GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
RESEARCH PROJECT INITIATION

Date: November 20, 1975

Project Title: Technical Evaluation of the Materials and Stitching System...

Project No: E-27-633 (Continuation of E-27-628)

Principal Investigator: Dr. W. D. Freeston

Sponsor: US Army Natick Development Center

Agreement Period: From 11/10/75 Until 1/9/76

Type Agreement: Purchase Order No. DAAG17-75-M-1033 Fixed Price

Amount: $1,500

Reports Required: Final Report

Sponsor Contact Person(s): Procurement Office
U.S. Army Natick Development Center
Kansas Street
Natick, Massachusetts 01760
ATTN: AMXNM-PE

Assigned to: Textile Engineering

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Project File

RA-3 (9-75)
GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
SPONSORED PROJECT TERMINATION

Date: May 4, 1976

Project Title: "Technical Evaluation of the Materials and Stitching System"

Project No: E-27-633

Project Director: Dr. W. D. Freeston

Sponsor: U. S. Army Natick Development Center

Effective Termination Date: 1/9/76

Clearance of Accounting Charges: 1/31/76

Grant/Contract Closeout Actions Remaining: NONE

assigned to: Textile Engineering

(School/Laboratory)

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- Project Code (GTRI)
- Other

CA-4 (3/76)
FINAL REPORT

Technical Evaluation of Materials and Stitching System
(contract No. DAAG-17-76-M-1088)

Prepared for

U. S. Army Natick Laboratories
Natick, Mass.

by

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School of Textile Engineering
Georgia Institute of Technology

March, 1975
Technical Evaluation of Materials and Stitching System

This investigation carried out for U.S. Army Natick Development Center examined for tensile strength and web fabric needle damage six samples in which web material, skin material and seam type were varied. Description of the samples tested follows:

<table>
<thead>
<tr>
<th>Sample Section No.</th>
<th>Web Material</th>
<th>Skin Material</th>
<th>Seam Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.)</td>
<td>Single Coat</td>
<td>Type I Class 1</td>
<td>Straight Stitch</td>
</tr>
<tr>
<td>2.)</td>
<td>Single Coat</td>
<td>Type I Class 2</td>
<td>Straight Stitch</td>
</tr>
<tr>
<td>3.)</td>
<td>Double Coat</td>
<td>Type I Class 1</td>
<td>Straight Stitch</td>
</tr>
<tr>
<td>4.)</td>
<td>Double Coat</td>
<td>Type I Class 2</td>
<td>Straight Stitch</td>
</tr>
<tr>
<td>5.)</td>
<td>Single Coat</td>
<td>Type I Class 1</td>
<td>Double Stitch</td>
</tr>
<tr>
<td>6.)</td>
<td>Single Coat</td>
<td>Type I Class 2</td>
<td>Double Stitch</td>
</tr>
</tbody>
</table>

All samples were sewn by Natick on a double needle, 3/16" gauge machine using Singer needle no. 4401 - size no. 23. The seams were sewn at 6 (+1) stitches per inch.

Three specimens of each were subjected to five cycles of preloading at 85 lbs. deadweight using a period of two hours under load and 1/2 hour relaxation per cycle. These three specimens and four additional specimens which had no preloading were tensile tested to failure. The stitches were removed from a six inch specimen of each sample material for a visual needle damage inspection of the warp and filling threads of the web material.

Results from these tests are as follows:
<table>
<thead>
<tr>
<th>Sample Section No.</th>
<th>AVERAGE ULTIMATE TENSILE STRENGTH (lbs/in. width)</th>
<th>NEEDLE DAMAGE (No. of cut yarns/stitch)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Preload</td>
<td>After 5 cycle preload</td>
</tr>
<tr>
<td>1</td>
<td>130</td>
<td>134</td>
</tr>
<tr>
<td>2</td>
<td>118</td>
<td>124</td>
</tr>
<tr>
<td>3</td>
<td>132</td>
<td>140</td>
</tr>
<tr>
<td>4</td>
<td>122</td>
<td>129</td>
</tr>
<tr>
<td>5</td>
<td>116</td>
<td>114</td>
</tr>
<tr>
<td>6</td>
<td>118</td>
<td>130</td>
</tr>
</tbody>
</table>

Some observations based upon these data include:

1.) All tensile failure load levels exceed the 3 psi over-pressure load level by 400%.

2.) The effect of cyclic preloading generally is to increase the tensile strength of specimens.

3.) The needle used cut less than one warp of filling yarn per seam stitch. At these very low levels of web fabric yarn damage due to sewing, tensile strength of the specimens is not relatable to needle caused yarn damage.

4.) The effect of web or skin material and double stitching produced no significant trends in the data. Comparison of data in which web material, skin material or seam type were grouped produced 7% or less change.