, volume in liters per minute; F, frequency in breaths per minute.

					INHALATION VALVES					EXHALATION VALVES				
					ALTITUDE					ALTITUDE				
					SL	10	15	25	Remarks	SL	10	15	25	Remarks
100% O_2	NUMBER OF HAIRS	ONE LOCATION	6	V	5.1	5.7	4.8	6.1	Subjects complained of mask discomfort. "O" rings were too delicate to withstand valve replacement. As with the A-13, four or more hairs caused breathing and communication difficulty.	5.8	5.4	4.8	4.9	General comments the same
				F	7.0	7.0	6.0	7.5		7.5	7.5	7.0	8.0	
			4	V	6.7	6.0	5.7	5.9		5.0	5.0	5.7	4.5	No problem with hair segments.
				F	5.5	6.0	7.5	6.0		6.0	6.5	7.0	8.0	
			2	V	4.3	5.6	5.4	5.5		5.0	5.0	4.9	5.2	
				F	6.5	6.0	6.5	7.0		6.5	6.0	6.5	7.5	
			0	V	6.3	5.4	6.2	6.0		5.1	4.8	4.7	5.2	
				F	6.8	6.5	7.2	8.2		5.8	7.5	6.5	8.0	
DILUTER DEMAND	NUMBER OF HAIRS	ONE LOCATION	6	V	5.5	6.2			As above	8.7	8.3			As above
				F	6.5	5.5				8.5	8.0			
			4	V	7.3	5.8				7.8	7.6			
				F	6.0	5.5				9.0	7.0			
			2	V	5.7	6.4				7.6	8.2			
				F	8.0	8.0				9.0	9.0			
			0	V	7.3	6.7				8.4	8.0			
				F	8.0	8.0				8.7	8.5			
SAFETY PRESSURE	NUMBER OF HAIRS	ONE LOCATION	6	V	7.2	8.7			As above	9.1	10.8			As above
				F	6.5	5.0				6.5	6.5			
			4	V	6.2	8.3				9.6	11.2			
				F	5.0	6.0				7.0	5.5			
			2	V	8.5	9.5				9.9	10.0			
				F	6.0	6.0				7.0	6.0			
			0	V	9.6	8.0				8.3	6.6			
				F	5.0	5.0				7.0	7.0			

MASK: (Clamshell) - HGU-20/P SUBJECT: Hebbeln, James TDAN

TITLE: Effects of Hair Segments In The Inhalation Valve

PARAMETERS: V-Volume in liters per minute F-Frequency in breaths per minute

100% O_2	NUMBER OF HAIRS	ONE LOCATION			EXHALATION VALVES ALTITUDE SL	10	15	25	REMARKS
			6	V	11.6	6.1	7.0	4.2	Hypoxia symptoms at 25 thousand ft.
				F	/	/	/	/	once with six hairs and once without
			4	V	10.8	7.0	5.8	5.0	any hair segments. Possibly due to the
				F	/	/	/	/	technic of breath holding while
			2	V	10.2	8.4	7.8	4.7	changing masks.
				F	/	/	/	/	
			0	V	0.6	7.3	6.1	4.6	
				F	/	/	/	/	

MASK: Smoke SUBJECT: MacCoy, John HM1

TITLE: Effects of Hair Segments In The Exhalation Valve

PARAMETERS: V-Volume in liters per minute F-Frequency in breaths per minute

				EXHALATION VALVES				
				ALTITUDE				
				SL	10	15	25	REMARKS
100% O_2	NUMBER OF HAIRS	ONE LOCATION	6	V	8.0	7.6	7.1	7.9	Valves can be inserted so that
				F	10.0	8.5	7.0	8.0	relatively large leaks occur.
			4	V	7.5	7.6	6.9	4.7	
				F	10.0	6.0	6.0	5.5	
			2	V	7.3	8.4	6.5	6.4	
				F	10.0	6.5	6.5	4.5	
			0	V	7.8	8.5	7.2	5.2	
				F	10.0	9.0	7.0	4.0	

A P P E N D I X B

SYNOPSIS OF RESULTS OF QUESTIONNAIRE SURVEY

MEDICAL PROBLEMS OF NAVAL FLIGHT PERSONNEL USING AVIATION OXYGEN BREATHING EQUIPMENT WHILE WEARING FACIAL HAIR GROWTH

CSOI-5
7 Oct 71

MEMORANDUM
From: Mr. Stan Winsko, Jr. (CSOI-5)
To: Mr. D. A. Mancinelli (CSL)

Subj: Synopsis of Results of Questionnaire Survey, Medical Problems of Naval Flight Personnel using Aviation Oxygen Breathing Equipment While Wearing Facial Hair Growth

1. On 4 August 1971, 506 Questionnaires were sent directly to the Naval Flight Surgeon Population based on a master list provided by Capt. H. S. Trostle, Head, Flight Safety Branch, Bureau of Medicine and Surgery. The results of the survey are summarized as follows:

280 - Questionnaires completed and returned; no medical problems or accidents reported.

200 - Questionnaires not returned.

22 - Questionnaires returned uncompleted because addressee could not be located.

4 - Questionnaires completed and returned with 5 cases of minor medical problems reported.

2. For the 5 cases of medical problems reported, a total of 2 duty days for flying were lost; this occurred to only one individual. There were no reports of flight accidents arising from wearing facial hair growth.

STAN WINSKO, JR.

NADC-72211-CS

DEPARTMENT OF THE NAVY
NAVAL AIR DEVELOPMENT CENTER
WARMINSTER PA. 18974

CSOI-5
1 August 1971

From: Director, Crew Systems Department, Naval Air Development Center, Warminster, Pa. 18974
To: All Naval Flight Surgeons

Subj: Questionnaire Survey of Medical Problems of Naval Flight Personnel Using Aviation Oxygen Breathing Equipment While Wearing Facial Hair Growth

Encl: (1) Questionnaire - Medical Problems of Facial Hair Growth
(2) Pre-addressed Return Envelope

1. Enclosure (1) is part of a research program being conducted by the Bureau of Medicine and Surgery and the Naval Air Systems Command. The ultimate purpose of this program is to objectively determine the existence and extent of any problems with Naval aviators and all other Naval flight personnel having facial hair growth such as beards and moustaches, and wearing aviation oxygen breathing masks.

2. In order to determine the nature and extent of such medical problems, objective data is needed from Naval flight surgeons having direct responsibility for the medical care of flying personnel.

3. The cooperation of each addressee is requested in completing and returning enclosure (1) as accurately and timely as possible. Response is desired by no later than 30 August 1971.

L. H. BLACKBURN
Captain (MC) USN
Acting Director

MEDICAL PROBLEMS OF FACIAL HAIR GROWTH

Instructions

The purpose of this questionnaire is to obtain accurate medical information on the existence of problems of Naval aviators and other flight personnel having facial hair growth, such as beards and moustaches, worn in conjunction with aviation oxygen breathing masks during flight or ground simulation such as low pressure training chamber facilities.

To ensure accuracy and clarity, each Flight Surgeon responsible for the medical care of flying personnel is requested to complete a separate questionnaire for each patient he has completed treating with facial hair growth problems. Additional copies of this questionnaire may be duplicated as needed.

No identifying data about the individual patient is required on these questionnaires. At the discretion of the individual Flight Surgeon, a copy of this questionnaire may be made for retention in his medical records for future reference.

The specific medical problems of interest to this survey are of two types:

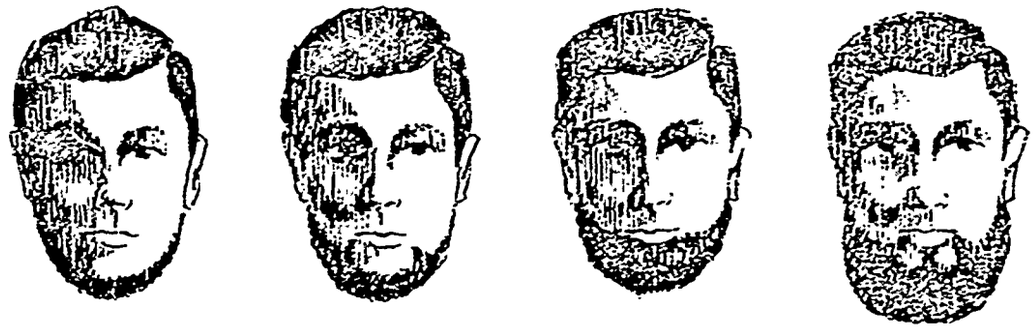
(1) Those caused by the physical action, pressure or rubbing, of the breathing mask on the hairy facial skin surface. Examples of such problems might include, but are not necessarily limited to, the following: chafing, swelling and tenderness. Only those skin abnormalities which can be reasonably related to the previous wearing of oxygen masks should be considered.

(2) Injuries to patient wearing facial hair growth, such as accidents, skin burns while breathing a high concentration of oxygen, or, hypoxia resulting from the facial hair growth adversely affecting the integrity of the breathing mask seal.

If there are no medical problems to report, complete Items 23 and 24 only.

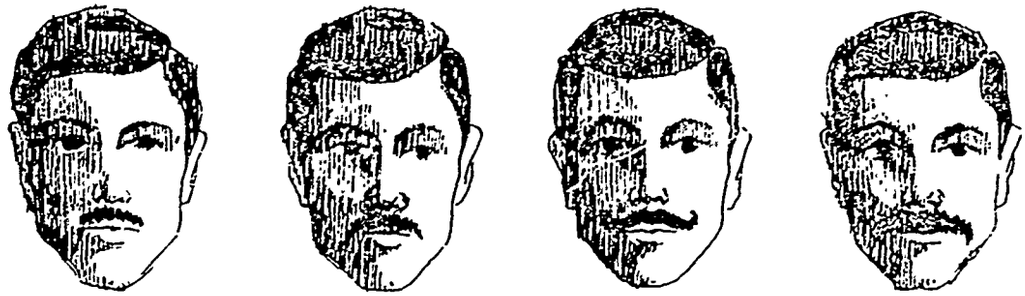
Return of the questionnaires is requested by no later than 30 August 1971, in the enclosed pre-addressed envelope.

1. Type of beard worn by patient treated. Check one most appropriate sample.



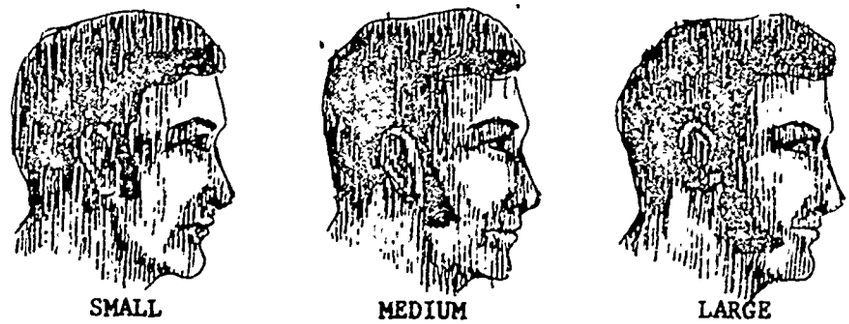
SMALL ☐ MEDIUM ☐ LARGE ☐ EXTRA LARGE ☐

2. Type of moustache worn by patient treated. Check one most appropriate sample.



SMALL ☐ MEDIUM ☐ LARGE ☐ EXTRA LARGE ☐

3. Type of sideburns worn by patient treated. Check one most appropriate sample.



SMALL ☐ MEDIUM ☐ LARGE ☐

4. Texture of patients facial hair growth. ☐ - Fine ☐ - Medium ☐ - Course

5. Skin surface of patient treated. ☐ - Normal ☐ - Dry ☐ - Oily

6. Complexion of patient treated. ☐ - Fair ☐ - Ruddy ☐ - Other _____ (specify)

7. Additional amplifying remarks about the patient's facial hair growth (optional). _____

_____

_____

8. Class of facial skin disorder treated in connection with facial hair growth worn with aviation oxygen breathing equipment in use during flight or ground simulation.

☐ - Pyodermia ☐ - Seborrhea ☐ - Eczema ☐ - Acne

☐ - Other (specify) _____

9. Probability that symptoms treated were caused by wearing facial hair growth in conjunction with aviation breathing equipment.

☐ - 50% ☐ - 100%

10. Length of time facial hair growth was worn prior to treatment, if known. _____

11. Was it necessary to refer the patient to a Dermatologist for treatment?

☐ - No ☐ - Yes

12. Did the patient have any previous history of facial skin disorders?

☐ - No ☐ - Yes

If yes, briefly explain. _____

_____

_____

13. Have you treated any injury cases that have resulted from accidents caused by the individual wearing facial hair growth?

☐ - No ☐ - Yes

If yes, give details. _____

_____

_____

_____

14. Have you treated any facial skin burn cases that resulted from wearing facial hair growth while breathing oxygen through the breathing mask?

☐ - No ☐ - Yes

If yes, give details. _____

_____

_____

_____

15. Have you treated any cases of hypoxia that were caused by facial hair growth interfering with the integrity of the breathing mask facial seal?

☐ - No ☐ - Yes

If yes, give details. _____

_____

_____

_____

16. Briefly describe the type of breathing equipment the patient used by model, and designation, if known (for skin disorders or injuries). _____

_____

_____

17. How many days was patient treated (for skin disorders or injuries)?

_____

18. How many duty days were lost (for skin disorders or injuries)? _____

19. How many days was patient grounded (for flying personnel only)? (for skin disorders or injuries) _____

20. General physical condition of patient at time of treatment.

☐ - Normal in all other respects

☐ - Other (specify) _____

21. Age of patient treated _____ Race _____

22. Additional medical remarks (optional), e.g. final disposition: _____

_____

_____

_____

23. Date, rank and signature of Flight Surgeon.

_____ _____ _____

24. Name and location of Medical Facility to which attached.

_____

_____