

New Respirator Fit Test Panels Representing the Current U.S. Civilian Workforce

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New Respirator Fit Test Panels Representing the Current U.S. Civilian Workforce

- **Importance of test panels**
- **Appropriateness of the LANL panels**
- **NIOSH research**
- **Proposed NIOSH panel**
- **Panel development timeline**

Importance of Test Panels

- Anthropometric panels of facial dimensions are relied upon to provide sizing reference for respirators in many applications
 - APF establishment
 - Respirator design and development
 - TIL certification and standards
 - Research standards

LANL Panels

- **The current panels were developed by Los Alamos National Laboratory (LANL) based on 1967–1968 U.S. Air Force surveys**
- **The facial anthropometry was assumed to be representative of U.S. adults**
- **LANL panels were expected to accommodate 90%–95% of the U.S. population**

LANL 25-Member Panel for Full-Facepiece Respirators

Face Width (mm)

117.5 126.5 135.5 144.5 153.5

133.5

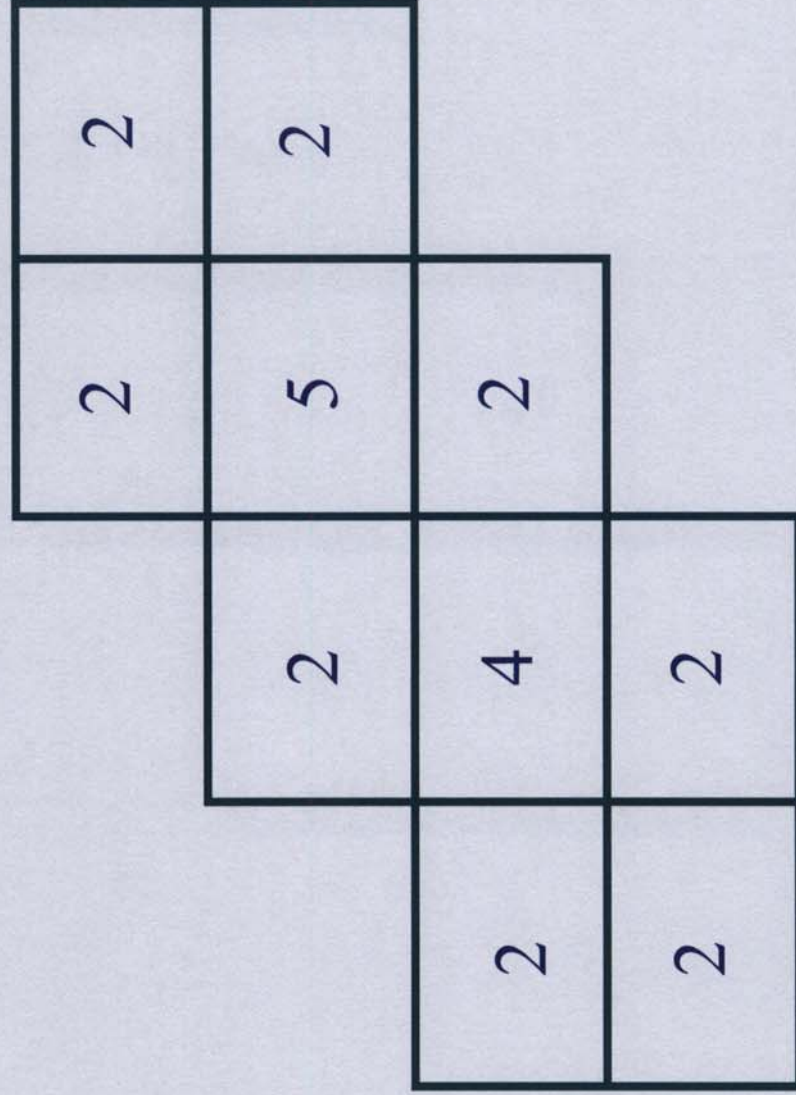
123.5

113.5

103.5

93.5

Face Length (mm)



LANL 25-Member Panel for Half-Mask Respirators

Lip Length (mm)

34.5 43.5 52.5 61.5

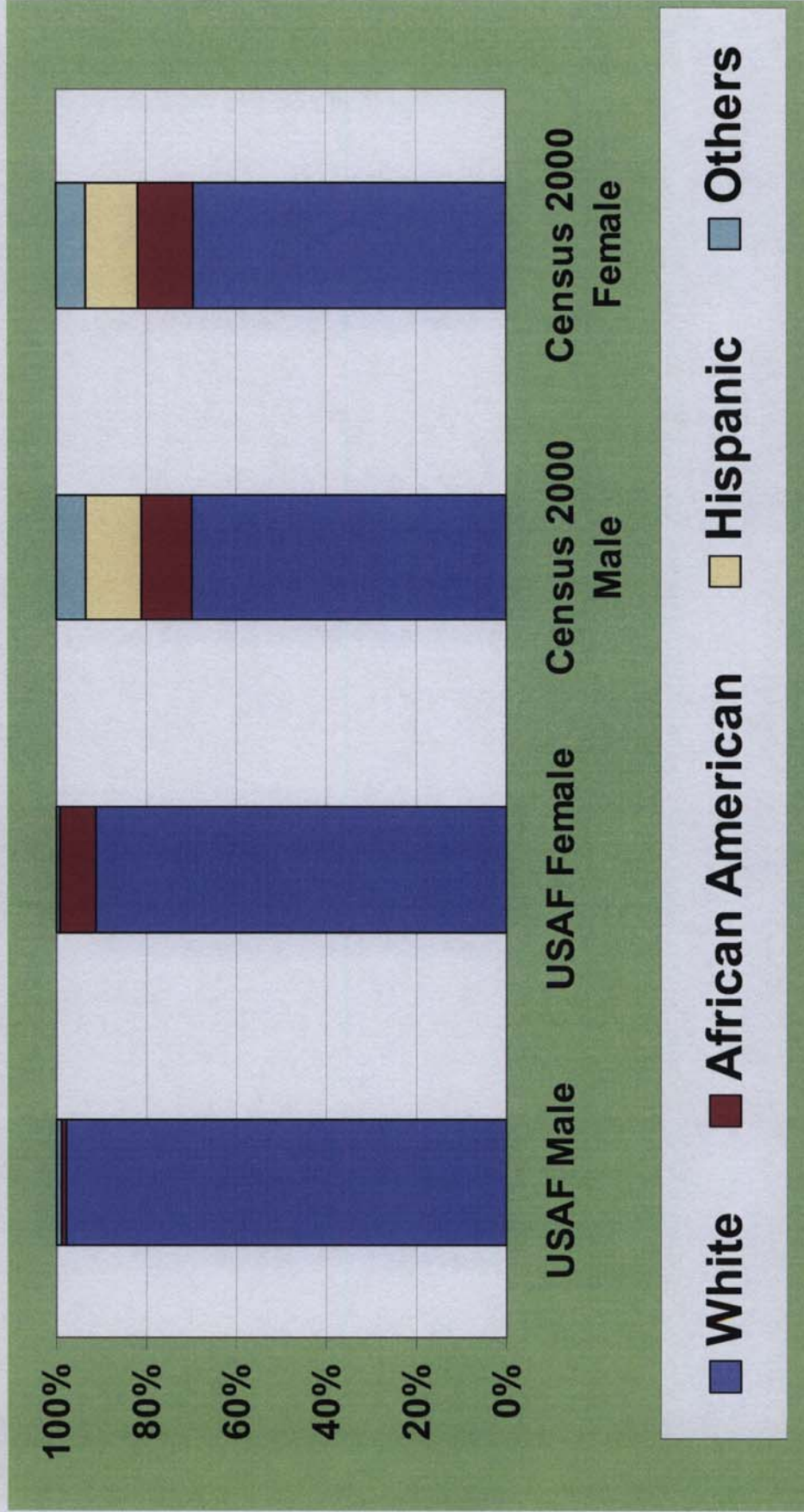
Face Length (mm)
 133.5
 123.5
 113.5
 103.5
 93.5

2	2	2
1	5	3
3	4	1
2	2	

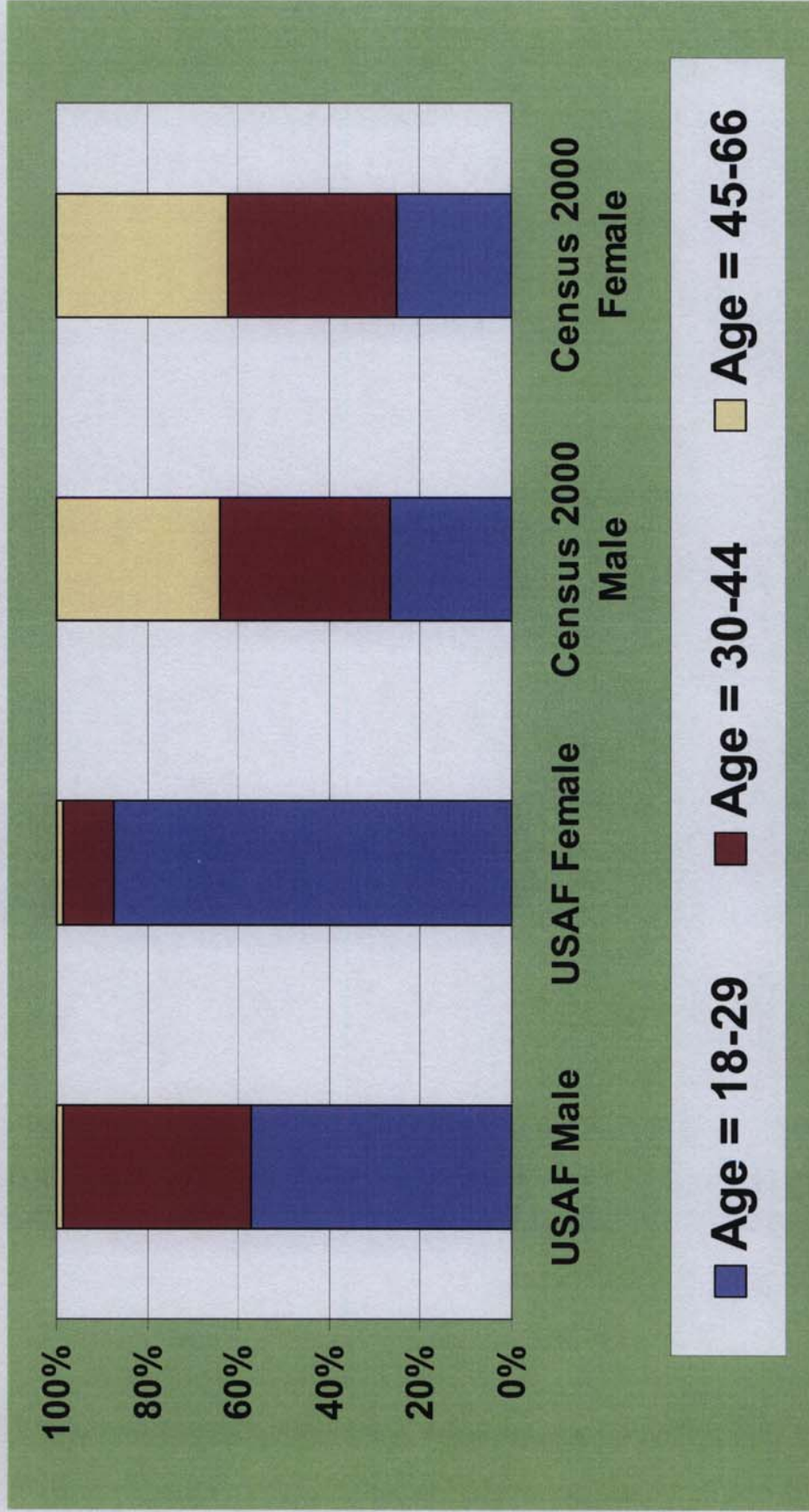
Panel Applicability Problem

- **Concern raised:**
 - **Demographics of the U.S. population has changed over the last 30 years**
 - **Military data may not fairly represent the diversity of face sizes**

Race Distribution of 1967-1968 Air Force Survey Subjects and 2000 Census Data



Age Distribution of 1967-1968 Air Force Survey Subjects and 2000 Census Data



Panel Applicability Problem

- **Scientific Evidence:**
 - Leigh measured 1,467 employees (1975)
 - Bureau of Mines surveyed 48 male mine rescue workers (1978)
 - NIOSH found that 16% of Civilian American and European Surface Anthropometry Resources (CAESAR) subjects were outside the limits of the LANL panel for full-facepiece respirators (2002)

NIOSH Research

THE RESULTS I AM PRESENTING TO YOU ARE DRAFT AND SUBJECT TO CHANGE SINCE THE STUDY IS UNDERGOING PEER REVIEW. MY PRESENTATION REPRESENTS MY PERSONAL VIEWS AND DOES NOT NECESSARILY REPRESENT THE VIEWS OF NIOSH. THE PURPOSE FOR PRESENTING THIS DRAFT INFORMATION TODAY IS TO SUPPORT A FULL DISCUSSION ABOUT THE TITLE CONCEPT.

NIOSH Research

- **Develop an anthropometric database detailing the face-size distributions of respirator users**
- **Evaluate the applicability of the LANL respirator fit test panels**
- **Investigate correlation between facial dimensions and respirator fit**
- **Develop new respirator fit test panels**

Anthropometric Data Base

- **A stratified sampling plan was used**
 - **Two-gender strata: male and female**
 - **Four race/ethnic groups:**
 - **White, African American, Hispanics, and others**
 - **Three age groups: 18–29, 30–44, and 45–66**
- **Sample size: 3,997**

Traditional Measurements



Sliding Caliper



Spreading Caliper



Anthropometer



Anthropometric Data Base

Race	Male				Female			
	Age group				Age group			
	18-29	30-44	45-65	Total	18-29	30-44	45-66	Total
White	271	611	485	1,367	151	194	174	519
African American	101	255	278	634	51	213	325	589
Hispanic	155	182	75	412	53	36	37	126
Other	24	47	59	130	52	65	103	220
Total	551	1095	897	2,543	307	508	639	1,454

Fitting the NIOSH Data into the LANL Panel

Face Width (mm)

117.5 126.5 135.5 144.5 153.5

Face Length (mm)

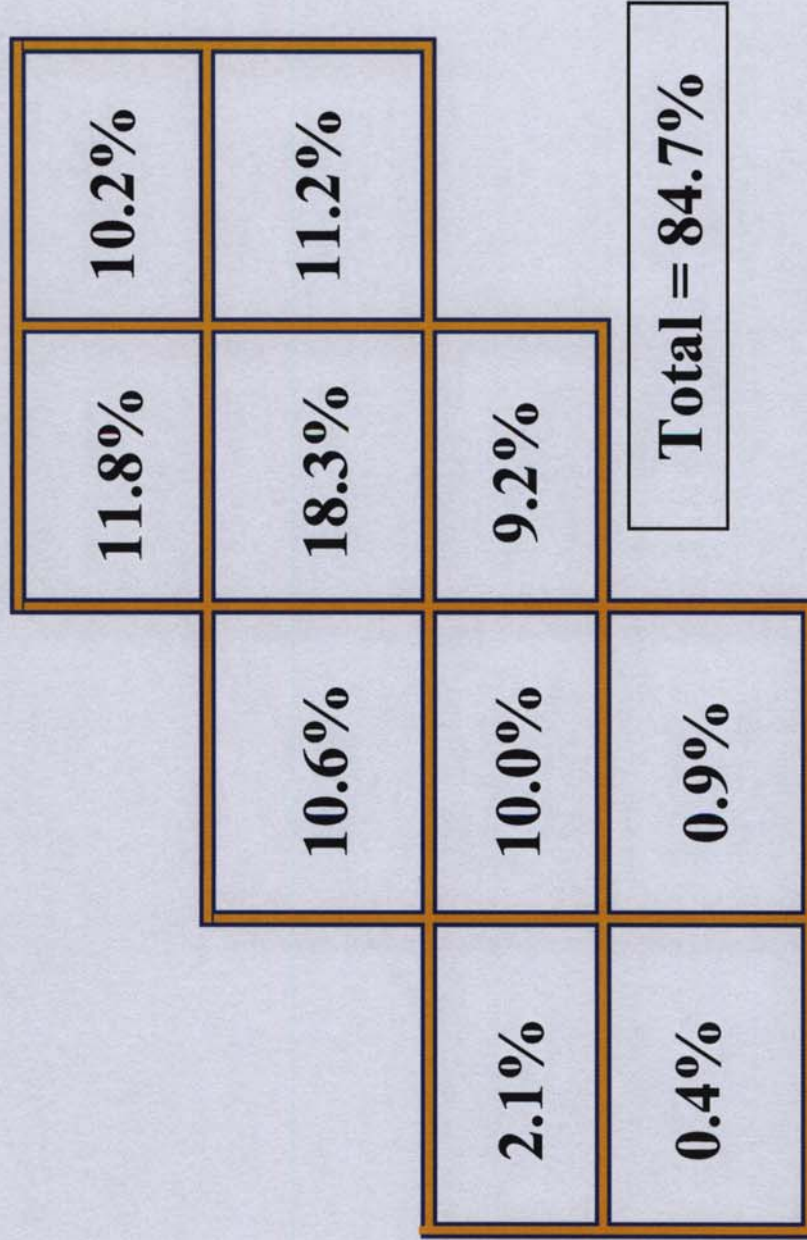
133.5

123.5

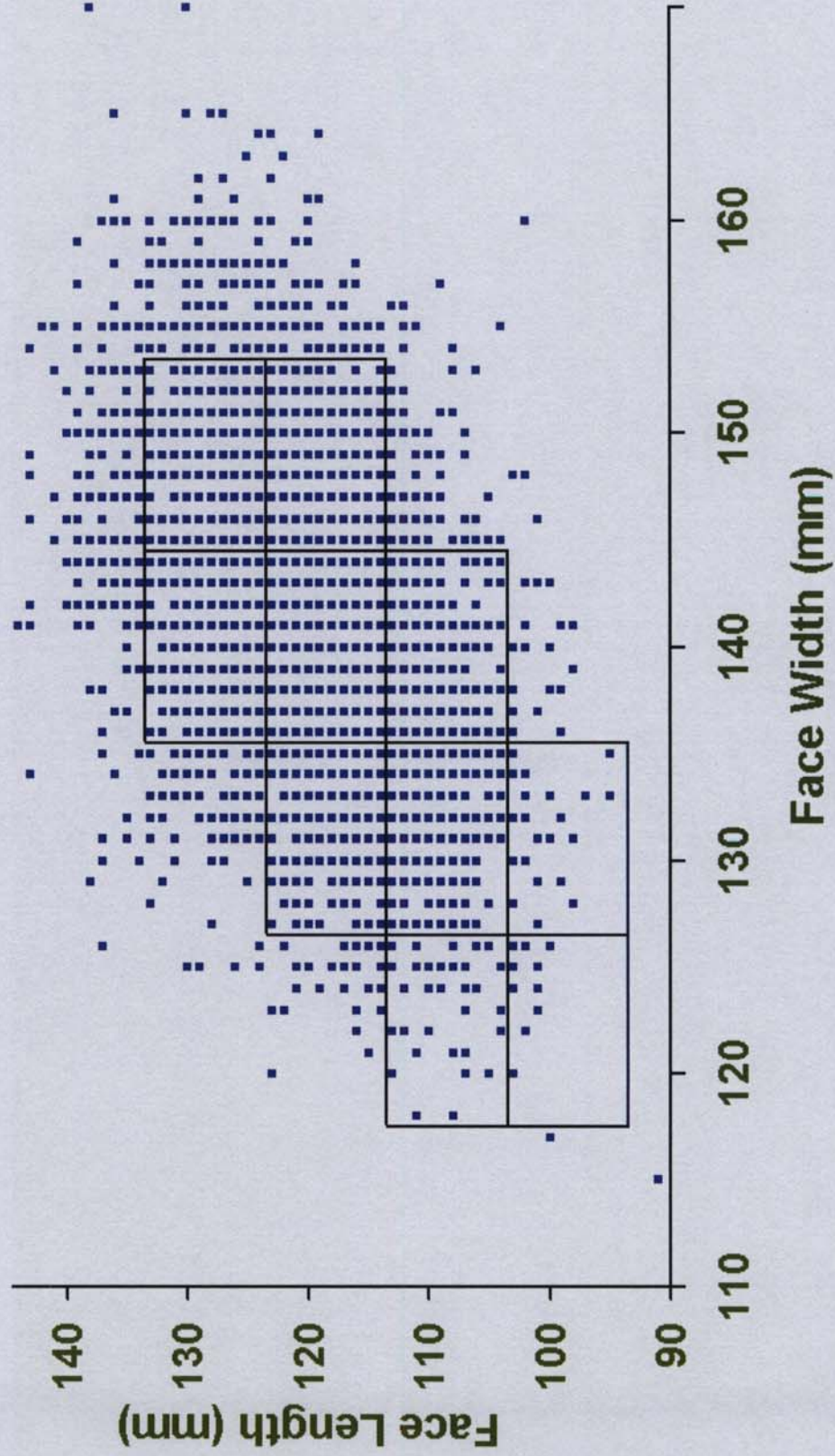
113.5

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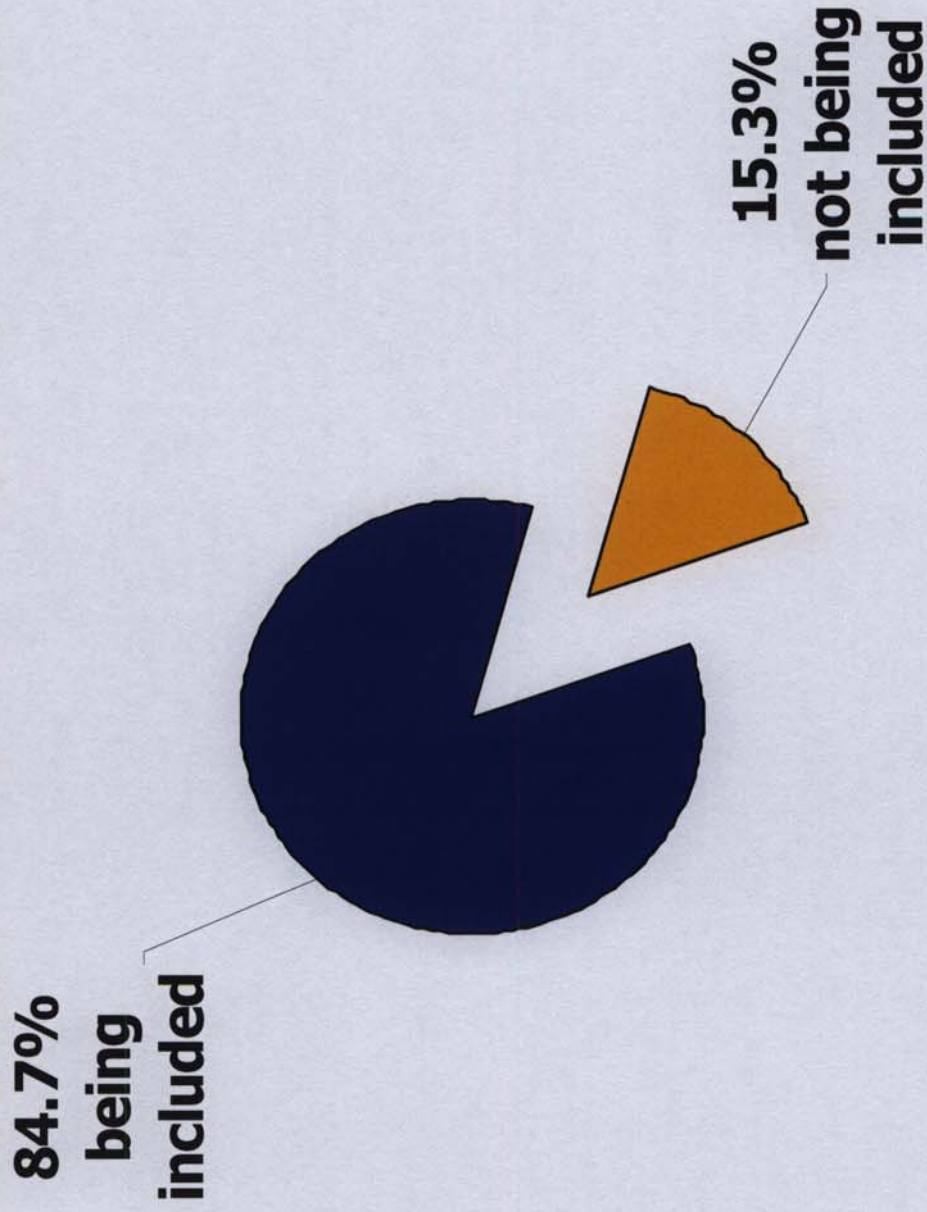
93.5



Bivariate Distribution against the LANL Panel



Fitting the NIOSH Data into the LANL Panel



Preliminary Findings

- **The 1967–1968 Air Force survey data was not reflective of the anthropometric distribution of the current U.S.**
- **New respirator fit test panels needed to be developed**

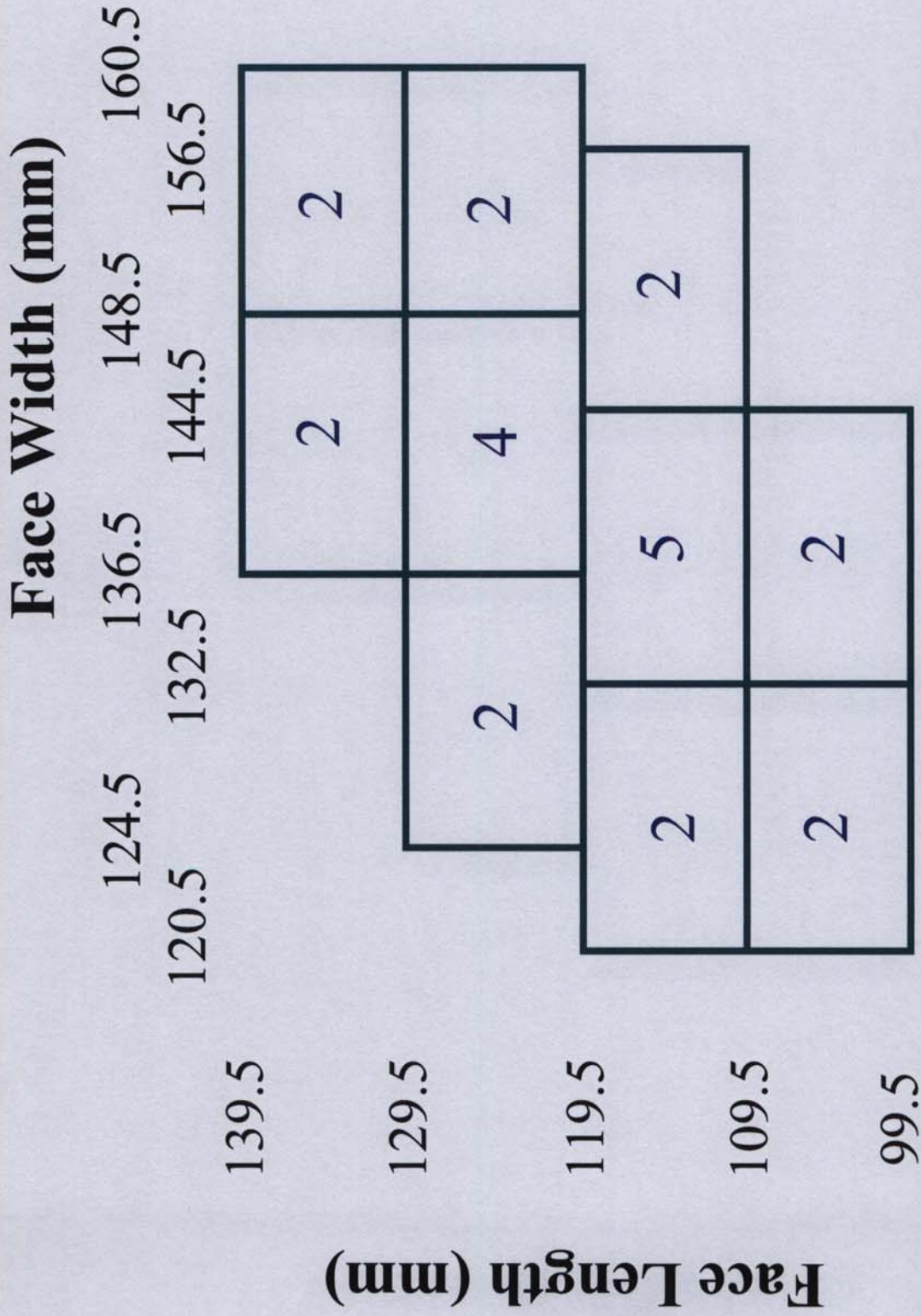
Correlations between Facial Dimensions and Respirator Fit

- Facial dimensions were found to be significantly correlated with fit factors in **28** of the **33** respirator model/size combinations
- Face width, bigonial breadth, nose protrusion, and face length were most frequently found to have significant correlation with fit factors
- Lip length is not appropriate
- Face length and face width are recommended

Proposed NIOSH Panel

- 10-cell panel
- 25 subjects
- At least two subjects for each cell
- Matching the distribution of the population
- Face length and face width were selected to define the panel for both half-masks and full-facepiece respirators

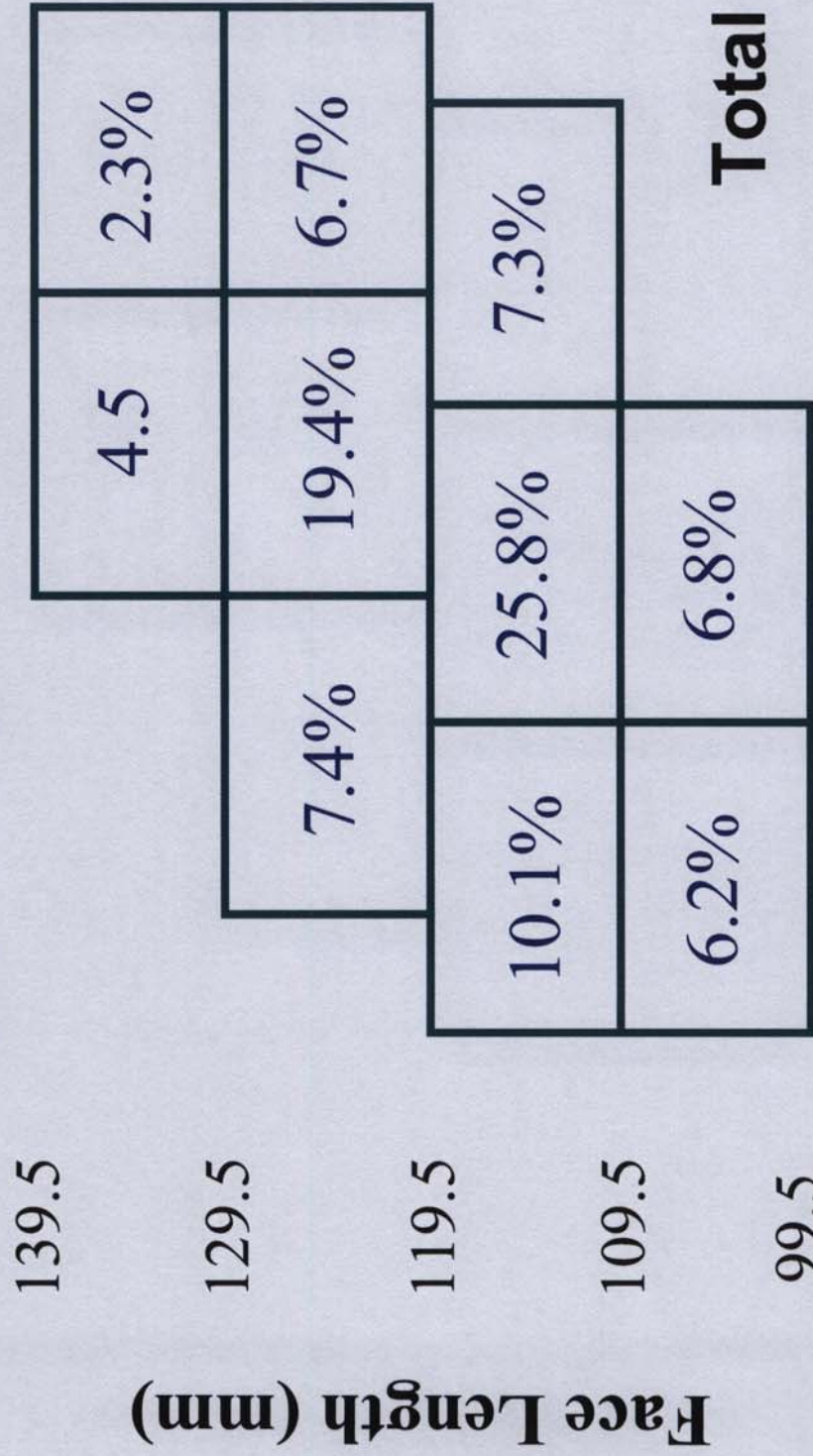
Proposed NIOSH Panel



Proposed NIOSH Panel

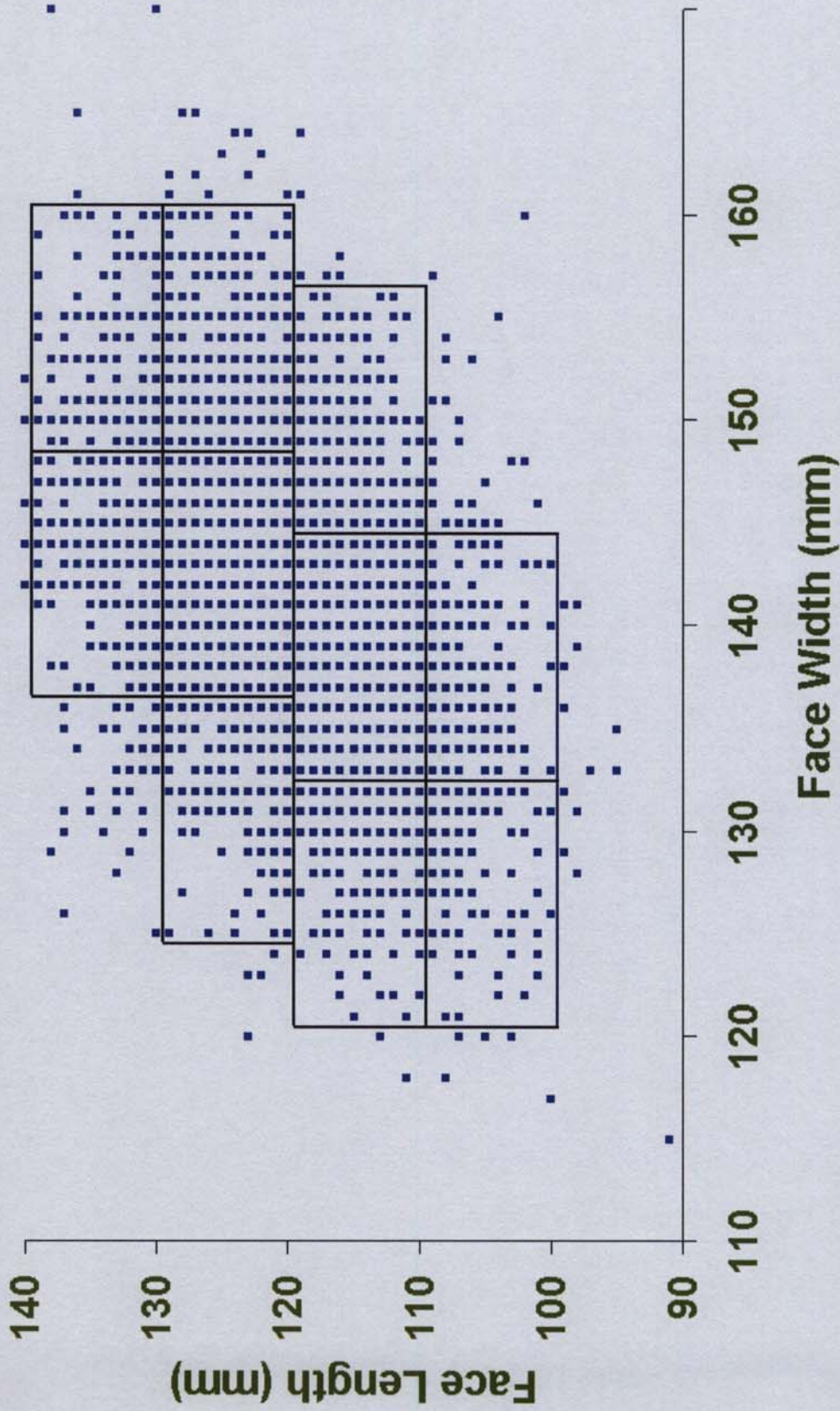
Face Width (mm)

124.5 136.5 148.5 160.5
 120.5 132.5 144.5 156.5



Face Length (mm)

Proposed NIOSH Panel - Bivariate Distribution



Proposed NIOSH Panel - Application

- **One size fits all**
 - Cells 1–10
 - 25 subjects, 2 donnings
- **Two sizes**
 - Cells 1–6 and 4–10
 - 50 subjects, 2 donnings
- **Three sizes**
 - Cells 1–5, 4–7, and 6–10
 - 75 subjects, 2 donnings

Panel Development Timeline

- **Protocol development and review**
 - November 2002
- **Data collection**
 - September 2003
- **Data analyses & report preparation**
 - May 2004
- **Peer-review**
 - 2nd Quarter 2005

Thank You

Any questions?