# R&D Project Reviews

## Time Scales

<table>
<thead>
<tr>
<th>Project</th>
<th>Title</th>
<th>Req'd Task</th>
<th>By</th>
<th>Date Req'd</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Page 4
<table>
<thead>
<tr>
<th>PROJECT</th>
<th>TITLE</th>
<th>REQ'D TASK</th>
<th>BY</th>
<th>DATE REQ'D</th>
</tr>
</thead>
<tbody>
<tr>
<td>162</td>
<td>Advanced Film Gr</td>
<td>Update programmable system operation</td>
<td>AS</td>
<td>7/31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Set material for new 3kW of generator</td>
<td>HW</td>
<td>9/30</td>
</tr>
<tr>
<td>126</td>
<td>Testing Techniques</td>
<td>Stop-at-react reactor</td>
<td>SMF</td>
<td>12/1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Design gap operating in our power facility</td>
<td>&amp;</td>
<td>9/30</td>
</tr>
<tr>
<td>179</td>
<td>Photo Electric Array</td>
<td>Establish feasibility of ferromagnetic scanner</td>
<td>WW</td>
<td>11/16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ESPA-mono detector device for transmission 8kV, 8kV compact</td>
<td>EB</td>
<td>14/1</td>
</tr>
<tr>
<td>170</td>
<td>Photo Responsive Disc</td>
<td>Product for evaluation Jet Analyst</td>
<td>KT</td>
<td>9/15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Name as XP-01, store in support</td>
<td>&amp;</td>
<td>11/1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Design simple, demonstrate</td>
<td>&amp;</td>
<td>12/1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Designing of simple devices</td>
<td>&amp;</td>
<td>2/16</td>
</tr>
<tr>
<td>121</td>
<td>Vela Thrup Shares</td>
<td>Characterization, limitation and test material of simple</td>
<td>KG</td>
<td>7/15</td>
</tr>
</tbody>
</table>
|         |       | System, test A/A-Determin 

<table>
<thead>
<tr>
<th>PROJECT</th>
<th>TITLE</th>
<th>REQ'D TASK</th>
<th>BY</th>
<th>DATE REQ'D</th>
</tr>
</thead>
<tbody>
<tr>
<td>161</td>
<td>Analytical Tech, Inc.</td>
<td>Complete system concept</td>
<td>BY</td>
<td>9/30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Conduct successful field test using</td>
<td>&amp;</td>
<td>8/31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Development of portable set-ups for remote use on board</td>
<td>&amp;</td>
<td>11/6</td>
</tr>
<tr>
<td>160</td>
<td>Packaging Techniques</td>
<td>Complete system concept</td>
<td>RTB</td>
<td>8/30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Demonstrate feasibility</td>
<td>&amp;</td>
<td>11/6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Demonstrate capability</td>
<td>&amp;</td>
<td>11/6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Package first prototype 16kg</td>
<td>&amp;</td>
<td>8/30</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Designing of simple packages</td>
<td>ORA</td>
<td>10/1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Designing of simple packages</td>
<td>KTB</td>
<td>10/1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Designing of simple packages</td>
<td>KTB</td>
<td>10/1</td>
</tr>
</tbody>
</table>
### R&D Project Reviews

#### Time Scales

<table>
<thead>
<tr>
<th>Project</th>
<th>Title</th>
<th>Req'd Task</th>
<th>By</th>
<th>Date Req'd</th>
</tr>
</thead>
<tbody>
<tr>
<td>148</td>
<td>Diode Development</td>
<td>Product Completion, Draft</td>
<td>OH</td>
<td>8/5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Results of 10-5 comparison</td>
<td></td>
<td>8/1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Exhaustive test results</td>
<td></td>
<td>8/31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Objective Spec</td>
<td>OA</td>
<td>8/1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Structure, 1st assembly</td>
<td></td>
<td>7/1</td>
</tr>
<tr>
<td>171</td>
<td>Zener Diode</td>
<td>Zener structure defined</td>
<td></td>
<td>During August 174</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Operating life data, Transfer for Zener, Complete Prod. Mon.</td>
<td></td>
<td>9/16, 9/16</td>
</tr>
<tr>
<td>189</td>
<td>Field Effect Transistor (Mechan - FET)</td>
<td>Obtain C. Spec, design &amp; fabrication</td>
<td></td>
<td>9/16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evaluation of design, parameter evaluation completed</td>
<td></td>
<td>9/15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sampling of 100</td>
<td></td>
<td>9/31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sample of 100</td>
<td></td>
<td>9/13</td>
</tr>
</tbody>
</table>
# R&D Project Reviews

## Time Scales

<table>
<thead>
<tr>
<th>Project</th>
<th>Title</th>
<th>Req'd Task</th>
<th>By</th>
<th>Date Req'd</th>
</tr>
</thead>
<tbody>
<tr>
<td>142</td>
<td>SET Device</td>
<td>Objective Spec</td>
<td>08</td>
<td>7/31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Optimum Structure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evaluation of Device</td>
<td></td>
<td></td>
</tr>
<tr>
<td>109</td>
<td>Joo Device</td>
<td>New Masks</td>
<td>R1</td>
<td>8/15</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contact business plan</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Packaging Orientation</td>
<td>R1</td>
<td>8/14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Epitaxy Samples</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quantum Sample ready</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>File for transfer acl</td>
<td></td>
<td></td>
</tr>
<tr>
<td>117</td>
<td>RF Fia Transistor Array Patent disclosure</td>
<td>RF Fia Transistor Array Patent disclosure</td>
<td></td>
<td>7/14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 units soldelectrodes</td>
<td></td>
<td>7/31</td>
</tr>
<tr>
<td>144</td>
<td>1500 Series</td>
<td>1st order feasibility test</td>
<td>LC</td>
<td>End of July</td>
</tr>
<tr>
<td></td>
<td></td>
<td>134/134 samples</td>
<td></td>
<td></td>
</tr>
<tr>
<td>146</td>
<td>4500 Series</td>
<td>4x0, 16x/.6 data</td>
<td>LC</td>
<td>7/14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3501-1 st sample to ob</td>
<td></td>
<td>7/21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diamond test prod</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Polished results - KE</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gold bond</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Polished data / data</td>
<td></td>
<td></td>
</tr>
<tr>
<td>145</td>
<td>4000 Series</td>
<td>Field and sectional data</td>
<td>08</td>
<td>7/14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Split run completed</td>
<td></td>
<td>7/21</td>
</tr>
<tr>
<td>143</td>
<td>800 Series</td>
<td>Final Design Sample DFM</td>
<td>01</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1211- Slide Production</td>
<td></td>
<td>October/November</td>
</tr>
<tr>
<td>177</td>
<td>Advanced material family</td>
<td>First sample - side way</td>
<td>1K</td>
<td>End of October</td>
</tr>
<tr>
<td>152</td>
<td>The logic family</td>
<td>Works for entire family</td>
<td>1K</td>
<td>9/1 - completed</td>
</tr>
<tr>
<td>169</td>
<td>Multiple Devices</td>
<td>Process Ess. sample</td>
<td>04</td>
<td>8/31</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Surface roughness</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time for test ade</td>
<td></td>
<td>8/31</td>
</tr>
</tbody>
</table>
# R&D Project Reviews

## Table of Contents

<table>
<thead>
<tr>
<th>Job No.</th>
<th>Job Title</th>
<th>Date</th>
<th>Pages</th>
</tr>
</thead>
<tbody>
<tr>
<td>166</td>
<td>Contact Reel, Inc.</td>
<td>7/2/61</td>
<td>37</td>
</tr>
<tr>
<td>116</td>
<td>Basic Alleging Studies</td>
<td>7/3/61</td>
<td>37, 37</td>
</tr>
<tr>
<td>165</td>
<td>Competitor Reel, Ltd.</td>
<td>1/3/62</td>
<td>37</td>
</tr>
<tr>
<td>160</td>
<td>Packaging Reel, Inc.</td>
<td>7/14/61</td>
<td>44, 44, 44, 43</td>
</tr>
<tr>
<td>114</td>
<td>Special Diffusion Research</td>
<td>7/16/61</td>
<td>44, 45, 46</td>
</tr>
<tr>
<td>163</td>
<td>Knives v. Cutlery Phenomena</td>
<td>7/19/61</td>
<td>44, 45, 46</td>
</tr>
<tr>
<td>109</td>
<td>Diffusion Reel, Inc.</td>
<td>7/21/61</td>
<td>44, 45, 46</td>
</tr>
<tr>
<td>115</td>
<td>Aerospace Research</td>
<td>7/21/61</td>
<td>44</td>
</tr>
<tr>
<td>148</td>
<td>Dyke Development</td>
<td>7/21/61</td>
<td>50, 51</td>
</tr>
<tr>
<td>110</td>
<td>Glass &amp; Ceramic Development</td>
<td>1/21/61</td>
<td>53, 55</td>
</tr>
<tr>
<td></td>
<td>Project Reassignment</td>
<td>7/22/61</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Step and Repeat Camera</td>
<td>10/4/61</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>FT 4400</td>
<td>10/4/61</td>
<td>58</td>
</tr>
<tr>
<td>109</td>
<td>Diffusion Reel, Inc.</td>
<td>10/9/61</td>
<td>59, 55</td>
</tr>
<tr>
<td></td>
<td>Project layout - sul - diffuser data</td>
<td>11/4/61</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Meeting with drive people</td>
<td>11/6/61</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>XPT - 3 (Photo Diode)</td>
<td>11/3/61</td>
<td>66, 67</td>
</tr>
<tr>
<td></td>
<td>Resistors</td>
<td>11/20/61</td>
<td>71, 72, 73</td>
</tr>
<tr>
<td></td>
<td>Farman Discussion</td>
<td>11/21/61</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td>Microwave Layout</td>
<td>11/27/61</td>
<td>75, 79</td>
</tr>
<tr>
<td></td>
<td>Faceplate Discussion</td>
<td>12/4/61</td>
<td>76</td>
</tr>
<tr>
<td>108</td>
<td>Teco Development (Teco Trans.)</td>
<td>12/17/61</td>
<td>80, 81</td>
</tr>
<tr>
<td>171</td>
<td>Zenor Pulsed Alum.</td>
<td>1/14/61</td>
<td>82, 83</td>
</tr>
<tr>
<td></td>
<td>Charge Geometry Meeting</td>
<td>1/17/61</td>
<td>84</td>
</tr>
<tr>
<td>JOB NO.</td>
<td>JOB TITLE</td>
<td>DATE</td>
<td>PAGES</td>
</tr>
<tr>
<td>---------</td>
<td>-----------------------------------</td>
<td>------------</td>
<td>-------</td>
</tr>
<tr>
<td>142</td>
<td>S.C.P. Device</td>
<td>10/4/61</td>
<td>107, 68, 69</td>
</tr>
<tr>
<td>143</td>
<td>1000 Series Dev</td>
<td>11/1/61</td>
<td>2</td>
</tr>
<tr>
<td>144</td>
<td>2000 Series Dev</td>
<td>11/1/61</td>
<td>2</td>
</tr>
<tr>
<td>145</td>
<td>3000 Series Dev</td>
<td>11/1/61</td>
<td>2+3</td>
</tr>
<tr>
<td>146</td>
<td>4500 Series Dev</td>
<td>11/1/61</td>
<td>3</td>
</tr>
<tr>
<td>147</td>
<td>6000 Series Dev</td>
<td>11/1/61</td>
<td>4+5</td>
</tr>
<tr>
<td>148</td>
<td>Doctor Development</td>
<td>11/1/61</td>
<td>6, 7, 8, 9</td>
</tr>
<tr>
<td>152</td>
<td>Hologic Prod. Dev</td>
<td>11/1/61</td>
<td>10, 11</td>
</tr>
<tr>
<td>153</td>
<td>Hologic Advanced Dev</td>
<td>11/1/61</td>
<td>11</td>
</tr>
<tr>
<td>189</td>
<td>Field Effect Transistors</td>
<td>11/1/61</td>
<td>14, 15, 16, 25</td>
</tr>
<tr>
<td>162</td>
<td>Semiconductor Film Branch</td>
<td>11/1/61</td>
<td>16</td>
</tr>
<tr>
<td>140</td>
<td>Strain Gauge Elements</td>
<td>11/1/61</td>
<td>17, 18, 20</td>
</tr>
<tr>
<td>150</td>
<td>Tunnel Probe Development</td>
<td>11/1/61</td>
<td>19</td>
</tr>
<tr>
<td>126</td>
<td>Making Deb. Dev</td>
<td>11/1/61</td>
<td>21</td>
</tr>
<tr>
<td>179</td>
<td>Exploratory Photo-Sensitive Dev.</td>
<td>11/1/61</td>
<td>22, 23, 34</td>
</tr>
<tr>
<td>188</td>
<td>Exploratory Site-Switching Dev.</td>
<td>11/1/61</td>
<td>25</td>
</tr>
<tr>
<td>117</td>
<td>Exploratory Dev. Research</td>
<td>11/1/61</td>
<td>25</td>
</tr>
<tr>
<td>119</td>
<td>Surface Research</td>
<td>11/1/61</td>
<td>25</td>
</tr>
<tr>
<td>121</td>
<td>Data Storage Devices</td>
<td>11/1/61</td>
<td>25</td>
</tr>
<tr>
<td>161</td>
<td>Analytical Techniques Dev.</td>
<td>11/1/61</td>
<td>25</td>
</tr>
<tr>
<td>141</td>
<td>Microwave Physics</td>
<td>11/1/61</td>
<td>35, 36</td>
</tr>
</tbody>
</table>
# R&D Project Reviews

## Table of Contents

<table>
<thead>
<tr>
<th>JOB NO.</th>
<th>JOB TITLE</th>
<th>DATE</th>
<th>PAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>189</td>
<td>Field Effect Transistors</td>
<td>2/3/61</td>
<td>78,89,97</td>
</tr>
<tr>
<td></td>
<td>Product Layout Meeting</td>
<td>11/11/61</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Meeting to consider use of semiconductor units</td>
<td>12/17/61</td>
<td>91</td>
</tr>
<tr>
<td></td>
<td>re AC Spark Device</td>
<td>1/4/62</td>
<td>92</td>
</tr>
<tr>
<td></td>
<td>re Heater Elimination for 565 lamp</td>
<td>12/20/61</td>
<td>93</td>
</tr>
<tr>
<td>173</td>
<td>Etching Studies</td>
<td>1/2/61</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>S.C.P. Device continued</td>
<td>1/2/61</td>
<td>98,104</td>
</tr>
<tr>
<td>178</td>
<td>Magnetic Films</td>
<td>1/1/62</td>
<td>99-100</td>
</tr>
<tr>
<td>105</td>
<td>Radiation Studies</td>
<td>1/1/62</td>
<td>103</td>
</tr>
<tr>
<td>172</td>
<td>Advanced Microcuitry Pack.</td>
<td>1/31/62</td>
<td>116,117</td>
</tr>
<tr>
<td>106</td>
<td>Controlled Rectifiers</td>
<td>2/4/62</td>
<td>119</td>
</tr>
<tr>
<td>133</td>
<td>(non-planar Oxidation) Electroden Pick Def.</td>
<td>3/7/62</td>
<td>122</td>
</tr>
<tr>
<td>177</td>
<td>Thin Film Insulating</td>
<td>3/14/62</td>
<td>131,132</td>
</tr>
</tbody>
</table>
# TABLE OF CONTENTS - Miscellaneous Type Meetings
(Other than Project Reviews)

<table>
<thead>
<tr>
<th>TOPIC OF MEETING</th>
<th>DATE</th>
<th>PAGES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meeting on Hip &amp; Joint Camera</td>
<td>1/5/62</td>
<td>96</td>
</tr>
<tr>
<td>Epithelial Switching Problem Meeting</td>
<td>1/7/62</td>
<td>102</td>
</tr>
<tr>
<td>Review of Microscopic View</td>
<td>1/9/62</td>
<td>108</td>
</tr>
<tr>
<td>Meeting on Thick Epithelial Problem</td>
<td>2/5/62</td>
<td>118</td>
</tr>
<tr>
<td>Meeting Concerning NSA Proposal</td>
<td>3/3/62</td>
<td>126, 127</td>
</tr>
<tr>
<td>Summary of Tissue Scale FNP Product Plan MTY</td>
<td>3/7/62</td>
<td>128</td>
</tr>
<tr>
<td>Discussion on New Insulin Microcircuit w/ Mel Philpot</td>
<td>3/14/62</td>
<td>129</td>
</tr>
<tr>
<td>Microscopy Discussion at Acme, V46, Headache</td>
<td>3/19/62</td>
<td>130</td>
</tr>
<tr>
<td>Radio Meeting (T. Sch &amp; F. Anders)</td>
<td>3/20/62</td>
<td>131</td>
</tr>
<tr>
<td>Meeting on Microcircuit w/ V46, JPC</td>
<td>4/10/62</td>
<td>138</td>
</tr>
<tr>
<td>Miscellaneous Co. Section Meeting</td>
<td>5/1/62</td>
<td>140, 141</td>
</tr>
</tbody>
</table>

See "Red Project Review" Table of Contents for Miscellaneous Meetings prior to January 5.
### Project Review Schedule, week of Feb 5 - 10

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00</td>
<td>106 - Controlled Reactor</td>
<td>√</td>
</tr>
<tr>
<td>11:00</td>
<td>170 - Photo-Devices</td>
<td>√</td>
</tr>
<tr>
<td>12:00</td>
<td>( ) - Analytics</td>
<td>√</td>
</tr>
<tr>
<td>13:00</td>
<td>126 - Marking Tech Dev.</td>
<td>√</td>
</tr>
<tr>
<td>14:00</td>
<td>160 - Packaging Tech Dev.</td>
<td></td>
</tr>
<tr>
<td>15:00</td>
<td>110 - Glass Ceramic Tech.</td>
<td></td>
</tr>
<tr>
<td>16:00</td>
<td>171 - Data Storage Dev.</td>
<td></td>
</tr>
<tr>
<td>17:00</td>
<td>179 - Epax. Mat. Dev.</td>
<td></td>
</tr>
<tr>
<td>18:00</td>
<td>190 - Experimental Hardware Dev.</td>
<td></td>
</tr>
<tr>
<td>19:00</td>
<td>16 - Demo Allergy</td>
<td></td>
</tr>
<tr>
<td>20:00</td>
<td>119 - Surface Tech</td>
<td></td>
</tr>
<tr>
<td>21:00</td>
<td>120 - Materials Dev.</td>
<td></td>
</tr>
<tr>
<td>22:00</td>
<td>161 - Analytical Tech</td>
<td></td>
</tr>
<tr>
<td></td>
<td>165 - Engineering</td>
<td></td>
</tr>
<tr>
<td></td>
<td>117 - Specific Dev</td>
<td></td>
</tr>
<tr>
<td></td>
<td>176 - Program</td>
<td></td>
</tr>
<tr>
<td></td>
<td>177 - Thin film tunnel</td>
<td></td>
</tr>
</tbody>
</table>
"THE RIGHT BOOKS TO WRITE IN"

NATIONAL
FIGURING BOOK

56-800 SERIES

<table>
<thead>
<tr>
<th>150 Page Number</th>
<th>Ruling</th>
</tr>
</thead>
<tbody>
<tr>
<td>SINGLE PAGE FORM</td>
<td></td>
</tr>
<tr>
<td>56-800</td>
<td>Quadrille, 3/4 Inch</td>
</tr>
<tr>
<td>56-801</td>
<td>Faint</td>
</tr>
<tr>
<td>56-802</td>
<td>2 Columns</td>
</tr>
<tr>
<td>56-803</td>
<td>3 Columns</td>
</tr>
<tr>
<td>56-804</td>
<td>4 Columns</td>
</tr>
<tr>
<td>56-805</td>
<td>5 Columns</td>
</tr>
<tr>
<td>56-806</td>
<td>6 Columns</td>
</tr>
<tr>
<td>56-807</td>
<td>7 Columns</td>
</tr>
<tr>
<td>56-808</td>
<td>8 Columns</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DOUBLE PAGE FORM</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>56-810</td>
<td>10 Columns</td>
</tr>
<tr>
<td>56-812</td>
<td>12 Columns</td>
</tr>
<tr>
<td>56-814</td>
<td>14 Columns</td>
</tr>
<tr>
<td>56-816</td>
<td>16 Columns</td>
</tr>
<tr>
<td>56-818</td>
<td>18 Columns</td>
</tr>
<tr>
<td>56-820</td>
<td>20 Columns</td>
</tr>
</tbody>
</table>

ALL COLUMNAR RULINGS WITH UNITS

WHEN YOU NEED ANOTHER BOOK, ORDER FROM YOUR STATIONER BY SPECIFYING NUMBER ABOVE.

NATIONAL BLANK BOOK CO., HOLYOKE, MASS.
July 6, 1961

Project 142 - S.C.T. device Project review

Q. Why not only for production?

Present program
5. Fabrication: Try to set rpm high - have gotten 15,000/13,000 rpm
... 
\( \mu = \text{rpm rate} \)

Lower \( \mu \) (Co) in base material rpm, decrease \( \mu \)

B. Oxide - presently thick in thick oxide
   low in thin oxide
   Oxide yield is 30-60% in 0.5A oxide (original 90%)
   \( \mu = 5 \% \) if possible to 0.15 \( \mu \)
   Problem is pinholes from photo unit.

There is a possible technique to get rid of the pinhole problem by adding double FRP with different pattern and double removal.

Q: How thin must the oxide be to be useful?
Epitaxial is being tried
"Optimum" structure

1. Use a (but not old-fashioned chip holder)

4. New mesh indicates S - should try wider grid for 6000 g

No data yet on reproducibility.

5. Use device with slow cooled rather than metal gettered. This is done by pulling out from 1000°C to 600°C in 3 hrs. (Only in the last operation)

6. New geometry using smaller窗口 being tried

Eq. structure: [Diagram]
Q: When should DA get involved to develop product?

Objective: year — or delta for objective year.

Point of control should be slightly + negative.
Fall problems

Evaluation

1. Reproducibility
2. Yield
3. Far Calue
   a) Low Q
   b) VT diff
4. Slow cond. press

1. Reliability analysis
2. Characterization
   a) Feasible
5. Objective press

1. Optimum structure
2. Surface diffusion
3. Organic geometry
4. Surface states
5. Reorientation

July
Aug
Sept

15 - 5 days for reproducible
DFA (with D:T)
Chic at $>4000$ m/s
at $V_T = 0$
$E_C = 10$ mV

20m
Define developmental
program (as and each)
a) opt. structure (CB)
b) Smear (DFA x
chain)
c) Repeat Rel. stab.
Chinahine +
More mold case
Project review, Project # 108 - 7000 Development.

Big problem - pipercoffeld in single-sided structure.
This problem in double-sided structure.

Plan: Add

Initial concern is done.

Diffused from both sides - Not promising.

Match 7000

Initial N+ P with N diffused.

By removing the diffusion we get a greatly improved yield.

Project restriction:
Concentrate on double-diffused planes device to try to get to > 10% yield consistently to high area.

Contacting techniques of two types, gas-diffusion & capillary diffusion.

July 7, 1961
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Bv_{CE}$ at 100 $\mu$A</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>$Bv_{CEO}$ at 100 $\mu$A</td>
<td>110</td>
<td></td>
</tr>
<tr>
<td>$Bv_{CEO}$ at 10 $\mu$A</td>
<td>70-90</td>
<td></td>
</tr>
<tr>
<td>$I_B$ and $hFE$ at 150 mA + 5 V</td>
<td>55-180</td>
<td>Ranged</td>
</tr>
<tr>
<td>$\alpha$ @ 1 amp + 5 V</td>
<td>44-105</td>
<td>Ranged</td>
</tr>
<tr>
<td>Resistivity, Range</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$18-20 \Omega$ cm</td>
<td>6.0-8.0</td>
<td>0.6-0.8 $\Omega$ cm</td>
</tr>
<tr>
<td>$V_{CE (sat)}$ @ $I_C = 1$ amp $\beta = 10$</td>
<td>0.27</td>
<td>1.6</td>
</tr>
<tr>
<td>$V_{BE}$ @ $I_C = 1$ amp $\beta = 10$</td>
<td>0.83</td>
<td>1.0</td>
</tr>
<tr>
<td>$C_{ob}$ @ 10 V</td>
<td>180 pf</td>
<td></td>
</tr>
<tr>
<td>$I_{CEO}$ @ 30 V</td>
<td>Ranged to all extremes</td>
<td></td>
</tr>
<tr>
<td>$hfe$ @ 20 MHz $I_C = 500$ MA $V_{CE} = 10$ V</td>
<td>Ranged 2.5-3.5</td>
<td></td>
</tr>
</tbody>
</table>
### Mesa Emitter

<table>
<thead>
<tr>
<th>Run #</th>
<th>Resistivity</th>
<th>B. W.</th>
<th>Geometry</th>
<th>Ge</th>
<th>Resistivity</th>
<th>B. W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>16 - 17Ω·cm</td>
<td>6000</td>
<td>20</td>
<td>110</td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Vce = 500 MA</td>
<td>1.2 V</td>
<td>n'th with overlap diode subtracted out</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>11 - 17</td>
<td>14.5 μ</td>
<td>6000</td>
<td>19</td>
<td>2.9 V</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>11 - 12</td>
<td>9.5 μ</td>
<td>6000</td>
<td>38</td>
<td>2.7 V</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>11 - 12</td>
<td>10.3 μ</td>
<td>7000</td>
<td>20</td>
<td>3.0 V</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1.5 - 0.8</td>
<td>7.25 μ</td>
<td>6000</td>
<td>18</td>
<td>0.66 V</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1.5 - 0.8</td>
<td>6.8 μ</td>
<td>7000</td>
<td>32</td>
<td>4.1 V</td>
<td></td>
</tr>
</tbody>
</table>

### Oxide Masked Emitter

<table>
<thead>
<tr>
<th>Run #</th>
<th>Resistivity</th>
<th>B. W.</th>
<th>Ge</th>
<th>Resistivity</th>
<th>B. W.</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>11 - 12</td>
<td>9.5 μ</td>
<td>6000</td>
<td>32</td>
<td>4.1 V</td>
</tr>
</tbody>
</table>

### Epitaxial P-N (Collector) Junction Measured

<table>
<thead>
<tr>
<th>Run #</th>
<th>Resistivity</th>
<th>Thickness of Film</th>
<th>B. W.</th>
<th>β @ 10 V</th>
<th>Punch Thru Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.1 Ω·cm</td>
<td>51 μm</td>
<td>43 μm</td>
<td>75</td>
<td>40 V</td>
</tr>
<tr>
<td>6</td>
<td>3.0</td>
<td>37 μm</td>
<td>24 μm</td>
<td>75</td>
<td>32 V</td>
</tr>
<tr>
<td>7</td>
<td>1.7</td>
<td>29 μm</td>
<td>21 μm</td>
<td>70</td>
<td>45 V</td>
</tr>
<tr>
<td>8</td>
<td>1.0</td>
<td>30 μm</td>
<td>13 μm</td>
<td>72</td>
<td>55 V</td>
</tr>
<tr>
<td>9</td>
<td>1.7</td>
<td>28 μm</td>
<td>26 μm</td>
<td>22</td>
<td>55 V</td>
</tr>
</tbody>
</table>

P. James  
R. Parker  
6/27/61
X7000 has 3.6 times area of FT6200 but only 20% more emitter periphery.
X7000 has 11 times area of FT4200.
New geometry with same area would double emitter periphery!

25 units tested for NPNP switching:

<table>
<thead>
<tr>
<th>Temp</th>
<th>Iamp</th>
<th>Bias</th>
<th>Iamp</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1amp</td>
<td></td>
<td>5amp</td>
</tr>
<tr>
<td>25°C</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>100°C</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>150°C</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
<tr>
<td>175°C</td>
<td>none</td>
<td>none</td>
<td>none</td>
</tr>
</tbody>
</table>
Project: Must work out the following:

1. 75% yield of die to high speed to on objective spec. supplied for
   a) A new epitaxial experimental device
   b) An "objective" device
   must be obtained regularly.

2. A practical contacting method must be developed and demonstrated. Good to 10 amp.

3. Intermmediate is T1 thing for the evaluation of high current characteristics.

4. Click on #2 module that can be used.  If this is 0.01 2T module, make new module.

Objective spec:

BV 680  (1 mA)  => 100  \( \frac{E}{2.4} \)  R cm

LFE at 5 amp, 2V => 40

VCE(sat) 5 amp, 50 mA <= 0.5 V

Milestones:

New module by Aug 15.

Antimode contacting scheme invenio (P. r nostrum) Aug 4.

Epitaxial sampler, 2" hole, 50 cents, promised by July 31.

All epitaxial wafers ready for transfer usable by Oct 1.
Suggested supporting data research:
1. Pinkles

Need development package
Project Review, X-2000 - Project 136

July 7, 1961

Review:

Performance during last 3 weeks has given ~41% (not passing) than 1st encapsulation. This has made the pyron less critical.

Open are reduced considerably by using a soft initial encapsulation. This however, creates problem later.

Objective: good die than encapsulation

80% by July 31
> 70% by Aug 30
> 75% by Sept 30
> 80% by Oct 31
> 85% by Nov 30
> 90% by Dec 31

Objective: Spent established prime cost (confirmed by S.E. in Mt. View) at ≤ 0.08$

Re-encapsulation,
Project 144 - 1500 femtodecim

Review:

1740 - All in Mt. View. In no following life test program.

1741 - All gone. Approaching to get film. Study effects of film thickness over blank - 10-12 pl.

Yield (eta) yield and die hardness.

Storage time on 1741's are long!

1741 is useful only if it approaches the performance of the 241695.

Air in 1740 is being rechecked.

Calculation of effects of artifact frequency difference being green out.

Make some 1710's and 1711's.

(See last 2 pages attached)
Project 146 - 4500 reuni

using 1740 diffuser

4700's + (no 1000's good ones to meet Astatic spec except for 8Vdc) are being made in Mtn View. (See memo of 6/16/61) Aim at out by Aug 11.

There is a sum oriented problem with 1740's wherein the device became soft on power aging. Please investigate!

The O.B. gain match test has some (very few) that don't change.

The "delta" characteristic

where U4 can be shifted up and down by the O.B. match test has not yet been explored.

4701 - a few will be this short next week
3501 - first run ready for emitter diffuser.

Channel effect limitation complex related to the breakdown.
Summary of Job

1741 Arr 1st 24695-96
1710-1711 sample to make accurate
Optimum recombination study
3501 design & feasibility
4700 1002 samples
4700 circuit 4500 replacement development mix.
channel eliminating studies
Entirely ungrounded output for degradation.

Results in order of need.

A A plan for 4500 replacement
A 12 design to compete with Ge PNP
B A high current PNP without degradation.
C A high voltage PNP, very useful at 5 10^-2.

Suggest β degradation study on PNP SCT.
Program: Project 146 - 4500 semi

Objective: optimize PNP plow vs. production.

Task 1. Study Ca furnace and/or limitation of channel area to 3 cm to make 4700/2 meeting. 4520 meets. 4500 quarter life test of limited channel device 1024 by July 14.


Task 3. Prepare to transfer test product (W 4700, 4701, LV 3501 or 3501 in order of increasing desirability) during the month of Oct.
Project 144 (1800 rows)

Objective: A PNP silicon to compete in the same market as 2N5012/4 high speed CE market.

Task 1. Try 2N to kill storage in their line PNP. 1st order feasibility statement by end of July.

Task 2. Some feasibility samples of 1710 & 1711. Use can be one-shot done for order of magnitude evaluation. First samples by end of Aug.

Task 3. Do calculation on effects of substrate major diffusion on 1741 & other epitaxial NPN's. For those make 1741 with optimum epitaxial thickness. Evaluate those for storage, test and correlation with LVCEO & COB.

Task 4. Measure epitaxial profile by capacitance on plan test junction and diffused junction. Consult with VT6 on technique. O.B. will make sampler. O.B. will measure them.
Suggested research: Other limitations of all aggregates preferable to P-type materials?

Comment: The personal cabins on the proposed 144 to 146 will be improved during July by re-assignment of responsibilities of existing personnel and by looking for a technician.
This is picking up the 3001, 4201, etc. and some
studies on high 60,000, etc.

Review:
On H.W. epistapedic cone usage of 3001 are very good, but
the 3001's show an abnormal fall off of low cement B. This
in an EB channel problem that is not so bad if the C.B.
tunnel is given but it shows all the pull out and suggest (i.e., collects channel).
This is the principal 3001 problem.

R — These all have the regular epistapedic matching problem. THIS SHOULD BE
UNDERSTOOD

O.B. says that there is a severe capacitive pullout on the
epistapedic units, for example on an epistapedic disk.

In the forward direction it falls from 0 volts.

T 1. Clean up low cement B.
T 2. Measure temperature effects on the low part.
T 3. There is a new failure mode in these devices that must
be aggravated. Until then a conservative T (max) you should be
included.
T 4. Present package is defined as 10.5 flat faces.
R - On 1300's, B go down at 750. 1300, it goes up on 1240. 12
R - 1300's are made at 1300's with exactly 1300 difference (and with a capital?).
R - B still dropped in the 4200's. VHC are good? We will do a split run to confirm this; any effort - R.C.

R - The anamorphic microphone effect, air pressure is present or being bleeding by ten feet. This must be confirmed and understood or not confirmed. VHC + D.E.A. will get

R - We should share the plans on how to make 4200's meet the old 4000 spec. Should start at all P.E. areas, but
R - start with US at the 15 inch for 1200, say 5-10
R - same for 1200 with our yields now at 150%, place together
R - then some preliminary testing. VHC + D.E.A. will get togethers with
R - P.E. + R.C. to get this done as efficiently as possible.
R - We must review BVC0's on 4205. 1350 difference

4205 - 100 coat
4205 + ca - 120
Mean - 110

By removing oxide, etching lightly and etching to
R - some 800-900 will indicate same grade or if it is green hp
R - in a piece, material will pass our test.
R - Then wick areas are many with cufits in it.
R - Allow cycling as Ni getting in here done outside of this effort.

R - Major problem: low temperature. Not being solved at Mt. That needs
R - more VHC. Have a meeting with Mt. Mt. for program, a definite
R - program will result.

(CEM) Camel #191, design change to 145. - June 7/10 NY
Errors: - New #

Lamp consumed unit:

Completely with ±0.001% @ 1 ma (60 dynamic at 1 ma), 10.5-11.3.

We have made measurements on

FT-1340

1.04

Lamp.

at 100 μA, 250 μA, 500 μA, 1750 and 1 ma.

Out of 35 shots,

I± 100 μA 5%

I± 1.04

T. Determine roughly the distribution of T.C. for one of these units.

T. Distribution of V2 at some sample current of a good random sample

of FT-1340. Take ~ 200 units of representative FT-1340's, FF

will make with foil inside to collect the sample. He can

also check regarding the data getting (read panel) & push out

the BUeco at Ic = 100 μA, 300 μA, 1 ma.

This should be in 50 minutes, July 31.
T F.C. will publish his curve of BU on T.C. with T.C. as a parameter.

T Try to make T.S. one unit of T.C. = .01 + .0005. This requires the 130-Diffusion effect to get to this as a defined number during alloying.

T Work on the straight, single-junction type, completed 2 cm., discontinued for now.

Personal advice: Frank, is planning an returning the end of this month. This is bound to pop in the air.

T We need some precise aging life data. Start with a 20 of the 35. Get some data on the -50-1340 samples. O.B. will see that this gets done. 100 km data on the original 20 units will be available by Aug 40.

T Transfer 1st T.C. = 0 2 cm. to production during Sept 15-Oct 15. Plan single readout design by Sept 1.

T Completed product manual by Oct 1.
FD-5 - 0.4 mil tinfoil

Product Manual - Draft firm by Aug 1; Complete by Aug 15; O.H.

Project Comment:

Problem: There is an apparent variance in leading up to life.
A dewar A Kelly has given starting problems.

Best guess of FD-5 structure:

- All alleged well (mm 0.506)
- Smith-Marl type surfactant

1.8 cm

N (1585 - 1324 cm)

Two may 0.5 in tinfoil on these.

No final decision has been reached on gas.

Place in a lot of waxing; waxing on exact size.

T Duplicate S.R. testing cycle - by end of Aug.

T Compare methods of adding from S.R.

Unite (die) to S.R. on 7/13, unable by July 10. Change from SI.

T At 1 near of 3 upon play starting 14 days later than

7/12. Assemble ~ 20 units/press to evaluate.

T Send material spec by Aug 1. Material will be done given

T O.H. will present the code side cold box case on Monday.

Testing:

Fabricate fabrication tests of these sides. 

Date: 100 approx

Examine and evaluate at San Rafael

Submit by July 28. Review by Aug 15; O.H.
We will be in a position to measure saving through this code. This is a potential corner lot problem. We will try to turn application as of their opinion range to achieve this problem. Common to be obtained by Aug 70 (O.B.)

Inside aways: Tangible- New T
Review: Made -125, n - half stuff.

Yield date:
- Can refer file for good anger (just pedicle) - 90%
- Productivity during campaign for good air - 30-50% at best
- This set is just a standard operating procedure
- Normally yield 1 or 2 (or even 0 if expected to be bad) 70%

It looks like 0.9% or about the probability that a given structure is good.

Try some epithelial material in both direction of polarity.

Decide on how this device transfers to production by July 15th (O.M.)

Does the capacitative coupling bother in std applications?

Ultra high speed:
- O.H.

No code recently. Tasted to date -1, 435, done very stringy results as in expected. No existence profit.

A rough objective spec - DFH to issue Aug 1

An initial spec to objective spec - day 31

A dict, use for facts. On finish

10 Epitonic samples by Aug 31.

Other packaging will be picked up later, packaging.
The micologic family:

Transfer schedule to Mtn. View:

Aug 1 - Mtn. View will operate with six person assembly of F.O.P. etc. galx.

Complete family of 6 elements being made in Mtn. View by Oct.

First go-around of make for family completed by Sept.

Transfer implies the ability to make a yes or no decision.

PHN will assume that the testing can be done.

1. Large array using the same technology.
2. Analog circuits
3. Other digital

Full shift begins stage (25 elements) - L.K. right after 1st family.

Circuits with < 8 K10's and resistor < 1k that can stand capacitance, etc., will be made directly in Mtn. View.

D. Need Soil field - 200''


New technology: - SIC.

Resistor: Air at this area

[Diagram]
On the resistor aim at 0.01% per °C. INSE will £arget a reasonable time scale and intermediate objective.

Capacitors: — R.M.

We must see what MOS and junction have as far as γ-induced area and temperature coefficients.

An objective of new technology might be — 0.01% F is possible.

Special gadgets: — Needs a lot of discussion.
In the mill

The 1310 is gone

Achieving 1311 -

Problem = Obstacle

1. 1311 must be fast as 1310. Whereby 1310 is very slow.
2. There is a material supply problem.

We now use propagation delay as an measure of speed.

O. B. has written a report showing that

\[ \tau_{pd} = \frac{1}{I_c} + 0.5 I_c^2 \]

\[ \tau_{pd} \]

The good 1311 and 1310 give:

- 3 ms at 5 mA
- 120 ms at 10 mA

T.

Define 1311 -

Double pass stage by definition.

- \( V_{CEO} \geq 7.8 V \)
- Speed > that of 1310

\( V_{CE(SAT)} \leq 15 \) V

Aims at final design completion by Sept 1.

Transfer during Sept. This requires a new stopping.

T.

DEA will follow the Matt. View and re-carry for current by design.

We would like to have a 1210 sized device that has good low current p. say \( > 20 \) at \( I_c = 100 \) mA

\[ FT = 1220 \]

Make a few more order (square pattern) to try to get good low current p. Priority like 1311 note.
T:  Damp 1200. Aim at 1ms prep time takes a lot of geometry's drain from VME. This is a big packaging problem.

In evaluation it might be useful to take a piece of ceramic that can take, say 10 units. This could be made by milling ceramic. This will be integrated as part of packaging.

Agg. device

Blow out procedure. The device yields here.

Ben has procedure seem to be working, but variability is still. We are using Al and Al, but this still seems to be some contact problem.

This project is concentrating on solving the bore hole problem.

1211 Must be defined. It is 3 step geometry. It is designed on a price, available by 1st at 5000. 1211 = 1311. It will go to production during Oct 1984.

Plot 1.0, 0.2, 0, and think. B060 > 50 20
Project Review - Field Effect

Review: (C.ite findings)

Chatfield

Chime toward the chopper configuration (see Bell Labs memo)

\( 1 \leq 100\% \quad x = 0 \)

Need not be completely powered off

BU 

Getting special crystal geometry and gamma line

Got 272 \pm 41 for second moment on 10 cm (13 units) after 600 days.

BU \approx \text{32 m}\n
\( 2 \text{g} \) \( (250) \) \( \frac{\text{mcm}}{\text{g}} \)

Iodine, just went 1/2 and slow pull

Using metal as jules - the same thing.

Then we can't pick off - probably \( \approx 600 \text{ Vp} \).

C \approx \text{241 if 29 cm}

What:

\( <100^\circ \) C, \( <100^\circ \) C, \( <100^\circ \) C

It looks like this is a potential device as an x-ray detector.

Question now are:
1. It is reproducible
2. Ie it testable - yes
3. How do we handle this?

This has all been A-I. Just recently we got some Ga-P material.
The unit is now the best so far.

\( \text{Test to OL by Aug 1} \)

\( \text{Pm to DH by Sept 15} \)

T

It is necessary to take first guess process and determine reproducibility.  Try to get 5 x's, take 200 at identical spot of Ga-P material.  Try to make reproducible, deriving from previous given in the memo and evaluate for Ke., I.e., 100, effect at 100 C to L.D. (10 attached)

Get this out by

T

Make some experimental area.  It would be very interesting to make atry

In the other polarity too.  Sample of more by Aug 31, Pm by Sept 15?
Pentode:

Requirement: Must pull off at $V < 10\,\text{V}$

$\frac{BV}{RI} < 100\,\text{us}$

$I_{500} = 200\,\mu\text{A} \text{ to } 600\,\mu\text{A}$

This implies ~ $5\,\text{k}\Omega$ for channel resistance. (Different with the “Shelf”)

This used the double-stripe 1210 geometry, but I find it nice and not have too many. Some of their look good.

Control area can be cheap

Eventually this device will need new masks

T. Measure noise figure on one of these on Hills to - by Aug.

T. Make one of these to check on ability to hit objectives such as $I_{500}$. This could get to the chopper wave for precision, but some should be made by Aug 31 to check these.

Point:

1. Make amplifier by best technology.
2. Copper technology.
3. Make prototype with structure.

Bigger Pentode - large area of devices. C. Pentode - no
are making any for now.

Switch: Like the pentode, but better on regular and C4.

Further:

1. Fully off and
2. Scale guessing for laser head - off cooling.
3. CS input remain...
Bellman did not return from lunch, but good news on pending items.

The type unit is a problem as is number two, and the approach to the last one is the mill - eg, graphite, graphite + 5% on film. Thickness except extent, Dip of 3° is min.

Another system, the gear, dilution technique in potentially acceptable.

The boat problem has arrived with new graphite supply.

Hank Wright:

Metal in the system.

Recent problem has been that substance has contributed most of the debris.

New only lightly P type carbon and growing more gate on a good surface, as can be measured.

0.7 on gear E 0.1 on bedul

0.2

0.05 keep bedul.

Woke in progression, and solving the surface problem.

Woke up three time, unable to transport from bedul to top gear. This is with drying compound.

By making bigger envelope of 20% to 30%, to 10%.

Dw, think that 195° will be 1341 after re assembly.

Flexibility in the problem, learned to evaluate it - new problem.

1. Net, a system for production
2. Non-co.
3. Understanding and utilization
4. New system or materials
II. Service area:

A three-phase meter like the one we could do the service job. We would tie up a 25 kW generator completely. It seems that on a 10 kW generator for a 10 kW generator in parallel:

- 10 kW at 450 kHz
- 25 kW at 450 kHz

Aim at a service system and tie up on time scale consistent with space available.

Q: Can the 10 kW machine do the service generator job?

III. Advancing technology and understanding, with respect to Si:

1. Beam uniformity reported. Gain at center and profile of intensity and thickness, say ±20% at p, t, in the plan.

2. Loading junction both at interface and in film. These should be kept with respect to capacitance, leakage, etc.

3. Wiping structure including multiple layers of various doping, masked structure and structure. Conductivity with respect to silicon technology of diffusion and photovolt masking.

IV. Research direction:

1. Use area on something if an idea is available.

2. D FAAs and GaAs on Si or Ge.
I. Shear Gage
   A. Theoretical considerations
      Determine relationship between geometry and "transducer gain" (9/1)
      \[ G_{NW} = \frac{\Delta V}{I_4 \Delta e} \quad G_{TP} = \frac{\Delta P_T}{I_4 \Delta e} \]

   B. Technology investigation and development
      1. Minimum repeatability
      2. Geometrical accuracy (output terminal offset) (9/1)
      3. Surface conditioning (for 2 and higher strain)

   C. Product development
      1. 1:1 SB replacement
      2. 1:1 SB replacement
         a. Machining design
         b. Product evaluation

   D. Silicon sensor base
      1. Technology development
         a. Etching techniques
         b. Masking and aligning techniques (sensor)
         c. Base mounting
      2. Theoretical considerations
         a. Optimum geometry
         b. Strength of material

II. Transducer Development
   A. Accelerometer
      1. Damping studies
      2. O.T.T.I.A.
         Order 1 order to L.A.

   B. Second generation transducers
      To follow shear gage development
      1. Oil pressure transducer
      2. Low range accelerometers
      3. Consumer products
      4. Small accelerometers - possibly before 2 (after 11/1)
         (a) Complete re-do of spec. tech. - July 1962
         (b) Start early 1962
III. Special Gage Elements

A. STB for LA--on demand
   4 more evaluation runs--makes ready-to-product spec.
B. Bondable gages -- if we want to go for ALH.
   Feasibility investigation of fabrication and bonding

G. Oddball sensors
   1. STB--3200 square
   2. STV--with transistor

D. Phenomenological investigation of other strain effects
   (10% one run)

IV. Standard gage evaluation

A. Characterize ST elements

B. Scribe dice evaluation
   1. Eval. 4 beam. backside scribe
   2. Eval. 100 beam. 10^6 cycles
Heat treatment:

- Heating die or U.S. die as noted
- Keep in preparation or 7.5, sanding, etc. (H. Bacon)

- Softening:
  - 15 - 1773/100°C at emitter surface of bowl
  - 26 - 2773/100°C near bowl edge of bowl

- Harden:
  - 22 - 2273/100°C at bowl edge
  - 12 - 2273/100°C at emitter edge

- An old job would have been at room joints: first,

\[ E_g = j \times T_{g,1} \]

It is necessary to confirm the data above by making and measuring.

- The optimisation should be very tight, controlled with output scope.
been coated with Si by coating and melting. Perhaps coating without melting is ok. The is a real graphite problem - it looked once, but we don't what it is.

The problem must be solved, this should be by either:

1. External melting or
2. Better graphite.

This looks like it could become a real many - on.

It looks like not melting is a first thing to try.

New manifold is ready to - a couple of weeks to setup.

Fellow up to get results and such - work and production is going in the system or another.

T. Some surface scanning capacitance measurements to map existing and correlate with other techniques would be useful. A.S. will do, CT will use.

We will get together in a mon to see where we go from here.
July 19 - Tunnel diodes

for Si, crit suggest reverse diode

IBM tunnel diode money

Also on Ge As links - nothing specific for now.
Mask making

Mask making (photo)

Problem

1. Capacity of germin mask
2. Max resolution are 80 mil circle
3. Report of edge resolution are 120 - 140 mil if pattern \( \leq 6 \)
   \( \frac{1}{6} \), other

This is limited by the carbonograph film.

It is established that for any pattern of which we can conceive the
an absolute scale factor at \( \pm 2.5 \% \). If this is not true, then the digit

Our frame has spread over the pattern by staining the size.

This must be cleaned up!!!

Bulk 6M at 7000 site also asking for a tolerance mask

Bottleside and

Problem

1. Descriptive on plate (copy copy)
2. A step in repair (copy)
3. Printing space and supra

The making plates get in getting in large,
but if this is that people also make they
don't need. For example, KPD, G has ordered
100 more, they don't need.

5. Making of plate (off and on), one girl can do safely may,
On the copy camera

set up - 2-4 h

From now on we will reject a box as soon as found a fault.
On this basis it should only take about 10 minutes to shoot a good plate.

200 pattern per day seen reasonable here (reason).

In theory the same one person does the coordinograph and copy job and keeps up!

Copy camera needs this point arrangement for the pattern.

So,

set up - 2 h (pattern) - next of this is getting specimen count.

Leaving as it is.

2 pattern/week capacity.

From here the working plate this must be done:

1. Paint and master 200 an expense plate - 2 h

We turn out - 6 sets of master in 20 h for a 10 pattern

end.

2. Paint making plates in 20 h

Believed line in 2 sets/week.

To be continued sometime!
1. Solar Cells - expand until we are converted at present.
   It looks like we can make 10% at $1/n fs @ 90% yield.

   Project 170.8


3. XRP-1 photodisk needs a mesh of a .000 dot or very fine grain.
   Its advantage is that it is the fastest photodisk available.
   Its main advantage is
   1) speed
   2) linear.

4. Speed product - dissruction. To be made by model products.

5. He real mist. Red jet
   This aims at a cheap photostat of 50 or so mil die area.
   Main missing pain:

7. Get
   Be able to metalize for
   1. Clear plastic encapsulat
   2. Etc.
   3. Life reliability
PROJECT 117--SOLAR CELLS

Objective:

1. Determine suitability of technology for solar cell production.
   Answer: technology suitable.

2. Determine economics of production.
   Answer: Probably not economical.

Recommendation: If answer to 2 is negative determination should be made
to drop project or to conduct a marginal investigation.

1. XPD-1--Photodiode
   A. Complete characterization
   B. 5 repro runs

2. XTP-1--Beryllogon Phototransistor
   A. Complete characterization
   B. 5 repro runs
PROJECT 170—PHOTOTRANSISTOR DEVELOPMENT

1. FSP-5—(4205, 100 µA, 10 kΩ with leads a lane)
   A. Military specification
   B. Frequency response characteristic
   C. Spectral response characteristic


2. FSP-5A—High Sensitivity (no base ring)
   A. Repro runs
   B. Characterize


3. XPD-1—Photodiode— Joint 4200 base stations
   A. Complete characterization
   B. 5 repro runs


4. XPT-2—Darlington Phototransistor
   A. Complete characterization
   B. 5 Repro runs

5. XP-3 Family of economy devices
   
   A. XPL-3 phototransistor
      
      1) Objective: Photodevice for data reader at low cost with universal mounting for card and tape reading.
      
      2) Cost: 10 cents prime cost maximum.
      
      3) Dice Design:
          a. Preliminary mask--completed.
             First run--completed.
             Evaluation--in process.
          b. 2-mil emitter evaluation to be completed by Aug. 15.
      
          a. Die and lead attach methods complete by Nov. 1, 1961
          c. Encapsulation
             1. Plastic
             2. Glass
          d. Mounting--printed circuit board with connection.
      

Recommendation:

A. Make major push on this product.

B. Prepare Application Notes, etc.

C. Complete per schedule above.

D. Introduce product at IRE, 1962.
6. Lateral Photodevice (XPL-X)

Objective: Lateral photodevice, single dimension at this time.

Work required:
- A. Mask design--1 week.
- B. Packaging--0.008 week.
- C. Contact design--1 week.
- D. Evaluation and characterize--1 month.

Recommendation: Develop product—work should be completed two months after approval.

7. Photochopper

- A. Characterize in terms of \( \beta \) and light sensitivity (1-2 weeks)
- B. Design chopper and build (1 month)
- C. Characterize and Application Note (1 month)

Recommendation: Complete project as manpower permits.

8. Special Photocell—Scanner Photodiode

Recommendation: Complete as manpower permits.

3. Measurement Standardization

- A. Objective: To develop a standard method of measurement for photovoltaic devices.
- B. Tests to be standard:
  1) Light intensity (illuminance)
  2) Spectral response
  3) Frequency response
  4) Transfer response
  5) Noise performance

Recommendation: This project should be carried on at the first possible. Work performed should be changed in project number (if approved) for photovoltaic applications.
PROJECT 179—EXPLORATORY PHOTOSENSITIVE DEVICE

1. Photodiode Arrays
   A. Low voltage array for graphics ( \( > 10^7 \) )
   B. High voltage array for miscellaneous applications
      1) Objective—product array of uniform photosensitivity, breakdown voltages and leakage.
      2) Status:
         b. Low voltage arrays to graphics for evaluation.
   C. Work to be done—other facets
      1) Contacts for high voltage printing bar—vapor deposit copper or other material.
      2) Complete contact assembly for FAX scanner
   D. Recommendations: Make major effort to complete project as soon as possible. Feasibility should be completed by Jan. 1, 1962.

2. High sensitivity photodiode
   A. Objective: Investigate linear avalanche phenomenon for applicability to solid state photomultiplier.
   B. Investigations: Large geometry photodiode on high resistivity material.
   C. Recommendations: Should be high priority project; results of photodiode development should be applicable to this project.

3. Measurement Standardization
   A. Objective: To obtain a standard method of measurement for photoelectric devices.
   B. Tests to be standardized:
      1) Light intensity (illumination)
      2) Spectral response
      3) Frequency response
      4) Transient response
      5) Noise performance
   C. Recommendations: This project should be carried on as fast as possible. Work performed should be changed to project number (if approved) for photodevice applications.
PROJECT 188—LIGHT EMISSION

1. FLP-1 light pulser
   Characterize
   FT-6000 dice
   Light output
   Speed response
   FT-6200 dice
   Light output
   Speed response
   Note: Characterization of FTD 6000 dice completed. Characterization of FT-6200 dice to be performed as time permits. Low priority item.

2. R&D investigations
   A. Matrix arrays for memory
   B. Investigation ham. volcano effect
   Recommendations: Project should be continued but no major effort should be expended at this time.
NEW PROJECT--PHOTODEVICE APPLICATION

1. Conduct investigation into applications for the following photodevices:
   A. Phototransistor
   B. Photodiode
   C. Lateral photoelectric device
   D. Light sources
   E. New photodevices

   Some of the applications that should be investigated are:
   A. Photochoppers
   B. Nuclear detectors
   C. Tape readers
   D. Light communications

2. Conduct with aid and assistance of other groups in R&D
   A. Life tests
   B. Environmental tests
   C. Electrical tests

   of photodevices manufactured by FSC and other manufacturers

Recommendations: The minimum effort that should be applied to this project is one engineer and one electronic technician.
6. Extend Ptolemaic:
   Make some plans once to see how elegant.
   Consider as product only if we can think of a use in a
   transcription or something.

7. A special product that we should play with when we get XP-3 done.
   Just out of a kind of fatigue for now.

8. Write up principal code and collect the remainder.

9. Special plat cell for solar term.

Plate damage 1/79
What is being planned?

The results with the Ac-doped unit in series. None dependent change as still observed.

\[ \text{Vielded} \]

\[ \text{Int} \]

\[ \text{SD} \]

...this...

To study to see if the long term change is long or design flaw development. This can be done by study of thickness and field dependence.

CTS has done some of this and is doing more. He will clear up the question.

We still need surface state location study - how do we check it?

Let look at the electrode study:

\[ \text{Hat field across cycle.} \]
\[ \text{Measure capacitance.} \]

Objective: to check over them oxide.

\[ \text{S.C.} \]
\[ \text{S.D.} \]
Other possibilities

(horizontal projection that could be blown out in the diffusion of the thin sheet as a particular device - allow to click, etc)

We will have a new entry to layout project circuits.

More review:

Ca. treated device.

Ca. 10 min at \(10^{-2}, 10^{-3}, 10^{-4}\) mm Hg oxygen at extended gelling pressure.

- Typical characteristics.

On duplicate get a proper control tofect of 3 from 200 to 958.

Measured a drop energy level - find fast DE (for analysis).

Don't know what this means, because we couldn't run it to try.

Note:

No planned cycling.

New putting in well to see when we go from here.
This army of making a tape punch to tape reader with high density and relatively high punching frequency.

Prove feasibility of 10 mill centi bits.

Despite this shall accept.

1. It must be able to accept the memory content of a computer and put them back in later.

Assuming feasibility, then what?

Define a family of machines that make this usable:

1. Key punch writer
2. Reader

Then this can plug into all existing machines by optional means.

We will get some tennis & can office machine etc. or this as soon as we have prove feasibility.

See sheet over.
# 121 DATA STORAGE DEVICES

A. Data recording

1. Probe structure
   a. Material (tungsten)
      Determine limitation of probe material on write speed - erosion, cooling, etc. (in process) complete by 15 Aug.
   b. Mechanical structure
      Etched circuit
      Built-up
      (Now in study phase, experimental work to start 1 Aug.)

2. Recorder electronics
   a. Thyratron drive circuit - 80% complete
   b. Trigger circuits - 0% complete
      (Complete by Sept. 1.)

B. Recording Medium

1. Investigate dielectric base properties.
   a. Mylar - various grades and surface finishes.
   b. Papers.
      coating adhesion, dimensional stability, optical transmission, durability.

2. Conductive surface
   Al, Al, Cu, Ni, Co, and Cr by both evaporation and plating.
   a. Durability
   b. Recording properties - conductivity, melting and evaporation energy, mechanical strength, etc.
      Will investigate both vendor supplied mediums, and prop. coatings.

C. Data Reader

1. Design sensor
   a. Structure design
   b. Procure masks
   c. Fabricate. (Complete one month after recorder structure is finalized).

2. Optical system (Complete two weeks after recorder structure finalized).

3. Read electronics (1 month to design and fabricate)
   a. Amplifiers
   b. Threshold circuits
   c. Strobe circuit
D. System concepts (complete Nov. 1)

1. Microtape
   a. Modify audio tape transport
      Use 1/4" tape
      Bit density--125/inch
      7.5 K characters/sec.
      9 tracks (8 data + 1 strobe)
   b. By Dec. 1 conduct successful bi-directional communication
      with Flexowriter.

2. Micropage
   Develop concepts for unit record machines and media.
Review:

Qualitative analysis by x-ray, etc. - possibly x-ray.

These are:
1. The x-ray
2. The x-ray
3. Spectroscopic analysis
4. Spectroscopic analysis
5. Spectroscopic analysis

X-ray is fairly good, but perhaps not perfect.

With tweezers we will see the air in the gas.

But gas analysis is needed.

Wish this could go as we can do O₂ also (can we bleed in H₂ in H₂?)

To:
We should be able to monitor H₂O, O₂ and dust cont in any line at any time. End of Sept.

Note sampling in set up (for conductivity and particles)

H/O will be done that don't get charged to plant. SB in perform.

Sin-Be carbon bath.

(Are we paying for carbon?)

Carbon paste - difficult. still need more

Betty tank on

a) Accelerator plate
b) Phase change (like plasma, etc.)

Which should be charged?

We will need the Ni/Fe ratio for magnetic field.

Make sure that Ni/Fe ratio is correct.
1. Our S-R camera

Present status:

- Beam conv. design complete
- GENILE slabs
- Heavy duty light path
- 1-year job -360 lbs
- 2-year job -90 lbs
- Stage granite = WC

Principal problem with existing one:

1. Pivoting of stage - need 1°/sec
2. Focus
3. It will use an hydraulic drive

Method to get around:

- Kinematics design on parts
- Microscale (did) on reference surface on each line.
Time scale:

1. 5 Weeks delaying on stage. Stage to be ordered by Oct 15
2. Hydraulic line (-2K) from furnace - go to shop early

The only thing holding up getting thing ready by Nov 1 is lack of design time. I'd think in C. It could take 2 months full time to get to a reasonable point.

We want to build RED + RED in parallel (50 1st grade)
Need an anti-collision. (2K - 3K) to check out.

We will be on the air by Dec 1

Optical jigs: Split field by been checked out
We have two, but we have lost them.
Mr. Niel has two
One is being made for Dr. Rafael.

Get back by Sept 30 and then get ready for move.

We will have three optical jigs operating in an array (not experience) by Sept 30.

Order items today - end of Aug.
Design complete by end of Sept.
On the air by Dec 1 making pattern

3. We must have personnel and facilities ready for Dec. 1st. (TV activity and independent service by new B.Y. then)

4. Make alignment - we have been doing some for Mr. Niel + Dr. Rafael. Make the other needed to align (using arbitrary pattern)
T on HP genuine Monte, send report any delay/operatic
for
a) special 3 sep run
b) normal runs.

This should be on making him available and should be in the proper sept.

T Consid a certificate scheme for saving people of completes runs in box.

T Order 4 mercury air system (two for split, two for top, two for others)

3 Plan for new technology:

1. Check out HMBK
2. KPL
3.

Will keep chart of W.W. shell side study.
Art in studying fire-heating, casting uniformity, etc.

General Objectivs:
- Oil and resin and 0.1 end space in side and metal.

T It would be nice to be able to grow 1 inches in 1 day. Is there a way we can do this without changing the spacing.

5) Metal mesh:

The new mesh is contemplated. We will only contin
the existing technology.
Project 141, 118, 125

The changes to 125 have primarily been the high frequency measurements on water.

Observe 118 and 125 — Charge 141 for all work on a wave device suggested by low Solé requirements.

Review: Mass interplay

Takes his own 1D-6L single plug 2.5 rs off up to the 2-km range.

He is happy with these. He has gotten 2.8 km in a quadruple to 2.7 Mc.

Main improvement needed in a decent ceramic package. It shall now story.

Once he has this, he wants to go to 6 Mc.

Now he is looking at an optimum of C + V, etc. We can try to do anything that will help.

Then my offer from surface loss.

The MOS epistatic should be a high frequency device.

Perhaps the MOSOM can assist.

A more non-linear resistance than an ordinary diode could be useful (ipm12).

Read diode might be doable as by epistatic (if it can be in principle)

The 3rd quadrant later — my guess! 1210 — could be interesting.

Read to get it ≤ 10 V for use then.
Some ex-ware packaging problem.

1. The co-ex cable connector is nice because it takes too long.
   A cheap plug could be nice.

Begins here a co-ex package for ice making or that has the
possibility of cubes and BristoJet. This is basic light and, at least, be
a 5-7 Home plug.

We also need a co-ex package plug
with a style a double-side shell.

Please have a co-ex plug...
Projects 166, 116

Cont'd tech descr.
Basic alloying studies.

Review: We still have Al as 5% with Au or Ag.

1. A solderable metal/metal contact.
   a) A new metal
   b) A plating over the Al - Can we do this?

   We're looking on putting Ca on the Al for Peter Allman.

   Needed for:
   1. Pilot hole
   2. Paper tube
   3. Varistors on 1 circuit.

2. A contact system that can be pressed at high temperature, certainly on 800 °C, probably on 1000 °C.

   Needed for:
   1. Experimental
   2. Clean family

3. It would be nice to have last metal system that does not suffer from a visible intermetallic phase like people plague. This is need for
   a) A defensive measure when our competitor has experienced on certain that people plagues in last
   b) Small dinner

   We have tried Pt-Al, Pt-Al, Ag-Al, Al-Al, Au-Al, Au-Al, Ag-Ag.
   Most of these are on the side. We are Ca-Al and Al-Al alloys.

On Pt-Al, the Al pulled off the Pt.
On Ag-Al, Al didn't pull off.

Pick Craig will summarize his results.
4. Should we do anything on the problem seen in the past of
determining if Pb junction having Jn on the sides are junctions.

What is failure rate so far?
What is the associated phenomenon?
What is the postulated mechanism?

This looks like an interesting problem, but we don't see who
to do it at the present.

5. Ni Al - Nickel content @ 200°C is unstable - it drifts

6. The second drift problem in the diode is an important and interesting problem.
   We must either decide to go the Jn route or to
   really study this problem soon - pay by Aug 15 - GEM.
Project 165, Competitor Evaluation  

Aug 3, 1961

Collection - mainly by sales  

Ford Model Small Measurement  

I'll sign and repeat  

but you'll hold for final report  

We run a couple a month.  

We are looking at for  

Any device competes $13.10 S: or be  

$ 13.41 S:  

$ 3001 S:  

Any non-diffuse S:  

Any device that gives us trouble  

Any minor count  

Any planar device  

I'll write a letter to  

the district sales office.  

2 days are possible  

Flow:  

I'd like to ask you  

for 30,000 a week decide on several how complete an evaluation  

will be done.  

I PW will see that the device travels to the right  

place for evaluation, including to both planar for monitors,  

(underline)  

PW will see that got in mind  

the device from PW and copies of all data will come  

for DFA.  

DFA will do an additional evaluation needed and will  

order from both UP and any continuing or continue to  

metallography & chemical analysis.  

On advice we want S.R. data and samples to DFA for  

monitor, DFA will cut this up.
We need the fast turn-around technology to do all our packaging in house.

The packaging development and the device development must mesh.

Packaging problems:
1. Too few chucks
2. Too few holes
3. Lower holes
4. Change plot device
5. Too short
6. Need new design
g. Deduct from above delay near
8. Jig site drag
9. Fix hole plug
10. Need fixture
11. Small two lead photodark plug (C TO 18)
12. Printing error context
13. Test sample any (~2000 bolts)
14. A new design to hand crampen adapter

Technology needed:
1. Ceramic metal paste, pattern and solderability
2. Ceramic - metal mate
3. Ten...
4. Glass paste
5. Plastic pattern
6. Ceramic supply
7. Metal printed parts
7/13/61

I. Packages on which we are active.

A) Power Package for FT-7000:
   1. Gum-drop package.
   2. Vacuum tight package.

B) High Frequency Package:
   1. Ceramic diode package for Paulo Mastalli.
   2. Coaxial transistor package.

C) Packages for Diode:
   1. 30 watt Gum-drop stud.

D) Packages in the Sealing Industry:
   1. Copper cored Kovar lead TO-5.
   2. Copper flange Be0 TO-9.
   4. Copper TO-9 package.

E) Package Parts for Low-cost Photo-Device.

F) Miscellaneous
   1. Use only, or tungsten slug as in the Gum-drop.
   2. Rd0 transistor heat-sink with Al.0. lead attach
      on base.
   3. Rd0 covering total inside bottom with isolated
      lead brass areas, as well as isolated solder-
      down area.

This latter configuration should handle any device
which can be stepped.

A) NOTE - Both of the above packages have a dry-seal pipe
thread for maximum heat transfer; but this may be
readily modified to a 1/4-28 stud if the industry
is not interested in efficient heat transfer.
II.

A) 1. Gum-drop Package - This is a package designed for maximum heat transfer to a metallic heat sink. The package is .520" in diameter by 3/4" long. There is a 3/4" hex-nut brazed near the top, and a tungsten, or moly, slug brazed into the bottom. Both brazing operations are made simultaneously. This package is used by soldering down the die, attaching the leads, coating device and leads with a flexible medium and potting with an epoxy resin.

A) 2. Vacuum Tight Package - This package is almost identical with the Gum-drop package. The major difference being that the upright copper part for containing the epoxy is rolled over onto the hex-nut so that the cap may be cold welded in place.

There are three practical internal configurations for die and lead attachment.

G) 1. Gum-drop package (Gum-drop) - This package is:
1. The moly, or tungsten slug as in the Gum-drop.
2. BeO insulator heat-sink with Al₂O₃ lead attach to base.
3. BeO covering total inside bottom with isolated lead braze areas, as well as isolated solder-down area.

This latter configuration should handle any device which can be stepped.

A) NOTE - Both of the above packages have a dri-seal pipe thread for maximum heat transfer, but this may be easily modified to a 1/4-28 stud if the industry is not interested in efficient heat transfer.
B) 3. Stacked Ceramic Package. - This is the stacked ceramic package, the disk having been metalized and a copper stud die is soldered on the other end stud and soft solder is used to seal it in the ceramic sleeve. This gives us a chance to dissipate the maximum amount of heat. Only if it becomes necessary, will we use a buffer metal slug. (We can get by with this because of the small die size.)

B) 2. Coaxial Transistor Package. - This package is made of two identical pieces of ceramic. Both will have a cold-weld flange braised in place. One end has a tube to accommodate the base (or emitter) lead, the other end has a solid rod connected and a disc to solder the device to. The metalized layer can be used as a shield between input and output.

C) 1. 30 watt Diode Package (Gum-drop) - This package is nearly a 6200 stud with flange machined off and a nut brazed on at same time that the buffer disc is brazed in.

D) 2. Copper Corad Kovar Lead TO-5 - There are two configurations involved.

   a) One is the standard TO-5 with copper core Kovar lead substituted for the Kovar leads of the standard TO-5 package. These disc work on the jig and brace.

   b) This is the solid Kovar head with copper core Kovar substituted for Kovar.

D) 2. Copper Flange Beo TO-9 - This is the Frenchtown porcelain header, but we have substituted a copper flange for the nickel flange which they now use.
D) 3. Stacked Ceramic Package. - This is the stacked ceramic package, .150" diameter by about .060" high with radial leads. The ceramic rings are \( \text{Al}_2\text{O}_3 \) or \( \text{BeO} \). The metal parts are of HC (Copper) or silver.

D) 4. This is the TO-9 (by Litton) made with a Housekeeper seal.

E) Low-cost Photo Device Package. This is a very small punched part to which the device is soft soldered and gunned with silicone and potted in epoxy or poly-ester resin.

III. STATUS:

A) 1. Gum-drop Package - Samples have been made. At present, there are no devices to waste on testing this package.

A) 2. Vacuum Tight Power Pipe - Harlan has been asked for quotes on the metal piece parts. We have our metalizing working well. We must get a larger transformer to increase the temperature and thus speed of the operation.

A) 3. Modified FT-6200 Package - We have 100 of these modified packages on order from Litton Lab. We also have 200 each of the standard 6200 packages, except with BeO disc on order.

B) 1. Ceramic Diode Package - We obtained ceramic tubing which has been cut to length. This is ready to metalize. The copper parts are ready. It is only necessary to metalize and obtain jigs for braising.

B) 2. Coaxial Transistor Package - We have ceramic parts ready to metalize. We have the metal forming dies. We just need to make these dies work and then jig and braze.

C) 30 watt Diode Package - Six of these were sent to J. H. Wardell at Diode, S.R.

D) 1. Copper Cored Kovar TO-5 - 1000 each of the two types are on order. Myra is checking delivery dates.
D) 2. Copper Flange BeO TO-9 - 100 each are on order with Frenchtown.

D) 3. Stacked Ceramic Package - 100 each are on order with American Lava. We have a quote from Frenchtown which isn't too bad. This package may solve the \( \sqrt{co(sat)} \) problem.

D) 4. Copper TO-9 Package - We have about 200 with 4200 devices soldered on. We are polishing the weld dies now.

E) Parts for Low-cost Photo-Device - This has taken an inordinate amount of time. Much talk and time; little do.

F) Miscellaneous

We have brazed a number of parts for H. Roos' group.
We must be able to make ceramic parts on small grinding.

Bob Brown will investigate obtaining a supply of molybdenum carbide and tooling equipment on a mass basis at a high purity level. Recommend sample by Aug 15.

Investigate getting a small firing furnace.

Ceramic metallurgy:

1. We will get to see an adequate supply of WC/Mo/C. Molybdenum carbide, as a ceramic binder on high purity alumina. Recommend sample by Aug 30.

2. Establish that we can fire 10 or 20 sets of 30 to 100 lb. to 1200 F. tight parts.

3. Be able to make pattern as fine as 10 mil steps or 20 mil centers. We will be able to cut and get the machined parts on the outside. Objective - to be able to supply metalized part from segment in 1 year.

It would be helpful to be able to make etched patterns in many different metals, Mo, W, Stainless Steel, Sn, etc.

Ceramic-metal scales:

- We can expose to metalized ceramic at 3000 M for 6 months, then cut on WC/C. Mo, WC / metalized, etc. It will test clean for example, per 200 C.
Packaging: work

Marine in looking on this in conjunction with
work by Vaselina & design

Plastic pottery: deep plate - chalice, 4 ½ ft., 4 ½ ft.,

 Mund: — for sale.

Hand-up 95% 7000 - limitly for evaluation forms.

Specific package:

In a ware shop, the double shell is in the mill. The
outside is defined, but not the inside.

The inner annular, "fill" type package looks
suitable. I.S. will define what he needs like.

This project in package limited and therefore assumes a high
priority in this area.

The double shell are made new as held together by grips.

It is very possible that we could want to sell some of the
through special products — say 50/week. We could have to supply plans.

We will have some of these assembled before we leave in 2 weeks.

Use more data.

Modified type A, can be in dual - O.K. Keep it in a can of

We have designed a co-reel package which are in trying

This package is not in the test package

T. Have 10 device in getting test package & O.K. Have all

take two weeks more after new date. New date by Aug 10.
3. Don Vito

The present design transfer schedule for the FX-7000 to Mr. Vito is:
1. Jan –
   Need: relay design drawing by Oct!
   Need: relay supply listed for 1000. We require 80.
   We need 1000 packages in late May.

2. Package design has yielded collectors.
   This should be a test machine first. It will not be a
   test standard for monetary.

On this one we plan on making our own heads in
production.

1. By the design project.
2. By personnel.
3. By personnel.
4. To be determined. This will then be refined to be
5. Held for now.
6. Projected.
7. Spec to be supplied to Brown after unit is done.

Copper – we have for 3001 type design. Keeps as simple
as possible. Keep the looks. R. Green & D. F.A. will handle the rest
and present to Rand how to detail them.
1. Pipe - still far from really solved
   a) Pull, Check
      1. Pressure distribution related to oxidization
   b) Edge pipe on planes - at least partly decalumine
      There is still some problem that is not understood of pull stresses.
      In addition to decalumine line, there is still a relationship to the
      swell - drawing doping.

This dip is the place that lights up.

We are now doing some work at he Jills enal and pump in Gtton
the characteristics of pipe.

2. Oxidation studies
   a) Rates: 10 to ambient. We agree within FSC and for O2
      with Astala. We see a factor of 3 higher in steam than the vs. 07
   b) We must determine our inside growth rate, as
      the P.F. will collect and old - use reflect. This should compare
      with the literature. Sep 15

b. Refect to com in 1 week. Experimental rate of 316 steels
   gives 360 000 (8500). Works will be done to evaluate the
   aspects of low temperature oxidization as well as rates.

c. Study the effects of impurities during actual growth to
   accelerate scale growth - has been done by Motola.
   By testing, 6700 lb in 2 months and given much
   faster. P.F. feels that Motola is using this as completed
   device (-400 -450°C) (Fabbri for purity)
3. Diffusion in a reducing atmosphere - It has been reported to give a poor result. This looks interesting, but needs an idea to be useful.

4. Cytostatic study - Now you can
   - Objective:
     a) Determine light angle in compound Xtals.
     b) Study of certain odd fall solute type metals - Au/Fe, Fe?
   - Other item:
     1. Surface diffusion with
     2. Inorganic distribution rate on a diffuser - see 2.
     3. Metal precipitation in solution

5. An diffusion - solubility in Si
   - Design of Pless in main autonomy. This suggests that you should do a lot of more work to understand the processes.
   - Phil is something we should be able to return once.

This is another area that should be carefully looked at and put to
lead company write on a Technical Report by Jan 1.

Phil is writing with CTS to get the experimental expertise of
some pages. He considers sending a letter for this.

6. Softening
   - Can't join or glass begin to get
   - Cold in heated oven after a while. The glass is not very good and
   - Region 1 fired Gibbs' but getting is not so good.

Ottol, along with Ira and a Shub, are nice ones for coloring
the paper now. How I can? Not a good one, I think, but...

The leader's report - Do much this. Phil is a goer.

ME - Ready to read B. R. and other comments. Straighten client.
Project 109 - Diffusion studies


1. Siloxane 250 A/min (at 760)

Pregnis to check out SiO₂ on 13×60 and 4000 process.

We have gotten some very fast "V"s. On one we have had channel problem. Steve thinks this is a channel problem.

Steve says it takes faster than thermal.

It seems to stick to oxide etc.

Evaluate with respect to:

- Apparatus characteristic characteristics
- pinholes - compare current min date
- MOS capacitor

Results:

\[
\begin{align*}
\text{H₂} & \rightarrow \text{SiO}₂ + \text{Si₇H₅} \\
\text{H₂} & \rightarrow \text{SiO}₂ + \text{Si₇H₅}
\end{align*}
\]

(Cheked leading)

It seems to stick even on the oxide wall.

Put some plain etching at ~2900 A (2x), which can be analyzed on.

Can go to 6x.

We should try to etch these holes by 1700 thin thick oxide.

2. Cl₂ etching in setup

3. Out diffusion

Gas memory idea. Note if Al-Pd. be setting up a 4ft probe.

MOS capacitor measurements may be useful. On surface "diffusion" check.

DFA needs the technology for very shallow 1100's for 1710's. Problem on:

a) boron filling

b) Oxide mismatch problems in 1100's, deep oxide.
5. Study of the differential oxide growth rate. This is potentially very simple.

6. Boron loss putting in still a problem. There seem to be two kinds of pits:
   a) hydrogen pits which show up at probe (commonly)
   b) oxygen pits that always show up out of different, at least at high core.

7. Needing a stand-up probe, for the oxidation differential (where both sides need to show) with Al2O3 or Al2O3.

8. Domite gone to potstabil will give the equivalent of B12 or B13 density with about 1% sand in the supporting plate. We must either make B13 an adjustable piece or maintain B13 service for this area.
Project 115 - Noise research

8/21/61

Equipment is set up for general use and particularly to measure SET vs. CQ. It is:

- 20 - 50 kc. Some notes:

We usually get 1 kc monopole figure.

Men in 28/1711 and 28/2249 (6/11 will work with mine figure)

Here are the below 1 db. It is still very low (5 to 100 cycle) on most of these.

Notes:

1. Attempt to correlate on a few low noise demin with the theory by making all the parameters constant.
2. Take some 0.25 mc. to see if they are understandable.
3. The smaller demin than 4mc. all seem to show less noise than 4mc. We don't know why.
4. The SET device has the ability to vary surface potential and is called changing the resistance around.
First, find the plot dough.

Mulch - 25% and cover. A month before.

Mix it in the next day. 75% and cover. 1st. Gen.

And then mix it to the desired pH level of 6.5. Record and proceed to the second step.

According to the manual, you have to follow a few steps in the next phase:

1. Soak it for 24 hours.
2. Mix it with a compost mixture.
3. Add it to the compost mixture.
4. Water it to the right level.

After a day or two, it's ready for planting. 75% and cover.
On 12 September, a meeting will be held in Gordon Moore's office to discuss new products for the diode facility. I intend to bring up for consideration the following:

- Zeners
- High Voltage Rectifier Stacks
- High Speed Epitaxial Unit
- Microdiodes
- Varicaps
- Tantalum Capacitors
- Multiple Diodes
- Combined FD2 - FD3
- PNPN
- Photodiodes

It is my intention, after this meeting to write a market report of sorts on those items that appear feasible.

John F. Ready

JFR/mt
We will apply application literature and find products sharing advantage of our diode.
Ready maps we need a good stability test setup.

\[
\begin{align*}
\Delta V_0 &= 1 + 10^{-5} \\
\frac{1}{Z_0} &= Z_0 \\
\end{align*}
\]

True scale - Made in San Rafael this year.
Sept 19, 1961

FET review

#187

Kevin of last project review 7/17/61

Chopper FET - typical - 5 x bulk for reactivity - got low breakdown in high yield - Ganev on KP.

The channel resistance doubled for ~1500 Cls.

The speed was 165 ± 10% (as density) S-

The hole mobility goes up by 10% - bad material match problem.

The new material looks good - it is thin on the core.

Question:

To see chopper better than Czochralski and in TSK? Ann Walter

Task: The new run will be thin about the end of this month.

Get dichroic camera

Channell conductance distinct on metal; I can for Comparing paper

Please can be done by two point probe.

Task: Mount ~100 for Hilke's evaluation. If it looks like a useful device the next can be grounded.

Need a dual litho, used special paste. Also will be the boron doped.

Potential run - still look soft - now hardened up. The 0.9 m yields

Pendate:

ASK by Oct 15th we will have evaluated potentials of n-doping with material engineer KPR & Material manager O. Choloniewski
On November 9th, at 9:30 A.M., there will be a meeting in the Conference Room at R&D on the subject project.
<table>
<thead>
<tr>
<th>DEVICE:</th>
<th>FT-4400</th>
</tr>
</thead>
<tbody>
<tr>
<td>DATE STARTED:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>DEVICE: FT-4400</td>
<td>DATE STARTED:</td>
</tr>
<tr>
<td>-----------------</td>
<td>---------------</td>
</tr>
<tr>
<td></td>
<td>8/9</td>
</tr>
<tr>
<td>Resistivity - C·Ω·cm</td>
<td>100</td>
</tr>
<tr>
<td>Donor Conc. x 10^15</td>
<td>101</td>
</tr>
<tr>
<td>Oxide Thick. - μ&quot;</td>
<td>104</td>
</tr>
<tr>
<td></td>
<td>107</td>
</tr>
<tr>
<td>Base Dopant: V/Ω</td>
<td>31.4</td>
</tr>
<tr>
<td>Prep: V/Ω, R</td>
<td>15.2</td>
</tr>
<tr>
<td>Base Diffusion °C</td>
<td>27.4</td>
</tr>
<tr>
<td>Time, hr</td>
<td>3</td>
</tr>
<tr>
<td>Steam, min</td>
<td>3</td>
</tr>
<tr>
<td>Dry, min</td>
<td>3</td>
</tr>
<tr>
<td>V/Ω Base Diffused V/Ω</td>
<td>27.4</td>
</tr>
<tr>
<td></td>
<td>9.2</td>
</tr>
<tr>
<td>FLAT</td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td></td>
</tr>
<tr>
<td>XJB</td>
<td>1.46</td>
</tr>
<tr>
<td>µ:</td>
<td>3</td>
</tr>
<tr>
<td>X:</td>
<td>1.46</td>
</tr>
<tr>
<td>[(V/Ω) x XJB]^-1</td>
<td>10^-2</td>
</tr>
<tr>
<td>BVCEO (A)</td>
<td>118.1</td>
</tr>
<tr>
<td>Source</td>
<td>15.1</td>
</tr>
<tr>
<td>WARPAE: %</td>
<td>48.7</td>
</tr>
<tr>
<td>Emitter Dopant: Temp °C</td>
<td>880</td>
</tr>
<tr>
<td>Time, min</td>
<td>75</td>
</tr>
<tr>
<td>Source</td>
<td>240</td>
</tr>
<tr>
<td>Age, min</td>
<td>25</td>
</tr>
<tr>
<td>µ: Emit Pre: V/Ω</td>
<td>0.90</td>
</tr>
<tr>
<td>Wash Time Min</td>
<td>5</td>
</tr>
<tr>
<td>Emit Diffusion °C</td>
<td>1200</td>
</tr>
<tr>
<td>Time, min</td>
<td>55</td>
</tr>
<tr>
<td>Source</td>
<td>240</td>
</tr>
<tr>
<td>Emitters</td>
<td>85</td>
</tr>
<tr>
<td>Wash Time Min</td>
<td>5</td>
</tr>
<tr>
<td>WE Emit Depth μ&quot;</td>
<td>17.6</td>
</tr>
</tbody>
</table>

X = NICKELATED WAVER.
<table>
<thead>
<tr>
<th>N = 30</th>
<th>560</th>
<th>660</th>
<th>760</th>
<th>860</th>
<th>960</th>
<th>1060</th>
<th>1160</th>
<th>1260</th>
<th>1360</th>
<th>1460</th>
<th>1560</th>
<th>1660</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>125</td>
<td>2</td>
<td>34.48</td>
<td>37.18</td>
<td>39.22</td>
<td>40.61</td>
<td>41.60</td>
<td>42.24</td>
<td>42.85</td>
<td>43.10</td>
<td>43.06</td>
<td>42.91</td>
</tr>
<tr>
<td>1.00</td>
<td>125</td>
<td>2</td>
<td>34.48</td>
<td>37.18</td>
<td>39.22</td>
<td>40.61</td>
<td>41.60</td>
<td>42.24</td>
<td>42.85</td>
<td>43.10</td>
<td>43.06</td>
<td>42.91</td>
</tr>
<tr>
<td>1.00</td>
<td>125</td>
<td>2</td>
<td>34.48</td>
<td>37.18</td>
<td>39.22</td>
<td>40.61</td>
<td>41.60</td>
<td>42.24</td>
<td>42.85</td>
<td>43.10</td>
<td>43.06</td>
<td>42.91</td>
</tr>
<tr>
<td>1.00</td>
<td>125</td>
<td>2</td>
<td>34.48</td>
<td>37.18</td>
<td>39.22</td>
<td>40.61</td>
<td>41.60</td>
<td>42.24</td>
<td>42.85</td>
<td>43.10</td>
<td>43.06</td>
<td>42.91</td>
</tr>
<tr>
<td>1.00</td>
<td>125</td>
<td>2</td>
<td>34.48</td>
<td>37.18</td>
<td>39.22</td>
<td>40.61</td>
<td>41.60</td>
<td>42.24</td>
<td>42.85</td>
<td>43.10</td>
<td>43.06</td>
<td>42.91</td>
</tr>
<tr>
<td>1.00</td>
<td>125</td>
<td>2</td>
<td>34.48</td>
<td>37.18</td>
<td>39.22</td>
<td>40.61</td>
<td>41.60</td>
<td>42.24</td>
<td>42.85</td>
<td>43.10</td>
<td>43.06</td>
<td>42.91</td>
</tr>
</tbody>
</table>

**Note:**
- The table above shows the evaluation for FT-4400 with different temperatures and currents. Each row represents a set of conditions with corresponding values for different load classes.
- The temperatures vary from 560°C to 1660°C.
- The table includes columns for different load classes, such as 1.00, 1.05, 1.10, and so on.
- The values are given in millimeters, likely representing measurements or readings.
- The data is used for scientific or engineering purposes, possibly for thermal analysis or material testing.
## FT-4400 Evaluation

<table>
<thead>
<tr>
<th>Node</th>
<th>Tc</th>
<th>Ec</th>
<th>C0</th>
<th>C0</th>
<th>C0</th>
<th>C0</th>
<th>C0</th>
<th>C0</th>
<th>F0</th>
<th>F0</th>
<th>F0</th>
<th>F0</th>
<th>F0</th>
<th>F0</th>
<th>F0</th>
</tr>
</thead>
<tbody>
<tr>
<td>HeG (5%)</td>
<td>1500</td>
<td>45.05</td>
<td>45.05</td>
<td>45.05</td>
<td>45.05</td>
<td>45.05</td>
<td>45.05</td>
<td>45.05</td>
<td>45.05</td>
<td>45.05</td>
<td>45.05</td>
<td>45.05</td>
<td>45.05</td>
<td>45.05</td>
<td>45.05</td>
</tr>
<tr>
<td>He, 3%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 5%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 7%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 10%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 12%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 15%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 20%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 25%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 30%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 40%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 50%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 60%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 70%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 80%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 90%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 100%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 110%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 120%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 130%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 140%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 150%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 160%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 170%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 180%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 190%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>He, 200%</td>
<td>1500</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
</tbody>
</table>

Note: The table above represents the evaluation of different nodes under various conditions. Each row indicates a specific node and the corresponding values in the columns. The values are likely to represent performance metrics or measurements under different conditions.

Abbreviations and units used in the table:
- **Tc**: Temperature (°C)
- **Ec**: Amount (ml)
- **C0**: Concentration (mol/L)
- **F0**: Flow rate (L/min)

For a more detailed understanding, please refer to the full document or consult the relevant sections for each parameter's significance.
Sept 20, 1961 - Glasser & Berman
+110

Melt an encapsulation of packaging device
Glass package

1. Preform and seal six balls - Corning glass
2. Place parts to contain the metal pyramidal
3. Pre-cut "notch" - Corning glass capsule, for example
4. Dipping - B12 on As-S glass

M.O. no comment, but #3 looks like low cost, can seal glass 665°C.

The glass being used (5871) has an oxygen 3% that of Si.

The things needed:

1. A metal system to take the temperature of encapsulation
2. Preheat glass at 400°C to 600°C
3. Mix traces of oxide penetration at encapsulation temperature

Try to incorporate PbO (or CdO - As2O3) into the Si:O

in order to:

a) reduce bandgap of Si:O to complete (red for p)
b) grow thicker layer of oxide by having multiple expan

Must test the ability of the PbO glasses met to better the electrical characteristics of the underlying junction.

Peroxide paste to see if don't want glass;
2) for it melt

Semi-conducting glasses - What is the aim? (the whole stuff)

Suggest Daniel content that PbO is a fairly high conducting metal that can be made by oxidizing Pb - Wright & Campbell
Sept 22, 1961 - Project Redesign -

Q: What geometry plane design should we consider to keep us competitive?

<table>
<thead>
<tr>
<th>LE</th>
<th>AE</th>
<th>Ac</th>
<th>X-1210 DE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1210</td>
<td>2</td>
<td>1</td>
<td>75</td>
</tr>
<tr>
<td>1340</td>
<td>13</td>
<td>13</td>
<td>78</td>
</tr>
<tr>
<td>4700</td>
<td>50</td>
<td>75</td>
<td>110</td>
</tr>
<tr>
<td>3021</td>
<td>50</td>
<td>75</td>
<td>225</td>
</tr>
<tr>
<td>1210DE</td>
<td>4</td>
<td>1</td>
<td>105</td>
</tr>
<tr>
<td>X-1210 DE</td>
<td>16</td>
<td>4</td>
<td>27.5</td>
</tr>
</tbody>
</table>

Conclusions:

1. Fly 3-stage 1211, 1311. Adjust resistors to meet 1210, 1310 specs.

2. Replace the 1240 family with STA design. Probably X-1210 DE alone.

3. Aim at this family by 4/4/62 for production.

4. Make a mark that design at written expense for P.L.

P.R. will get 910 units to Schultz (1310 DB) to maintain to 241744 cts.
Sept 27, 1961 - Proj 109 and (Nov 4)  

Phil Hall - Phone  
Myra - Finish  

109 - Diffusion Technology  
114 - Special Diffusion  
163 - Deep  

Repair of Idealizer polysil  

Can make quiteuble free films, if the room is clean.  

Ethyl Silicate in 40% solution @ 750°C. Set 2.15 A/min  

\[ \text{Diagram} \]  

Activity Energy - 150 kcal  

Make well up to 15 μ thick films. Above this, after the Cl₂ forms, we see silicon in the sublimate  

\[ \text{Diagram} \]  

Cold not get good films with carbon gas  

Or make "enriched" type oxide. Must flood at ethyl silicate before letting in air  

Try  
1. Pulp film & heat contact C  
2. E01 grid check  
3. Check wire from pate  
4. Try for MVP channel
Sept 4, 1961
Stop Band Repeat Camera

Summary: Since the last meeting, the granite system now looks like a development program. Jain recommends that we scrap it. The granite costs are going up and the company will not guarantee the stay cost, now from $4,500 to $5,200 in granite, but no guarantee that it will work.

New stay is 27,500
Summary:
There are 600$^\circ$ C00V
The $\beta$ signal alarm map.

Ordinary We set 20% zero in 2
On $g_n$ at 12 am

The following was measured:
Cg - Op-amp gate is almost nothing
Ic Ige - Adjust to 20 ma Ic @ Vg $= -50$ V, fix Ic and
mean $I_c$ at $+50$ V.

All of these were placed a slope like

\[ I_c \]
\[ V_g \]

Also measured $g_m$ and $V_g (g_m = -1000)$

\begin{tabular}{|c|c|}
\hline
$g_m$ & $V_g$ (Max) \\
\hline
10 & 9.8 \\
350 & 1500 \\
100 & 770 \\
90 & 1400 \\
37 & 610 \\
\hline
\end{tabular}

There is a bend in a lot we don't understand about the device as
that makes.

Conclusion:
Don't just state with few words and lost gain
structure of diode-emitter type to develop
C(T) to continue to understand physics
There is a big job.
Program Plan (P.F.) by Oct 17th
Summary:

CTS has seen some detailed DFG m(Fe-FeO) reflective.

Some of the old stuff, from -55 to +125. EF 10 cm. The 4400 are about 4. The 4405 are on 2.5. The 2.5 is the last we've done yet.

The results that have really not yet been checked in the Y1 after diffusion of the emitters. We've tried, but something always leads to Y1 25-30.

This must be fixed - attempt to make some samples of -52 to Y1.

If measure some of the "stupid" 4400's and see if the curves really are crossing.
Postal, east - he was data

silica - have grown 4.5± in wall cracking by slight steam
overheated for growth.

Our attempt: used a 2.5± stuff to make shorter - of
deposition.

It is thing still is ready to beam one to Del McCull.

They talk like to try at carrier gas system for 10 days. In
this way the dop doping during growth can be tried. Problem here
is that it must be completely free of O₂ and H₂O. The vacuum growth
is more uniform.

Action: We got Del McCull going with the system in a vacuum
deposition after October - that would factor in.

Shiny carrier will do service more until we develop
stable conditions. Then we will set it up under McCull
in the different area.

So much for silica - CTS will patch for light to McCull.

Phil Flint has gotten some very exciting ablation prod-
ucts on S₁. This is an important later to continue.

Differential Cl₂ Etch:

How is going to make hole for Hob'd tube. Cl₂ is a
chelating agent for film form.

Differential:

What do we need:
1. Boron above 400 ¼ in not reproducing - fearless paper help?
2. Boron putting in a problem
3. Adjacent device doesn't well matched as one might think.
4. ETS say some useful info can be obtained concerning the problem.
5. Cut differential - bill days absence, etc.

Agent experiment for phosphor bullet.
No record

1. Production of
   mm² per
   1341
   300
   draw
   pp 1741

2. Production of mm², 1311

3. Study of substrate-to-
   layer doping transfer

4. Learn to completely
   eliminate the need for
   test wafer of opposite type

5. Study surface properties
   and stress effects on the
   quality of the growth

6. Compare different sources
   of tellurium

1. Supply new to Petrin for
   open on drive, 1241, etc.

2. Learn to grow lead junction

3. Study introduction of dislocations
   (find out what they are
   introduced and eliminate)

4. Study linearized system for
   better light-thickness control

5. Learn to grow high-pn
   loops

6. Study of growth, brittleness and
   imperfection

7. Growth of multiple junctions
   and complex structures

8. Other materials
We have made a number of runs using undoped silane and have confirmed that maximum film resistivities are a function of substrate resistivity in the present type vertical reactor.

As an example, 12 runs were made (360 wafers with 72 samples) using substrates identified as 0.01 to 0.05 Ω cm n+; the minimum film resistivity observed was 1.5 Ω cm (120 v diode); maximum 4.8 Ω cm (280 v diode); and average 2.7 Ω cm (185 v diode). Assuming the average substrate resistivity to be 0.025 Ω cm, it is seen that:

\[ \frac{1}{\text{Substrate}} = \frac{1}{\text{film}} \times 0.009 \]

Six similar tests were made using 0.01 to 0.02 n+ substrates and the following relationship holds:

\[ \frac{1}{\text{Substrate}} = \frac{1}{\text{film}} \times 0.007 \]

For p-type, in the range of 1741 specification:

\[ \frac{1}{\text{Substrate}} = \frac{1}{\text{film}} \times 0.0036 \]

These figures are not precise inasmuch as the substrates were not sorted precisely, however, they are as accurate as necessary for guidance now.

In summary, for production resistivity specifications:

- 1340 use substrates 0.007 to 0.009 Ω cm As doped
- 3001 use substrates 0.012 to 0.015 Ω cm As doped
- 1741 use substrates 0.006 to 0.008 Ω cm B doped

No doping need be added to the silane, but some silicon coating must be behind the wafers before the run or the film resistivities may drop. We find it most convenient to coat the mandrel for 15 minutes after two wafer runs. Wafers of opposite type need not and should not be included.

Our requirements for substrates will be adjusted accordingly in a separate letter.

W. Wigton
1. Custom micro-electronic capability employing micro-technology to Meta-View is one objective.

2. It would be nice to make PNP blocks that are plug-in replacements for p-n family — say 5MC etc. Feasibility not established (Naco).

3. Can we make a 5MC direct plug-in replacement using only established techniques —
   1) Considering the possibility of using n-p-n & p-n-p epitaxial standby and projected dozen.


5. A product manual should be written & to conclude —
   a) A discussion of the simplicity and simplicity of product features.
   b) Fabrication problems, quality, and making limitations.
   c) Specifications of the elements.
   d) Parts lists, distributors & fanout.

6. Suppose that 1.50 - 1.60 - 1.30 - 13.20 type Kton age available
   and that evaporated +10% resistors can be made. Far out the program necessary to get to 20 Mc integrated building blocks.

7. Discussion:

   Simplified regular: fiber lost chips (also for special products)

   of volume 100 200 500 1k 2k 5k 10k

   A Tech Memo will be written to available expected units
   technology — one cent chip reliability.

   Existing evaporated metals: 25-100, 12, 27, 54 ng and multiple times of.

   5. Analogue data — Memory and amplifiers as simple — 10220, 1020, 1030.

   Option 5 will be done with 1st first and all will be done to pure out the list.
Today is the last day of school. HNH and I spent all day in a nearby park.

NHN presented an idea for a project. If I recall correctly, it was about a new technology.

NHN was in charge of the presentation. He found an interesting graph to show off at the end.

I am looking forward to next year. It's going to be an exciting year!
Nov 6, 1961

Fab. Hands

Project is urgent for publication dates in ~ 3.5 months.

This task ~ 1000 kg Si in pilot run at Mexico. 5/50 k to enable 50 ppm.

That all the high temp oxidation is going down, but both AsO2 and O2 are worth looking at. For example, let's look at:

high temp - low temp
steam - dry
thick - thin
high press - low press

What else should be looking on?

No diffusion technology seems necessary now; still will catch

for diffusion duplication.

CaAs diffusion:

- Main Objective: Make high performance, lower cost (at least
  a planar collector junction), T.I. in their lab make
  a test using Mn in doping and Au-Sn alloyed

- Solder Objective: A planar diode

- Current Objective: a: using lead diode
  b: Demonstrating and matching against diffusion.

On the project, etch activator there in evidence of doping.

Proposed CaAs diffusion air complete evidence of S:O2, etc.

Also we have interest in trying Al2O3 deposition from Al(OH)3.

We're also working with CaAs and SiO2 diffused.
...
Nov 8, 1961  Glaser - Ceramic #110 Melting Point

Review:
A new pyrometer bridge that eliminates the redox to Pb. This
was used for a check (Ag, contact).

but Pb is not stable in air: to get a
structure like this, it is best to use a prefered tech., with rest in
often, but alone, that is done in range 440-600°C (depending upon the glass).
For example, with 8371 (melting 525°C) and held in 575-600°C for 10-15 min.
The metal is a bit of a problem in spraying Pt, Pd, and Titanium.

Concluding Glase:

looking at GeTeSe (400-550°C softening - can be superposed). This
or the one that was used for Argan's tunnel device. A.S. is
continuing.

As TeC; β = 10^3 cm → 10^2 cm on n-type II-VI. This is
the possibility of local 'magnetogalvanic'

PdO - Copper, 30% Pd, 20% S, this stuff is wet after fabrication.

Ag/Pt - SK01 on a nice clean film.

Outline the packaging effort
Nov 13, 1961

Review:

1. Machined and mounted preforms
   - Machined Cu preforms
   - Metallization on Al/Cu bond seems to work well (or will be improved in volume)
   - Problem:
     a) getting die positioned
     b) removing positioning jig

2. The T.C. bonds after plugging
   - See part A
   - Painted Cu

   Solution:
   - Capillary - pour a drop of epoxy into the mold

3. Use glass bedding, then paint by brush after glass

   - Use kapton by gong clump on top
On the basis of the discussion it looks like we should define the role of an animal form.

1. Prepare assembly using #12 #12½ - try to use a high-temperature belt instead of 5min.

2. Pitting will be by single cavity (or multiple cavity) mold.

Nov 15, 1961 – SCT Meeting

We reviewed data on the first heated filament unit. A typical characteristic is:

![Graph]

The metal has not been heat treated. We don’t know if the metal can be heat treated. This will be tried.

They look like a 30 mc ft.

The cloud in the center of the absorber may only be 100 mc ft.

The cloud is not the same as the original argon atmosphere.

It is better if the device is operated at constant 100 mc ft. for 200 days.

We need more info on the temperature dependence of these.

We need life test data – both temp operating.

We must make enough dies for 2000 good units to be assembled in Metsch’s plant for sampling. Before we do this, we must have all the drawings ready and test criteria.

Aim at getting the dies in Metsch’s by Jan.

Pine is looking at the 4-hour possibility.

High frequency geometry?

My grid structure shall be patented.

We will grid out the big one solving all the problems, 1 1/2 prints.

We will do high freq on 2nd print.
FAIRCHILD SEMICONDUCTOR CORPORATION
DEVICE EVALUATION DATA SHEET

Identification No. MB 187

Remarks:

Date: 11/14/61
Data Taken By: Dennis Waring
Supervisor: 
Engineer: Howes Roger

<table>
<thead>
<tr>
<th>Xistor No.</th>
<th>I ( nan)</th>
<th>V 5'</th>
<th>I ( mill)</th>
<th>V 5.1</th>
<th>G ( micro)</th>
<th>V 5.5</th>
<th>I</th>
<th>V 0.1</th>
<th>I</th>
<th>V 0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>15.0</td>
<td>24</td>
<td>36.0</td>
<td>17.9</td>
<td>22.0</td>
<td>52.0</td>
<td></td>
<td>15.0</td>
<td>22.0</td>
<td>52.0</td>
</tr>
<tr>
<td>21</td>
<td>36.0</td>
<td>138</td>
<td>39.0</td>
<td>16.8</td>
<td>22.5</td>
<td>52.0</td>
<td></td>
<td>16.8</td>
<td>22.5</td>
<td>52.0</td>
</tr>
<tr>
<td>22</td>
<td>680</td>
<td>127</td>
<td>41.0</td>
<td>15.1</td>
<td>16.3</td>
<td>45.0</td>
<td></td>
<td>15.1</td>
<td>16.3</td>
<td>45.0</td>
</tr>
<tr>
<td>23</td>
<td>10.0</td>
<td>28</td>
<td>53.5</td>
<td>14</td>
<td>14.7</td>
<td>52.0</td>
<td></td>
<td>14.7</td>
<td>52.0</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>67.0</td>
<td>125</td>
<td>41.5</td>
<td>14</td>
<td>3.0</td>
<td>48.0</td>
<td></td>
<td>3.0</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>60.0</td>
<td>5.8</td>
<td>39.5</td>
<td>10</td>
<td>13.6</td>
<td>48.0</td>
<td></td>
<td>13.6</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>84.0</td>
<td>21.5</td>
<td>53.0</td>
<td>11</td>
<td>1.2</td>
<td>51.0</td>
<td></td>
<td>1.2</td>
<td>51.0</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>32.0</td>
<td>15</td>
<td>40.0</td>
<td>14.5</td>
<td>12.0</td>
<td>50.0</td>
<td></td>
<td>12.0</td>
<td>50.0</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>79.0</td>
<td>18</td>
<td>45.0</td>
<td>16</td>
<td>2.3</td>
<td>49.0</td>
<td></td>
<td>2.3</td>
<td>49.0</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>31.0</td>
<td>167</td>
<td>41.5</td>
<td>15</td>
<td>16.3</td>
<td>49.0</td>
<td></td>
<td>16.3</td>
<td>49.0</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>90.0</td>
<td>21</td>
<td>51.0</td>
<td>14</td>
<td>2.5</td>
<td>49.0</td>
<td></td>
<td>2.5</td>
<td>49.0</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>73.0</td>
<td>16</td>
<td>45.0</td>
<td>15</td>
<td>3.1</td>
<td>49.0</td>
<td></td>
<td>3.1</td>
<td>49.0</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>61.0</td>
<td>12</td>
<td>41.0</td>
<td>15</td>
<td>4.1</td>
<td>48.0</td>
<td></td>
<td>4.1</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>16.0</td>
<td>46</td>
<td>40.0</td>
<td>16</td>
<td>3.7</td>
<td>49.0</td>
<td></td>
<td>3.7</td>
<td>49.0</td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>47.0</td>
<td>395</td>
<td>53.0</td>
<td>13</td>
<td>2.5</td>
<td>48.0</td>
<td></td>
<td>2.5</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>51.0</td>
<td>677</td>
<td>44.0</td>
<td>14</td>
<td>4.0</td>
<td>48.0</td>
<td></td>
<td>4.0</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>25.0</td>
<td>091</td>
<td>41.0</td>
<td>15</td>
<td>8.0</td>
<td>48.0</td>
<td></td>
<td>8.0</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>68.0</td>
<td>0155</td>
<td>38.0</td>
<td>14</td>
<td>3.6</td>
<td>48.0</td>
<td></td>
<td>3.6</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>73.0</td>
<td>101</td>
<td>48.0</td>
<td>16</td>
<td>1.3</td>
<td>51.0</td>
<td></td>
<td>1.3</td>
<td>51.0</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>82.0</td>
<td>052</td>
<td>44.0</td>
<td>14</td>
<td>2.15</td>
<td>48.0</td>
<td></td>
<td>2.15</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>17.0</td>
<td>345</td>
<td>65.0</td>
<td>12</td>
<td>7.5</td>
<td>51.0</td>
<td></td>
<td>7.5</td>
<td>51.0</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>65.0</td>
<td>088</td>
<td>45.0</td>
<td>14</td>
<td>4.1</td>
<td>51.0</td>
<td></td>
<td>4.1</td>
<td>51.0</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>66.0</td>
<td>43</td>
<td>41.0</td>
<td>15</td>
<td>1.5</td>
<td>48.0</td>
<td></td>
<td>1.5</td>
<td>48.0</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>75.0</td>
<td>093</td>
<td>45.0</td>
<td>13</td>
<td>5.7</td>
<td>49.0</td>
<td></td>
<td>5.7</td>
<td>49.0</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>81.0</td>
<td>470</td>
<td>47.0</td>
<td>12</td>
<td>8.0</td>
<td>49.0</td>
<td></td>
<td>8.0</td>
<td>49.0</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>80.0</td>
<td>065</td>
<td>44.0</td>
<td>16</td>
<td>1.9</td>
<td>48.0</td>
<td></td>
<td>1.9</td>
<td>48.0</td>
<td></td>
</tr>
</tbody>
</table>
FAIRCHILD SEMICONDUCTOR CORPORATION
DEVICE EVALUATION DATA SHEET

FT - SCT

Identification No. HB161

Log Book Ref: __________

Remarks: __________

Date: 11-14-61

Data Taken By: O. W.

Supervisor: __________

Engineer: Howard Bogert

<table>
<thead>
<tr>
<th>Xistor No.</th>
<th>50 mA</th>
<th>100 mA</th>
<th>500 mA</th>
<th>5 MA</th>
<th>Voltage</th>
<th>O1</th>
<th>E10</th>
<th>0.5 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>46</td>
<td>-10.0</td>
<td>-33</td>
<td>43.0</td>
<td>0.58</td>
<td>-1.2</td>
<td>16.9</td>
<td>22.1</td>
<td>48.0</td>
</tr>
<tr>
<td>47</td>
<td>87.0</td>
<td>28.0</td>
<td>40.0</td>
<td>0.17</td>
<td>-0.36</td>
<td>17.6</td>
<td>22.9</td>
<td>49.0</td>
</tr>
<tr>
<td>48</td>
<td>94.0</td>
<td>60.0</td>
<td>66.0</td>
<td>0.35</td>
<td>-1.65</td>
<td>14.9</td>
<td>21.5</td>
<td>53.0</td>
</tr>
</tbody>
</table>
Review:

7000 power package. The TI package is presumably available.
Phil will see that we get at least 5K in edge.
We point out we may need 5K, 200 mc package (approximately 254,100 mc).
Six points at the agg change problem.

The TI solid ceramic package is not well defined for us. We will go up a little larger.

We need the following for the package:
1. Lead tip (attach them to metallic ceramic)
2. Seal leads into the ceramic
3. Attach the tin
4. epoxy style lead bonds
5.ivet foil plates

We can pour 2. no ceramic metallic tin.
Rovers:

Differential resisters: 100/10 ohm, 0.1 mils, style X

100 mohm made 250K with 9 mil path and steel style X

Will make 100 ohm in 2" x 32 mil. (2 mil 2.5 mil gap) -- but
this one at 800 V/10 ohm.

On old resistor by the dibem floor at 0.27° C and
pretty linear between 0-210°C.

Both limits to 20 volts (by memory) in usual case
all at 120° is about same as 0.7 and conductivity 8 x 0.15-0.227° C.

Nichrome evaporated resistor:

Set resistance range of 75±1/2 ohm limited by amount of metal available on a pound

<250 ohm/10 ohm by date to date -- can possibly go

to 1000 need to know date.

Temperature coeff in range 0.5-300 (some 200 pm/° C

Bull. nichrome 1° in 100 pm, mean change 50 pm)

Uniformly better than 1% over a run -- can take for reproducibility

better than that.

All units to date have had Aluminia wedge bonded

At 300°C we had 8 at 133 x 25° at 5000 psi

All batches gave similar 8 at much smaller force.

In order to make resisters for special products we will need a

mask that allows 8 to be used.

Etching of nichrome as in old form high-ifty and a more

gemetric.

between the graphite and 11 - 13 ohms.

KMRE can and did become the KPP

should hold up then. Del Marre thinks that with a new

etching solution we could get more and KPP-ranges. This now

takes much more rapidly. Give resisters test bath with old KMTECH.

The film sticks through peeling and can not control easily.
We will need #2 resistors someday. We had little luck at
1) Controlled evaporation to get the majority.

We must make a mask with 6 mil circular hole varied
from the existing strips for Mt. Nevis. These picks should be
drilled from the Pickings. Make one geometry with the capability
of 1000-10000 Hz with the 10 microamp available.
That suggests a 500-5000 and a 5000-500 geometry.

Bob Fleck will see that operating and other life tests
on these resistors will be started ASAP.

High Resistors:

SnO$_2$: Original was a furnace deposited with a very little
content over about 3 hours. Order of magnitude variation
was in a few from near 20 to 30 and large
variation over what occurred.
A new apparatus like the graphite type is being built.

A #3 in 100-4000 range seems most likely, but
higher values have been seen—up to 1000 Hz.
Adding HCl 5% and water and zone in a dish.

Al does not make good contacts.

In devising these as thermal problem. One of them is
that any reducing atmosphere changes the film.
Otherwise they are failed.

We are a long way from a useful process here. Stabilities in
4 and 40 being much better than we are.
The temp. curve here is low (20-50°C), but is variable and
can sometime be adjusted to for some slightly.
PdO - PdO₂

Eutectic PdO and quickly at 300-400°C. The eutectic allows incompletely divided.
are comparable to multiple costs in steel, and it is.
should be 1000-1000 Pd

Using Pd and Si, alloy compositions, we get good adhesive film in:
5-10h \( \Omega \) (and up to 100 MΩ/h)

Aaron feels that the pure Pd system is perhaps the best
we have to work on.

Maurice and Jim will work closely together to conclude
what next she should go in the high vent. This must
be checked in a month.
It looks like the following is the way to fly:

Pilot Cir.

Parker (in full) - gen foreman.

Move him to E-materials and train for pilot Cir.

For the technology area:

Diff special training 3 McCall + techs to train.

2 in, 4 to change.

McCall + 2 techs study KM ends, Signal.
2 techs study diff parts and McCall cond Diff.

Out can go to pilot party on new shift.
11/27/61 - Microcircuit Layout

Jobs to be done:

1. R-element
2. Test of T2/L family
3. i = 0.2 
4. M ERC V | 2 with Hrm Air
5. Diff Amp

The people we have (1) available:

Finnin
Grant
Craigo
Rugy
Fascimile discussion - 12/6/61

Present are prints on mat paper by us, then by<br>electrotyping. But also have capability to use Delta paper (multi-layer tape) to punch holes through top to type blank bugs.

Then we can a convenient file and line bugs up as if we go to FM type rendition.

Hert O'Shea on the Willard - the whole department will be here tomorrow.

We have the idea of using ordinary phones to adapt.

For the printing problem we could go the dip development and do the development or development and printing.

In any case, we will need the electrostatic printing.

Some bugs are working now.

We would have to have a new rag and start from scratch. Let's get each a rag -- a combination pigment-organic dyestuff.

A way to do the "hedge clitch" that I suggested during this meeting.

Kay

I had clay, et cetera.
Review:

The 3501 has relatively bad low current beta compared to 35002. There are not split cases, since the epitaxial material is too variable. If a split were made the 3501 often have predipout, in fusion the 3500-0.75 yield of the epitaxial wafer and as variable as all get out. The CTE suggests that there is less peeling.

It is obvious that there is a real epitaxial problem. We should continue that we can grow an essentially perfect 12 on 12 or 12 on material.

By an intermediate 12ch and carefully omit the different fields that show the good reactions in adjusting individual wafers.

At present the best material is being supplied by [name redacted]. Work is much variable than winter and delivery is slowing. A pretty good correlation between Henke breakdown or electron and Fermi level. Correlation with thickness is still not as good as one would like.

The layer thickness needed is as follows:

<table>
<thead>
<tr>
<th>Conducting Parts</th>
<th>5.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conducting Def</td>
<td>5.0</td>
</tr>
<tr>
<td>IR conduct</td>
<td>3.7</td>
</tr>
<tr>
<td>Space charge</td>
<td>2.1</td>
</tr>
<tr>
<td>15.0</td>
<td></td>
</tr>
</tbody>
</table>

While this material problem is annoying to say the least if you can't do this and not use it for now.

Comparative matching figure:

<table>
<thead>
<tr>
<th>Layer</th>
<th>500</th>
<th>600</th>
<th>700</th>
<th>800</th>
<th>900</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,500</td>
<td>20</td>
<td>51</td>
<td>540</td>
<td>140</td>
<td>50</td>
</tr>
<tr>
<td>3,500</td>
<td>15</td>
<td>30</td>
<td>400</td>
<td>100</td>
<td>55</td>
</tr>
<tr>
<td>3,011</td>
<td>30</td>
<td>250</td>
<td>50</td>
<td>80</td>
<td>110</td>
</tr>
<tr>
<td>4,700</td>
<td>30</td>
<td>100</td>
<td>300</td>
<td>160</td>
<td></td>
</tr>
</tbody>
</table>

This is probably the right dope and effective, life data is good.

As far as far as concerned our good life tech data starts at 3501 %. (We are good until recently).

We will assemble the available life data on planes PNP's for all common and will summarize on one sheet of paper.
There is some feeling (our data) that a problem exists with respect to the Pi not sticking adequately to the table.

The trend toward 1 mm done alone was good with a particularly age - at all the mid-may and winter tapping assistance.

Summary of tests to see effect of A on their demineralization process.

Control - with gold pulled to lead
Test - no gold - all 4th lead attached.

Group I - 40 lbm @ 25°C
II - 40 lbm @ 300°C

Then they were placed upon power, 300 mm (probably 30 cm @ 10v).

Group I: (To change in life) Group II

Control 0-48 lbm 48-513 lbm min
Test 0-48 (20°C) 48-573 (70°C)

<table>
<thead>
<tr>
<th>Test</th>
<th>0.2</th>
<th>N.C.</th>
<th>no change except 1 unit 1200x</th>
<th>(20-500%), (400-940%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test</td>
<td>0.1</td>
<td>N.C.</td>
<td>no change except 2 units 1200x</td>
<td>(13-300%), (14-615%)</td>
</tr>
<tr>
<td>Test</td>
<td>0.1</td>
<td>N.C.</td>
<td>20-42</td>
<td>(12-500%), (40-124%)</td>
</tr>
</tbody>
</table>

Early experience with Be on surface looks suggests that it is better than Ca, but data is preliminary.

Meeting to be held on life date.
Rod should be completely through with family by Dec 15, except:
1. If yield on C2 is close to 60% for some reason
2. We are checking out the new math ideas on the 5-element minimum squares unless a rectangle is more convenient.

R - elements - The math is clear, there is an experimental structure to test; the capability to make something the big.

Nut I - Must be done in present camera - can't wait. - This thing is still flexible logged down, miscalculated.

Nut Tian will run on a T1 later on in this. He wants to check the effects of the violations.

Rod should point out that by differing on 1 before P before optical growth gets around the VC load problem.

This is important - it looks excellent to try fast.
Problem of LWC10 in primary material.

Material:
- Metal: Typical 25%
- Ag & Pd: 15%
- B & P: 45% alloy (chad graphic)

ASC:
- Second group - 2 years completed, asked 1 year 30% finished
- Second group - all three can shake
- Third group - 1 year, year 70%, 2 years completion

Six samples are being struck in from LWC10 material.
Each of material by different B & P on entire surface and check for LWC10.
Each material also main channels. It is thought that this is a function of the dopp in the substrate, which is variable.

ME: Get the optimum program going!
- Not material is still a little lighter - may 30% an error.

Dan's plan:
- 2-4 alloy open at -180°C addition - is container.
- Start with Al on top.

The best open at the moment are Al in middle down and Al & Al overlap. Some of these will be put up high that 180°C. Need to take close care to ensure the angle down.
- Better of I'd like to start the gates on top.
- Need the input of Al-Si-Fe details.
Hirese says that the preparation of the Master is very important. Doing work as like.

[Diagram]

[Chemical equation: Al₂O₃]
The new diode is now up in the air.
Essentially everything differs from the 1340 by now.

Here is the definition of the product:

1. It will use 1340 geometry.
2. It will be different in that we'll have a small geometry, and with a slightly modified (titanium only) more diffusion.
3. It will be die cut to give low temp off by measuring BU6co (V2)
4. We will supply data (general case) for
   a) adjusting V2 & get pnp vs T1. (it at gain control)
   b) die cut voltage.

We self destruct in 24 for 25° - 150°C, but for -55 we might be nice.

* Any
* It is important that we get life data.

Requested mini: Johnson - 14v
Requested - 14v
(possibly mini robinson mini)

We need life data immediately. It will be the end of year before we have data.
Rest of the Zen family

7.5 meters. The solution looks like an advantage - not a gap can support different at crossing and you must deduce.

NE: Write a description of an Zen program.
Large geometry meeting: (Almost everybody was there, Bag, Spade, Fred, Safety, Ralph, etc.)

3001:
The written objective was in LVCEO = 25.
We should be able to do 35.

The competitor is LE - 50 amp
AC - 60 amp
Wine - min. ~ 60

On problem is that 1v, 1a cost or look at ~ 550 LVCEO.
Aim at two products
1. LVCEO > 35, VCE (SAT) < 1v @ 1amp
2. LVCEO > 60 v for now. Write objective for 100 v,
   And collect to 66 v for now.
It looks like a Feb. product announced for both.

3101 - Some spread in VCE (SAT) - 0.8 - 1.2 volts

Only one: LVCEO > 35 v
VCE (SAT) (500 ma) < |v |
VCE > 25

Not now to fronting - they continue 4300

>11-stripper (4011)
Not, but low BLEBO - March - Clarifying

4400: We are doing - 1.6 - 1.8 am
Are (500 - 550)

Let's cut the cord for 4400 - 4400 Not much
   toward supply & 4405 (600 - LVCEO)

6200 - We want another one on this filter package,
could use 6106 in the stead for A.C. spike application. Need 100 v LVCEO
   for everything.
6206 - No work now.
Mitsubishi order on 3206
Phil Alto split on 7000

7000 -
Mitsubishi to F.A. on Dec 18.
Chip will be on 416 stud.

Air at March IRE product announcement.

2N1954 (Asbromatic) in clamping arm.
Mitered stem is the toughest.

THB will notify us if a direct competitor is needed here at a credit basis.

PNP
Mitsubishi is making 4700 (clen 1700)

2501 - We need an life test data in order. At the moment he has 90C life on claim on these.
In order to select the 4520 data, we must meet the 300C life test.
Dec 13, 1961 - Semiconductor Film Growth Project 

Review of status of silicon work:

"For even depts on similar and fairly even on
the outside." -- use a spread of 20-26 furnz tip
for bottom on the outside.

Reproducibility at a given set is +/-.5% when the pump - clock value
is working, it should be working from box on out.

Reactivity is still controlled by the resistivity relationship:
9 ft/sq ft. x fast x 1.009, by
using the 3001 as an undisturbed
fast. 
In spite of the relationship looks like it in fast x 1.002

The speculation on the doping X-Rays is that the dopant<brandid="0" style="color:rgb(255,0,0);">
are being transported from high temperature to low temperature regions.

Hard device that needs an oven to grow on very high-temperature substrate.

Try to minimize transfer, but if not, looks like trying
Silly instead of S. Al., since I'm proposing that Al is necessary for the
material transport.

Run at lower temp and lower rates will be tried now that we have
a good melting system.

The problem of chemically polished surface are such we get very
high deposition rate - reduction high substrate problems.

With chemically polished surface (only 1-type polished) we get a 2 ft/mo.
deposition in Al2O3 film. . . both . . . 5000 to . . . 6000. However, just
get very substrate grain that same effective it would be a good
deal to do more work on subgrains. Ideally we would not introduce
any more air these in the original substrate,

in our doubly heated run everything ran shot on a small drift

Rudimentary damage introduced in film growth as pyramids
and domes.

Pyramids are thought to be part of melting - sub-growth temperature.

Ledges are thought to be caused by drift.

"Low drift" are always present in growth films, but they don't hurt.

Pyramids always kill a device.

Ledges don't occur very often (especially not at high temperatures), their
effect is not known.
Hank feels that silicon carbide might well be the culprit on the pyramidal type defect.

Heulken has found a defect that can be developed by slow etching with CCl₄ and H₂O₂. On the Heraeus material,things that originally were triangles etched out to triangles made down to the underlying glass etched. The CCl₄ + H₂O₂; however, etches out rounded pits at the base. These are rounder than that of the original triangles.

The pits that etch out also etched with a 1Portrait pit of the grooves is generally smaller before etching than the grooves in general.

Hank will check these for correlation with electrical problems.

Electrical properties of the film:

Before going into backing silver gone really large channel on the sample. These are ~120 200 x 200. It may just be a drift stability effect from instead of a drift wall. On the other hand, it's unusual (that he also should go look before) gain from channels. There is some indication that there are not really a simple drift affect in the sense of them not being cleared up by surface treatment.

On some junctions, we have gotten pretty good form more to 30% into the original system of ~3 & maybe and on the inside of the present oxide. The regular surface are not nearly as good.

The main differences are
1. New growth
2. Lateral condensation.

The improvement has been observed yet by growing junctions in the starting film.

Summary of pattern:

1. Electrical characteristic, especially e-e short.
2. Lateral condensation, especially to public film independent of porosity limits.
3. The apparent grain p large at the interface.
On the 7000 run still one checked by a stick of three test surface, all of which were good. All with the three faces in the third ply are was good.

Accord to F.P. the Made MNT is just what needs rage it is up to 2.5 0-2m.

As a test vehicle to check all the measuring electrical characteristics are can be differenced with B and half with P. The structure looks in fiction and make mean:

...
Material - use Ca-P doped steel mainly, some Al-10 in small. Material is fairly printable - it seems to follow normal simple normal freezing of the two components individually. Some epitaxy has been tried, for 10-20 min.

In the out-diffusion plotting, if we do not get good agreement, it is likely to be that the m/e is not strong and can be taken into account empirically. We have in the past identified the difference, hence, in steps that can be accounted for by all EIP in the S., that is, Chrysler. This can be a factor here. The last statement is not confirmed. Also, if we calculate, we get 1000 s., as gets 10-15 m/s.

It would be worthwhile making good diffusion calculations on the basis of this existing data:

Charger reproducibility - remains high.

- thin, green,

1. Photon count problem - 20% for breakdown.
2. RV = 200 (by visual inspection), but spread 100-500.
3. RV = 350; 

New style has higher. vs.

by growing a smaller guide before out-diffusion. The pile-up can be greatly reduced. Have this flat tried by 1.189.

All good news medals allowing for any channel diffusion over the channel to

1. Reduce film if possible.
2. Procure solutin.

No reliable date exists at present.

We have made some device with diffusion on the channel but got a light to diffusion, of an the top of regular device. Some that gained some new. The gallium diffusion didn't seem to be well...
A. PROJECT OBJECTIVES

Generally, it is desired to develop the optimum configuration for each of the field effect transistors discussed below. A comparison of two or possibly three approaches to developing the devices should be made. That is, one should investigate the possibility of making field effect transistors using the technology we have at hand, such as, out-diffusion, in-diffusion and epitaxially grown films.

Inherent in the development of each of the various types is the determination of whether or not the devices can be made with adequate reproducibility and stability.

Since field effect devices are potentially very useful in integrated circuitry.

The following list includes the various types of field effect devices that are of interest. An additional sheet gives a more thorough discussion of some of them.

1. Chopper

Objective specs are \( R_{SD} \lesssim 100 \, \text{ohms at } V_g = 0, \, BV_{SGO} \geq 5 \, \text{volts} \).

It need not pinch off completely. Leakage currents should be very small. The devices to date have been made primarily from aluminum phosphorus compensated crystals. Initial results with gallium phosphorus material looks actually encouraging and seems to avoid some of the problems.

2. Pentode

Requirements: Must pinch off at \( V_g < 10 \, \text{volts}, \, C_{sg} < 10 \, \text{pF}, \) preferably 1 or 2, \( BV_{SGO} > 40 \, \text{volts}, \, I_{SD0} \, \text{(sat) } 200\mu\text{a to } 600\mu\text{a} \).

This implies approximately 5kilohms for channel resistance. While the present experimental devices use the double stripe 1210 geometry, the final device need not have the double structure. Eventually, this device will need new masks.
3. Bigger Pentode FET
   Eventually we will want to make a larger version of the above pentode. No work on this is contemplated for the present.

4. Switch FET
   This one is similar to the pentode, but a lower on impedance and higher off would be nice.

5. Metal Over Oxide FET
   This structure offers the possible advantages of
   a. Making normally off switch
   b. Double gating for lower pinch-off voltage
   c. Infinite input resistance

6. Application and Development Program
   The field effect transistor has possible usage in three major fields
   a. As a chopper modulator
   b. As a high OFF impedance switch
   c. As a high input impedance amplifier (pentode replacement)

The first application, as a chopper, competes with mechanical choppers and transistor pair choppers. The requirements here are a low offset voltage that should be less than one microvolt, in order to be competitive with mechanical choppers. For instrumentation purposes this should hold over a temperature range from 0°C to 60°C (military equipment -55°C to 125°C). The main advantage here would be the possibility of operating at quite high frequency so that the system bandwidth could be considerably improved over mechanical chopper systems. This would require the balancing of capacity currents that also create and offset voltage. The present structure is aimed in one device. One question of design of this device revolves around the compromise between frequency response and temperature range.
The second application, as a high OFF impedance switch, requires that the device be completely pinched off and be used in place of stepping switches in large process control installations. The requirements of the OFF impedance are determined primarily by the number of switch points tied to one input. In general, to be useful these should be of the order of 10 to 100. In order to prevent cross coupling, this requires that the OFF impedance be in the order of $10^{12} \Omega$. This is a much more stringent requirement since the gate leakage current flowing in the OFF direction will add up from the OFF switches and flow through the ON device. Frequency response and temperature range are not as completely determined here. Possible more attempt to control the temperature should be made, if the performance characteristics justify this.

The final application, the pentode replacement, would be for building completely transistorized test equipment so that the input stage could be both the high input impedance and high frequency response. Present transistor circuits require use of very low currents to get the high impedance and hence frequency response suffers. In addition, the possibility of using a field effect device as a DC amplifier has not been exploited and warrants attention. The characteristics as an input stage in a piece of test instrumentation would require that the amplifier it produces be compatible with present VTVM and scope input preamplifiers; that is, in the order of $1 - 10$ megohms shunted by less than 50 pf, which must be met with reasonably high gm devices.

B. PROPOSED PLAN

1. Chopper

A new set of masks has been designed which makes it possible to use the the same crystals (for the case of cut-diffusion) or the same epitaxially grown films for both the chopper and pentode replacement. The following characteristics should be obtained:

$BV_{GS} = 40 \text{ v}$, $R_{SDO} = 200 \text{ ohms}$, $V_p < 10 \text{ v}$,

$I_{GS} = 20 \mu\text{A} \text{ at } 20 \text{ v reverse bias}$, $V_{OFF} = \leq 1 \mu\text{v} \text{ at } 25^\circ\text{C}$

b. Design masks and make reproducibility runs for a low noise chopper, is isolate channels from surface using a transistor like structure.

2. Pentode Replacement ($I_D = 200 - 600 \mu A$)

   A new set of masks has been designed but will not be available until the first part of January 1962. The new configuration isolates the channel from the surface. This was done to reduce noise figure (see attached drawing).

   a. Check effect of isolated channel on noise figure.
   b. If noise figure is sufficiently reduced over the range using the above masks make reproducibility runs using both outdiffused and epitaxial material.

3. Switch FET

   Dave Hilbiber has expressed interest in a device with the approximate characteristics $I_D = 10 \mu A$, $V_p = 2 - 5$ volts $I_{GS} = 20 \mu A$ at 20 volts. Some devices with similar characteristics have been supplied.

   a. Nothing specific on this device.

4. Metal Over Oxide FET

   Provision has been made in this new Pentode Replacement masks for a gate over the oxide if desired.

   a. Some devices of this type will be made when masks are available (January 1962)
PENTODE REPLACEMENT XFE 50E

Diagram showing the layout and components of a pentode replacement circuit, specifically the XFE 50E model.
Some choppers are on the mill. Blue will be out next week. As soon as data on these is available, we will meet and decide exactly how to get a set field effect out on the market. I want presumably tie the lines even tighter on this one.
Product layout meeting - Peilo

Topics for discussion:

1. FDA 1, 2, 3 (Adam)
2. Ultralight - 3.5 X for mill
3. 100% B护卫 - ""
4. 1/2" base
5. Am. layer process - 8 x 3 mill take second cut - let them make film
6. Small Adams
7. High V. rectifier - 99% product under development &
8. MPN light source Kill
9. Controlled Melt - S.H. report - next 1.6.1 - Sept 16 Apri
10. Heat V. rectifier 3 - col 7
11. High V. Stack
12. IBM Plastic photowires
13. Multiple chambers - let's work this out! :)!

Miscellaneous:

If S.H. wants, they can work upon info and go.

Dil will continue to investigate high voltage junctions.
Agenda for 12-14 diode meeting

1. FDA 1, 2 and 3 (Adam)
2. Ultra fast
3. 100 micro amp zener
4. 7 1/2 millimap zener
5. General zener
6. Small Adam
7. High voltage rectifier
8. PNP 2 terminal PNPN light sensitive
9. Controlled rectifier
10. High voltage - high current rectifier
   high voltage stacks epoxy
11. Varicaps and varactors
12. IBM plastic package photodiode
13. Multiple diode
14. Charged storage diode
15. Tantalum capacitors
Meeting to consider the use of cobalt for Henri job - Dec 18, 1961.

Data review:

<table>
<thead>
<tr>
<th>Cobalt</th>
<th>Steel</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.12</td>
<td>0.15</td>
</tr>
<tr>
<td>0.20</td>
<td>0.18</td>
</tr>
<tr>
<td>0.19</td>
<td>0.15</td>
</tr>
<tr>
<td>0.17</td>
<td>0.14</td>
</tr>
<tr>
<td>0.16</td>
<td>0.13</td>
</tr>
<tr>
<td>0.15</td>
<td>0.12</td>
</tr>
</tbody>
</table>

Geared 47% 1270
Time 10 1/2 20 1/8

Soldering of 30 random electrical strips (milled) found 14 will crack.

New data on temp cooled. High voltage, high temp. When this is collected, we will make a yes or no fret decision.

Many hope to have their for 11/10/61. We will meet then.

Cyndy Thompson will call the meeting.
Meeting concerning A.C. design, Dec. 18, 1961

L1 1724 3 ft. l.f. 7-1/2 amp
2N 1937 200 amp rating (make 10 k.V.A. 7/8 ph. T. I get
a contact to produce 400 volts for building. This is
the one they really need.

We can 7000 or 90 instead if L1 1724 - don't plug in - if so, they will
plug some in. If this gets, they will assume that we
can make the 2N 1937.

We will supply sampler to T.B. for K.S.P. - 6 bg/ft.

About the contact for the 18000 class that should
do the 10 amp job easily.
Meeting concerning Verde elimination on a cheap SGS later 12/20/61

To get solid effort 0 SGS 5 must be cheaper than C & device.

The problem is one of cutting material cost to a minimum.

SGS can make an completed 1 ton load in for $0.08 or hope for $0.05 Solved.

We are talking of a selling price in the 15$ price range.

A Japanese buyer is being calculated. It shall cost - $0.05. We (R&D) shall look at non-Inhibited this latest possibility. We will restrict our effort to this task. Mr. Aras will supply the leader. We will check along

BE invite for ideas. Try a C4 photo?
Review:

The strain gauge is having to be more technologically developed. There is a need for a better depth p-type layer. For this reason n-diffusion is not as good. Silicon material is just arriving. The use of the quartz poling (o-type gauge) layer as a factor of 2o to one can get data like the 5 volt output objective is being on the 250 p strain amplification. The bridge gain is 5v at 1600 µ strain.

The print quality of the strain gauge is

![Diagram]

Measurements of strain is still a major problem. Need further progress to do on the testing on check meter.

For sure the thing must be attached to the display. Test in place.

We will proceed to make a test vehicle to use the dead weight tester to get evaluation of the all Si beam and strain gauge. Time scale...
Project Plan for Project #140
Strain Gauge Development

Project Leader: ______________________ G. Vick
Approved Section Head: ______________________
Approved Director's Office: ______________________

PROJECT OBJECTIVE:

1. Increase output of shear gauge.
   The quantity \( \frac{V_0}{V_{in}} \) should be increased from its present value of 50 to a value of 84 to 100 as compared to 125 for a strain gauge bridge. This will permit outputs of 2.5 volts with 25V to 30V in at strain of .001 in/in. The quantity \( \frac{V_0}{P_{in}} \) should also be increased to permit these output levels at reasonable power consumption.

2. Improvement of temperature dependence.
   The principal temperature effect consists of change with temperature of the zero strain output. This output may be attributed to (a) misalignment of output terminals, (b) residual strains due to die down, (c) imperfect contact areas, (d) inhomogeneities in the crystal or diffusion. The new mask and all-silicon beam are expected to reduce this problem to manageable proportions.
   
   only (d) might still be of significance

3. Determine limits on linearity.
   With the all-silicon sensor base, the maximum strain that may be applied is limited by the linearity of the output rather than by the breaking point of the silicon.
   
   should result in a paper on future term
4. Improved measuring techniques.
Implementation of 2 and 3 will require improvement by an order of magnitude in our present measuring and control of temperature and in our measurement of strain. The temperature problem can be circumvented by temperature compensating the sensors with temperature sensitive resistive networks. Measurements of relative strain, which are now measured to 0.1% of full scale (.001 in/in) will be improved to 0.01% fs.

5. Design of transducers commensurate with improved strain elements.
Design objectives will be twofold: 1) Improve the accuracy over existing devices (e.g., 3SG), and 2) provide performance similar to existing devices at lower cost. Specific design objectives to be determined upon examination of market survey results.

PROPOSED PLAN FOR NEXT SIX MONTHS:

1. Service to Los Angeles will continue as requested and will be charged to #167.

2. Study of diffusion techniques for attainment of minimum $X_j$ and $C_o$ for shear gauge. Primarily a study of the applicability of epitaxial deposits and of repetitive low temperature oxidation—HF cycles to achieving low doping and thin structures. This will require one man for the next six months. The design of transducers is not dependent upon the results of these tests and can proceed concurrently. The
improvement will be seen in reduced power consumption for a given output and will not necessitate redesign of transducers.

3. Determine and attempt to eliminate source of zero offset voltage and zero drift in the shear gauge. The possible causes of zero offset voltage are listed above. Evaluation of the new mask and the all-silicon beam with respect to zero offset should be completed by February 15. If these do not reduce the problem to acceptable levels, the effects of crystal homogeneity and surface condition will be examined. This will require a one-man-effort until completed, at which time this effort will be re-channeled.

4. Linearity studies.

There are two effects which contribute to nonlinearity of shear gauge output versus strain. 1) Change in the piezoresistive coefficient with strain, and 2) a geometric nonlinearity resulting from E and J being in different directions (Hall effect shows an analogous nonlinearity).

These are in opposite directions and should tend to cancel. Both are subject to a degree of control which can be used to enhance the cancellation. In addition, there is the nonlinearity due to strain not being directly proportional to beam deflection. This is also subject to control and can be used to cancel whichever of the above is predominant.

a. This area is where the improved measuring techniques both of temperature and of strain required. The temperature effects can be improved by temperature compensating the experimental sensors, and the strain measurement by a careful redesign of our test specimens. These will be complete by February 1.
b. Study of the nonlinearities and the development of a sensor with optimum linearity should be complete by June 30.

This will require a one-man-effort for the next six months.

5. Transducer development.

This may be divided into three phases as follows:

a. Market survey. Assistance will be provided to Gordon Goodrich in his market survey as required. The results will be studied as they become available.

b. Concurrently with (a), new materials and methods for design of transducers will be investigated both theoretically and experimentally (e.g., ceramic materials for pressure diaphragms and springs; configurations which will eliminate soldered mechanical linkages, etc).

c. By the end of the first quarter of 1962 we should have enough information to begin to design and build a prototype pressure transducer and linear accelerometer. Prototypes will be made and tested by the end of the second quarter.

d. Feasibility studies will also be made from time to time for additional new devices such as microphones.
6. Tunnel diode effects appear interesting and should be pursued as time permits throughout the next six months.

7. Develop a $7,536 38G accelerometer for Project #923.

PERSONNEL:

G. Vick: Engineer full time 1,000 hrs.
N. Pearson: Engineer full time 1,000 hrs.
H. Scherling: Technician full time 1,000 hrs.
M. Dragmire: Technician 50% 500 hrs.
S. Mizote: Technician 30% 300 hrs.
B. Fallis: Data Clerk 100% 1,000 hrs.

CAPITAL EQUIPMENT:

Equipment for precise measurement of displacement ($10^{-7}$in) to be determined. Est. $5,000.

Power Supply—voltage—for driving constant current supply. Est. $200.
Pre-Meeting Summary for Review of Etching Studies

Projects

The two chief projects in this category at present are the electropolishing of silicon (work being charged to No. 133) and oxide etching (work charged to No. 173).

Electropolishing silicon

Project objective: To etch silicon wafers controllably leaving a flat, highly polished surface, free from damage and significant imperfections. Wafers to be subsequently used as epitaxial substrates, and other uses.

Proposed plan; tentative outline:

January 15 - Preparation of low resistivity p-type material reasonably satisfactory. Agreement established on standards and evaluation of samples prepared.

January 31 - Low resistivity n-type feasibility established and reasonable success obtained. (Slotted wheel needed before this work can be performed; is on order.)

February 15 - Low resistivity n-type being run fairly routinely and with reasonably satisfactory results.

February 28 - Some exploration of alternative plates or treatments; training of other personnel if desired. Duplicate apparatus constructed for larger scale preparation of wafers.

Personnel and estimated hours:

Past: W. Smart full time since middle of November; approx. 210 to date.
M. Buenz before October; part time.

E. Duffek January, 1962, 40 hours.
W. Smart February 150 hours.
E. Duffek February 30 hours.

Technician from another group (if training desired) say 30-40 hrs.

Beyond February, 1962: see below

Capital Equipment: No major expenditures anticipated. Apparatus used can be constructed, or duplicated, for relatively small sum. Power source borrowed or relatively inexpensive. (Total, less than $1000.)
After the end of February it is proposed to continue similar work, under No. 173, "Etching Studies" with somewhat broadened objectives. Other materials should be used, with gallium arsenide being given first attention, perhaps already in February.

Project Objectives: To etch materials controllably leaving a flat, highly polished surface, free from damage and significant imperfections.

Proposed plan:
Schedules to be set as work progress and laboratory needs indicate.

Personnel and Estimated hours:
Continuing effort will utilize probably:

- E. Duffek 30 hours/month
- W. Smart 60 hours/month

Capital equipment needed: No major new equipment anticipated.
Perhaps a Lapmaster or polishing wheel; perhaps a small power source. At present, need for surface roughness meter ($5,000 - $10,000 as at Bell Labs) not adequately established.
Oxide Etching

Project Objectives: To obtain improved control over etching silicon oxide formed under a variety of conditions, and with the admixture of other oxides such as those of boron and phosphorus.

Proposed Plan:
To initiate work again as soon as the constant temperature bath can be obtained. It is now on loan, pending the repair of the one used by diffusion and other personnel.

Parameters to be studied include temperature, etch composition, oxide preparation (steam, dry $O_2$, anodic, thermal decomposition of silanoids), oxide composition (including some boron or phosphorus oxide).

Personnel and Estimated Hours:
None recently; year to date on No. 173, as given in monthly reports. Future: M. Buenz, 100-150 hours/month, depending on relative priorities of this and other projects.

Capital Equipment Needed:
No expensive purchase of items anticipated, if constant temperature bath again made available.

Miscellaneous Etching

Special short projects to be undertaken as needed by other Sections, but no other major efforts now planned for near future.

W. Waring
December 21, 1961
Project 173  Electrolytic Studs

We made some studit bonded film chemical etch.

Contact is made by Ni plating and soldering on lead which in turn is attached to a pool of Ag.

Electrolyte is 2.5% HF in 50-50 glycerine H2O

We use current of ~1Amp/cm2.

Surface on 12-in P-Type is not good yet.

Solder gets oxidized very quickly.

Bill uses the following:

[Diagram showing a wire with a dropper of solution and a fluted stick, slightly off-center.]

He etched at very low current now. But don't seem particular. This gig is 100x safer now, good for and spring contacts.
Summary of Costs expended as of 6 Jan '62

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmard Contract</td>
<td>25,980</td>
</tr>
<tr>
<td>&quot; Ext for Column</td>
<td>1,525</td>
</tr>
<tr>
<td>More Pedestal</td>
<td>500</td>
</tr>
<tr>
<td>Master Slide</td>
<td>1,310</td>
</tr>
<tr>
<td>Column Extension</td>
<td>250</td>
</tr>
<tr>
<td>Lapping Magnets</td>
<td>90</td>
</tr>
<tr>
<td>Magnetic Chuck (new plate)</td>
<td>45</td>
</tr>
<tr>
<td>Brake Motors &amp; Controls</td>
<td>275</td>
</tr>
<tr>
<td>Dayton Motor Reducer</td>
<td>30</td>
</tr>
<tr>
<td>Vernac Scale System</td>
<td>943</td>
</tr>
<tr>
<td>Diaphragms</td>
<td>45</td>
</tr>
<tr>
<td>Microscope Bodies</td>
<td>850</td>
</tr>
<tr>
<td>Micrometer Thimbles</td>
<td>112</td>
</tr>
<tr>
<td>Dayton Blower</td>
<td>37</td>
</tr>
<tr>
<td>Power Supply (RD #257-50)</td>
<td>2,058</td>
</tr>
<tr>
<td>Miscellaneouces</td>
<td>500</td>
</tr>
</tbody>
</table>

Sub-total (1) 37,610

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controllers</td>
<td>2,500</td>
</tr>
<tr>
<td>Mirrors</td>
<td>1,500</td>
</tr>
<tr>
<td>B &amp; L Lenses</td>
<td>1,000</td>
</tr>
</tbody>
</table>

Sub-total (2) 4,000

Costs Unexpended

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microscope Frame</td>
<td>900</td>
</tr>
<tr>
<td>Light Box Cary (lot)</td>
<td>1,095</td>
</tr>
<tr>
<td>Handmade Alums</td>
<td>150</td>
</tr>
<tr>
<td>Traveling Microscope</td>
<td>650</td>
</tr>
<tr>
<td>2x2 Plate Holders</td>
<td>150</td>
</tr>
<tr>
<td>Magnetic Chuck machining</td>
<td>130</td>
</tr>
<tr>
<td>&quot; Lapping</td>
<td>275</td>
</tr>
<tr>
<td>Autocollimator Mtg Bar</td>
<td>100</td>
</tr>
</tbody>
</table>

Sub-total (3) 3,453

(cont.)
Costs unexpended (cont.)

Shipping Cost (freight)  1080
(Insurance)  260
(Loading)  28
Sub-total:  1,368

Assembly and check-out cost:
- Estimate 4 men for 4 weeks, n. 80
  man-days @ $30/day = $2,400
Sub-total:  2,400

Funds expended

Sub-total: (1) 3,7610
(2) 4,000
Total: $41,610

Funds unexpended

Sub-total: (3) 3453
(4) 1,368
(5) 2,400
Total: $7,221

Total expected cost:

A  41,610
B  7,221
Total: $48,831 (not including engineering costs)

Project Budget Approval:

$47,508

Deficit = $1,323 plus engineering costs:
- 3 men @ $30/day = $3,400
- Approx. 180 man-days

Jan 62
Jan 6, 1962
11:00 AM

Talked to Al Johnson this morning regarding delivery of our machine to Farrand. He says the machines still look almost ready and the thinkers they could be shipped possibly Tuesday or Wednesday and not later than Friday of next week. Delivery to Farrand would be made by motor on truck and should not take over one day.

He doesn't know when Farrand gets its info about more being 3 weeks late.

Leo Grey
FAIRCHILD SEMI-CONDUCTOR CORP.
644 CHARLESTON ROAD
Palo Alto, California

ATT: A.L. Greig

GENTLEMEN:

THIS IS TO CONFIRM OUR CONVERSATION OF JANUARY 3.

WE CAN ASSURE YOU THAT WITH OUR MACHINE, INSTALLED IN A TEMPERATURE CONTROLLED ROOM FOR OPERATOR COMFORT OF APPROXIMATELY 75° F, WILL PERFORM TO OUR USUAL SPECIFICATIONS FOR JIG BORERS AND JIG GRINDERS EVEN THOUGH WE CHECK THEM OUT AT 68°F.

WE WILL SHIP A GALLON OF PAINT ALONG WITH THE MACHINE.

VERY TRULY YOURS,

MOORE SPECIAL TOOL CO., INC.

A.E. Johnson

A.E. Johnson

AEJ: ES
<table>
<thead>
<tr>
<th>Design &amp; Fabrication for Step &amp; Repeat Camera</th>
</tr>
</thead>
</table>

**General Lay-Out (326,150)**
- Moore Columb OHC with Moore Machine Order Date
- Estimated Cost: $600 (Work in Progress)
- Scheduled Completion: 1 Feb 62

**Special Mere Column (321)**
- Facing Down to 321
- Magnetic Chuck Pedestal
- Magnetic Chucks

- Size: 10 in
- Ordered Date: 29 Dec 61
- Estimated Completion: 1 Feb 62

**Light Box**
- Design: 7 Dec 61
- Estimated Completion: 3 Jan 62

**Column Extension & Mite Brk**
- Design Completed: 14 Dec 61
- Fabrication to be Complete: 2 Feb 62
- Estimated Completion: 2 Feb 62

**Microscope Body Frame**
- Design Completed: 5 Jan 62
- Preliminary Estimate (Pending): $900
- Estimated Completion: 2 Feb 62

**R-2 Plate Holders**
- Design Completed: 9 Jan 62
- Estimated Cost: $120
- Estimated Completion: 2 Feb 62

**Autocollimation Mute Bracket**
- Complete Design: 12 Jan
- Estimated Cost: $50

**Upper Scale Mute Details**
- Estimated Cost: $10

**Modifying "Master" Slide**
- Design Completed: 9 Jan 62
- Estimated Cost: $10

**Traveling Microscope**
- Final Design: 15 Jan
- Estimated Cost: $50
- Actual Completion: Not Critical, But Should Be Ready About March 15, 62

**Modify Brodie Drive Motor**
- This Work has been Completed for RED

**Modify Dayton Drive Motor**

**Modify Microscope Bodies for Frame**
- Bodies are on Hand; Should be Modified by 2 Feb
- Estimated Cost: $100

**Assembly & Check-Out**
- Estimated Delivery to Future (Clipped Note Fell off Page)

**Assembly Completion**
- Same as above
- Work at shop: 7 to 10
- Deliveries
- F 62

**Fabrication**
- Same as above
- Fabrication of Unit
- F 62

Minimum Expected Completion: 23 Mar 62
(Could be 2-4 weeks later)
The device presently is a 3-stage 4 x 10 m.s.

The portale is a 2-stage 4 x 2 m.s.

Old Summary:

1. Diffusion calculation didn't agree before.

Assuming perfect out diffusion I accepted perfect pile up of 6th accept, thus still seems to be too much conductance around -10, too much P still.

2. The chopper arms in the mill came thru to get into production.

Program: Making new 2-stage valves with B - diffusion and getter. Also 240 V AC R & S - check by Sah today.

Make 500 sealed devices: operating several times and at least 3 diffusion, 
m or 10-18

Schedule:

Have these made by Feb 28.

Test:

Life test:

- 10 units, 500 h, strong
- 10 units, 200 h, strong
10-40 V, Vsd, gate tied to source.

Monte, Fred, Pico, Up, pm

Otto will help in to design and to make these. We will then go back to Phil first.
SCT - Jan 9, 1962

Life test data

15 unit 400 mm (40 mm 10 x) grounded base
gate Hef to emitter supply at -10 vol.

After 100 hours
88 coded - 48
Ie = 0 - 48
gate junction the same as decreased - unit in 5000 phe to 40 mm
- V+.
These limits were not 500°C aged.

We need a greatly expanded set of conditions:
We will do the following

<table>
<thead>
<tr>
<th>Condition</th>
<th>Lead at 100°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 300°C 300°C storage</td>
<td>1, 3, 10, 20, 40, 100</td>
</tr>
<tr>
<td>B +100°C 250°C storage</td>
<td>10</td>
</tr>
<tr>
<td>C +100°C 400°C storage</td>
<td>10</td>
</tr>
<tr>
<td>D +110°C 500°C storage</td>
<td>10</td>
</tr>
</tbody>
</table>

But Friday we should know of the Au wire unit on the grid
not a tendency to short.

This wire more, but I left only.
January 9, 1962
(Steve Sandor)

PROJECT PLAN FOR PROJECT 158

Project Leader: 

Approved Section Head: 

Approved Directors’ Head: 

I. OBJECTIVES
A. Produce a high frequency GaAs Transistor by diffusion

II. PLAN
A. Evaluate sources of material supply
B. Study contacts and alloying
C. Closed tube diffusion of Zn, Cd, Hg, Te, and Se
D. Coating with SiO₂
E. Masking
F. Predeposition and diffusion Zn, Cd, Te, and Se
   1. Carrier gas system
   2. Vacuum system

III. SCHEDULE
A. Project was started in December: S. Sandor 15% / 200 = 30
B. Future: S. Sandor - 30% time
   Assistant - 40% time

2. S. Sandor will work along toward the objectives of 1/15/62.
2. Facts: 1. continued
   2. on table.

1. Review by Wyman on Cals.

Transfer by Al-containing atmosphere, screen, etc. details

Mo | GaAs or Ge (spin = 0, p-type)
GaAs

With Cals substitut, we now get a good junction. It is
difficult to make 4-point pulse measurements and thermal pulse curves.

With Ge substitut (p-type) and unpolished GaAs (n-type), this
gave good band 60 v. junction on curve traces.

We will save some of these and make V-I or T measurements
to locate the junction.

T: Steve will supply a GaAs page or 2 for Basic Data book.

The layer thickness are ~ 12 μ. — Think we still having at 1946.

My speculation is that the present junction is caused by 6e diffusing into GaAs.

We will probe along on these. The people making them will be on
the production.

2. Steve will work along toward the objective of 11/12/61
I 300°C - 60 hr. (10 devices) Cg-NX(on) Jm(mv@10m) Vg adjusted. 18pf-16pF earthed 0 to +10V 10-0.3

These moved the opposite way of the original one under pressure.

II 200°C Rood et al.

III 200°C (6 devices)

All changes less than 20% except in two cases for 6F unit.

IV. Temperature cycling 18 units.

2 units direct ray by.

The effect is in such a direction the point of bias on the grid during power aging (and probably high long) mean turned on.

Three things to say:
1. Rood et al.
2. Thrice aged
3. Sealed in H2
It looks like a molecular reaction.

For a 13411 \[ J = 3 \times 10^3 \text{ a/cm}^2 \]

The current density at which we get to limiting current should be ~1,000.

The point at that M = 0.05 is all we need to match 1, 50 amp per second.

Need tech opt #1 by now.

\[ I_5 \]

Lucr on \[ I_5 \] with next \[ I_5 \] as normal.

\[ I_5 \] in gravity at cost here.

\[ I_5 \] in future work?
PROJECT PLAN FOR PROJECT # 162

Art Hale

OBJECTIVE:
1. Best or practical method and procedure for magnetic film deposition
   a. "As is" with usual cleaning
2. Most efficient geometry for thin magnetic film memory elements
   b. Mechanically polished and cleaned
3. Memory elements compatible with micrologic elements. That is, memory bits on the same silicon chip as the micrologic elements.

SCHEDULE TO JUNE 1962:
1. Evaporated film preparation defined by June so that a practical procedure is available. Parameters to be varied are:
   a. Alloy composition
   b. Evaporated magnetic films
      1. Ni-Fe
      2. Ni-Fe-Co
   c. Other
   d. Deposition parameters
4. Comparison of magnetic film characteristics to be studied by June 1962

PARAMETERS:
1. Substrate temperature
2. Evaporation rate
   a. "Uncooled" construction completed by June 1962
   b. Cooled type construction by June 1962
4. Vacuum
   c. Annealing

OTHER:
1. Analysis - Chemical and X-ray
   a. Approx. 300 hours
2. Substrates
   1. Microscope slides and cover glasses
   2. Silicon (mirrored?)
   3. Photo resist and masks
   a. Approx. 200 hours
   b. Approx. 300 hours
PROJECT PLAN FOR PROJECT # 162

Art Hale

PROJECT PLAN Page 2

Page 3

1. Surface preparation of substrates
   a. "As is" with usual cleaning
   b. Mechanically polished and cleaned
      1. "Dirty Vacuum System" 300 - 1,000
      2. Etched and cleaned
      3. Power Supply (High current) 320
   2. Electrodeposition of magnetic films
      a. Literature search completed by February 1
      b. Experimental schedule available by February 1
      c. Electrodeposited magnetic films by April 1
   3. Vapor deposited magnetic films
      a. Literature search completed by February 1
      b. Experimental schedule available by February 1 if literature search is favorable
   4. Comparison of the films by various methods to be studied by June 1962
   5. Memory elements of special construction
      a. "Sandwich" construction available by June 1962
      b. Closed loop construction by June 1962

PERSONNEL:

1. Art Hale, Engineer 100% time on 162 to June 1962
2. R. Oldham, Sr. Technician 100% time on 162 to June 1962
3. W. Augros, Technician 100% time on 162 to June 1962 3,000 hours

OTHER:

1. Analysis - Chemical and X-ray Approx. 150 hours
2. Shop Approx. 200 hours
3. Photo resist and masks Approx. 300 hours
PROJECT PLAN FOR PROJECT # 162
Art Hall
Page 3

EQUIPMENT NEEDS:

1. "Dirty Vacuum System" 500 - 1,000
2. Power Supply (high current) < 425
3. Ultra High Vacuum System (?) < 10,000
Project 178 - Magnetirols
Jan 17, 1962

Project Review:

1. We have a system to operate in 10^-6 way.
I think we need a better system.
This in no way evidences that an ultra high vacuum is
a real advantage.

2. Better beam better seen on the air, etc.

3. Frizzly de

4. Hydrograph - some measurement problem
   get columnate from
   [illegible]
   [illegible]

5. Pulse tests - a pulse with other sense under
   The prompt pulse is a gross thing being made with trouble.
   It could much better be made by some other film techniques.


Film now has many problems like looking at a star sky.
We are mostly reading the pulse amplitudes to evaluate.
Jan 18, 1962

Oxidation Studies

Revised on January 10, 1962.

Rate - essentially complete. 10T atom.

Some deviation from parabolic has been observed. Biggest at low thickness.

This latter rate is not understood.

In oxygen we get a nice activation energy of 1.7 ev.

In steam we have a lot more curvature problems - we disagree considerably with Atella.

Bond work at high P has been 2.000 psi, and 500°C, broma 376 stainless. By using the Wyatt anneals in the bomb.

This is some data indicating that the low temperature oxides have "interesting" electrical properties.

T.

T., get as we can grow the high pressure oxide.

Check the pyrolytic oxide for the high breakdown possibilities.

As far as growth rate and doping in general, we have the following:

Also, according to the data above, the following:

with regard to
PROJECT PLAN FOR PROJECT # 114
SPECIAL DIFFUSION RESEARCH
J. E. Sandor

OBJECTIVES:
Project A: Develop techniques to measure small diffusion profiles of P in Silicon.
Project B: Develop techniques to measure Diffusion profiles of As in Fairchild's epitaxial silicon.

PLAN PROJECT A:
* 1. Sample preparation: Oxidation under various conditions
* 2. "Slicing" technique development
  3. Neutron irradiation of samples
  4. Slicing and etching the anodized Si
  5. Activity measurement
  6. Calculations
*Note: Steps 1 and 2 have been performed

TIME:
S. Sandor Lab Technician
2 1/2 months 30% = 120 hrs.
1 1/2 months 30% = 72 hrs.

FUTURE:
S. Sandor Lab Technician
1/2 month = 120 hrs.
1 month = 48 hrs.

PLAN PROJECT B:
% 1. Preparation of alumina discs
% 2. Grinding with Stanford's Microgrinder
  3. Neutron irradiation of discs
  4. Count activity
  5. Calculation

TIME:
S. Sandor
1 1/2 month (included in previous project)
E. Yim
1 month = 10 hrs.

FUTURE:
Included in project A.
Collect data on the growth rate of guinea with different strains on different diets, which shows that the standard nutriment produces faster growth. It will sure that these are used for stink rate studies.

114° Special diffusion studies

A. Field diffusion studies (Phil Flint)

The data still doesn't fit the theory, but the theory is subject to an adjustable parameter. Can we find the x-axis first of all the diffusion temperature difference in a x10.

From doubts, all mention activities, data and repeat an independent check.

The samples are labeled as '10x' and '50x' for example.

Then move them to A.3 in 1M HCl, 0.5M HCl, etc.

Taking 4200° and doing A.4 diffusion

\[ VCE(SAT) \]

It was found that a sample held in more A.4 at 4200° and the 4100 gets of 1050°.

We should look for a detect to count p.m. p.s.

The crystal

1. It looks like a sphere

Can't on p. 07
A. PROJECT OBJECTIVES

Generally the objectives are to study the important and not well understood basic noise sources in semiconductor devices. Primarily this will concern silicon transistors and field controlled devices. This type of study should lead to:

1. Understanding the causes and characteristics of noise in new devices.
2. Information and insight into the influence of device construction and geometry on noise. Possibly, devices can be built designed for low noise specifically.
3. Knowledge of how circuits should be designed to minimize the effect of the noise sources in a device.

Another function of the noise project is to provide equipment and personnel capable of making accurate noise measurements on a wide range of devices. This is a service function for those who are interested in noise measurements for specification purposes or other reasons.

B. PROPOSED PLAN

1. FET Noise
   a. The characteristics of the noise induced on the gate electrode will be investigated. This noise should correlate with the circuit properties of the device just as the induced grid noise on vacuum tubes does.

   The FET high frequency noise figure is very sensitive to the source impedance and it is desired to determine how good this is.

   b. The device construction appears to affect the magnitude of the shot noise in the channel. How? and Why?

   c. 1/f noise in FET. Practically nothing is known about this, except that it is presently slightly lower than the best transistors. How much lower is possible?
2. SCT Noise
   At present some basic measurements of approximate characteristics
   are being made. This is a complicated device and more measurements
   may be made if they seem promising.
3. Transistor Noise
   a. Study of 1/f noise
      This can be pursued along several lines.
      1. Further use of SCT devices to measure the effect of surface
         fields on the noise
      2. Correlation with I_EBO
         This may be an easy way to select low 1/f noise units
   b. High frequency Noise Measurements
      This is a new area to possibly move into, but no definite plans
      are formulated now.
4. Diodes
   This looks like the most promising direction to go in order to
   measure the effect of space charge generation-recombination on the
   junction shot noise. It is difficult to observe this in transistors
   since the transistor gain drops too low when appreciable space charge
   generation occurs.

C: PERSONNEL AND HOURS CHARGING TO THIS PROJECT
   This has been and probably will be one professional and one non-pro-
   fessional persons charging full time to this projects.
   About four days per month have involved noise measurements specifically
   for other people and groups not generally related to the noise research
   work.
D. MAJOR CAPITAL EQUIPMENT TO BE PURCHASED

1. Equipment for quicker and more accurate low frequency noise measurements (10 cps to 100 cps).
   a. Low frequency band pass filter (to be purchased or built)?
   b. Vidar DC to frequency converter. $800.00
   c. Counter (Possibly can be borrowed) $200.00

2. Wayne Kerr Audio Frequency Bridge $800.00

3. Equipment for high frequency (above 30 mc) if it is decided to go into this.
Project 115: Noise studies

Add to write up:

Project Objective:
1. Add study of avalanche noise
2. FET has a feed-back noise mechanism
3. Avalanche adorns a great addition of the shot noise than we do. (We have the compressing effect).

Even with bubble, panel off we can get 100 noise.

It's not due to leakage current.
Pete think this is a bulk effect!! CTS think this could be right.

Some FET noise vs. lifetime. Billing will be tested it.

Proprio:
1. FET Mechanism
2. SET to study 10
3. Dick read - 50a noise
4. Avalanche noise

We will study FET vs. avalanche
People may use SET to Vs
etc.
Wanted to mean diffuse x-ray with Zr in
Current plan is to apply x-rays and solution by anode after. He is using ~ 9.6 - 9.10 h. Time is ~ 200 cc of anode after.

The present scheme:

<table>
<thead>
<tr>
<th>Time</th>
<th>Agent</th>
<th>Steam</th>
<th>Oz</th>
</tr>
</thead>
<tbody>
<tr>
<td>1100</td>
<td>Steam</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td></td>
<td>2 h</td>
<td></td>
</tr>
<tr>
<td>1300</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A question:
1. What is the value of k?
2. Be the direct evidence of pile up
3. Dependence of k on T ~ same and ~ 0.001 if k is
observable as a man - year quantity.

On the case profile on a pitual sampler.

The data on-related affixing at interface is smallizing and can get easily.
Meeting on snorking for trial - Jan 21, 1962

Questions I want answered:

1. Do crabs under a metal conductor shut or open in life?

2. What happens if the bell goes on a crab?

Action: Scribe carefully.
<table>
<thead>
<tr>
<th>TEST</th>
<th>RUN # &amp; QTY.</th>
<th>NUMBER FAILED</th>
<th>FAILURE ANALYSIS</th>
<th>RUN # &amp; QTY.</th>
<th>NUMBER FAILED</th>
<th>FAILURE ANALYSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(8)</td>
<td></td>
<td></td>
<td>(8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(8)</td>
<td></td>
<td></td>
<td>(8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(8)</td>
<td></td>
<td></td>
<td>(7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeat of Environmental</td>
<td>G-30-A-1</td>
<td>none</td>
<td></td>
<td>G-30-A-2</td>
<td>1</td>
<td>Bond Lifted</td>
</tr>
<tr>
<td></td>
<td>(8)</td>
<td></td>
<td></td>
<td>(7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic Environmental</td>
<td>G-30-A-1</td>
<td>1</td>
<td>Lead bonds snapped at post</td>
<td>G-30-A-2</td>
<td>20</td>
<td>Bonds lifted from pads</td>
</tr>
<tr>
<td></td>
<td>(50)</td>
<td></td>
<td></td>
<td>(50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(10)</td>
<td></td>
<td></td>
<td>(16)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(16)</td>
<td></td>
<td></td>
<td>(16)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td></td>
<td></td>
<td>(4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4)</td>
<td></td>
<td></td>
<td>(4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water-10 cycles</td>
<td>(10)</td>
<td></td>
<td></td>
<td>(10)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal Shock Liq. Nitrogen to Boiling</td>
<td>F-201-15</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water-10 cycles</td>
<td>(10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal Shock Liq. Nitrogen to Boiling</td>
<td>F-205-S</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water-10 cycles</td>
<td>(10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal Shock Liq. Nitrogen to Boiling</td>
<td>F-209-S</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water-10 cycles</td>
<td>(10)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal Shock 20 v. v. to heat device, then to liquid nit.</td>
<td>G-30-A-1</td>
<td>none</td>
<td></td>
<td>G-30-A-2</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td></td>
<td></td>
<td>(1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G-5003-S (cracked)</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process: Dice Wafer</td>
<td>Scribing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td>---------</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Chemically</strong></td>
<td><strong>Scribing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Mount wafer on slide with black wax - face up</td>
<td>1. Mount wafer on scribing block with paraffin - face down</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Wash off excess black wax</td>
<td>2. Orient wafer on scribing block for use on scribing 15-angle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Reheat slide to settle wafer</td>
<td>3. Scribe using diamond point - backside</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Place mask in position - alignment time &amp; handling considerations</td>
<td>6. Cover surface with light coat of paraffin</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Coat rubber stopper with hot black wax</td>
<td>5. Heat scribing block &amp; slide wafer off onto bibulous paper</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Press wax coated stopper onto mask to print wax on wafer - leaving dicing lines clear</td>
<td>6. Cover with bibulous paper &amp; roll with light pressure to fracture wafer along scribe lines</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Remove stopper &amp; mask from slide</td>
<td>7. Rotate 90° &amp; roll again to ensure complete wafer break-up</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Melt out wax to completely cover each pattern</td>
<td>8. Rinse dice 3-4 times in TCE to start cleaning process</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Immerse slide in HF to remove oxide from dicing lines</td>
<td>9. Clean dice with hot TCE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Etch wafer thru dicing lines using acid, until gold is visible</td>
<td>10. Place dice in Soxhlet extractor for 60 min to finish cleaning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Immerse in Aqua Regia to dissolve gold</td>
<td>11. Dry dice &amp; move to next process station</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Remove dice from wafer by soaking in TCE</td>
<td>Advantages</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Clean dice with hot TCE to remove remaining wax</td>
<td>No black wax - bonding implications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Place dice in Soxhlet extractor for 30 min to finish cleaning</td>
<td>- lack of uniformity from batch to batch of wax</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Dry dice &amp; move to next process station</td>
<td>Closer spacing - more dice/wafer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time savings - dicing operations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- operator training</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Material cost savings - operator safety - less floor space required</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increased die uniformity - Auto assembly implications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Known technology</td>
<td><strong>Advantages</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No cracks generated in dicing operation</td>
<td>No black wax - bonding implications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dice any shape</td>
<td>- lack of uniformity from batch to batch of wax</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Advantages**

- No black wax - bonding implications
- Closer spacing - more dice/wafer
- Time savings - dicing operations
- Operator training
- Material cost savings - operator safety - less floor space required
- Increased die uniformity - Auto assembly implications
Scribe Program:

Runs supplied to compare scribe to chem etch. A1 group are scribed.

G-30 A1 and A2        Supplied during November, 1961
G-36 A1 and A2        Supplied during December, 1961
G-143 A1 and A2       Supplied on January 20, 1962

Tests to be preformed:

1. Classify
2. Environmental - Standard MIL 19500B.
3. Storage for 1000 hours at 150°C and 300°C.
4. Classify
5. Environmental - Standard MIL 19500B.
6. Additional Testing

Results of tests to date:

1. Classification results.

<table>
<thead>
<tr>
<th>Run Identity</th>
<th>%A</th>
<th>%B</th>
<th>%Rejects</th>
<th>%Opens</th>
</tr>
</thead>
<tbody>
<tr>
<td>30A1 (Scribe)</td>
<td>70</td>
<td>19</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>30A2</td>
<td>68</td>
<td>15</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>36A1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36A2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>143A1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>143A2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Environmental results.
3. Storage results.

4. Environmental results.

5. Additional tests planned.
Runs supplied to check good electrical but cracked scribe dice:

<table>
<thead>
<tr>
<th>Run</th>
<th>Qty.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gates</td>
<td>8</td>
</tr>
<tr>
<td>F-201</td>
<td>21</td>
</tr>
<tr>
<td>F-205</td>
<td>52</td>
</tr>
<tr>
<td>F-209</td>
<td>43</td>
</tr>
</tbody>
</table>

Test to be preformed:

1. Classify.
2. Environmental.
3. Storage at 300°C.
4. Temperature shock.
5. Additional testing.

Results of Tests:

1. Environmental.

3. Storage at 300°C.

4. Temperature shock.
5. Additional test planned.

Chlorine Etch:

Results - Times greater than 5 minutes resulted in over etching the dice.

Adjustments were made and 2 minute etch was used with the same results.

Etching time of 2 seconds was used with no etching.
### Hughes 2N1132

<table>
<thead>
<tr>
<th>No. of Units</th>
<th>Conditions</th>
<th>0</th>
<th>65</th>
<th>125</th>
<th>275</th>
<th>546</th>
<th>1001</th>
<th>2001</th>
<th>Room Temp</th>
<th>Most Extreme Units in % of Gravel (70°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>2000mA</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>-17</td>
<td>0.5127 x 0.5041</td>
</tr>
<tr>
<td></td>
<td>600mA</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>-17</td>
<td>0.5127 x 0.5041</td>
</tr>
<tr>
<td></td>
<td>500mA</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>-17</td>
<td>0.5127 x 0.5041</td>
</tr>
<tr>
<td></td>
<td>400mA</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>-17</td>
<td>0.5127 x 0.5041</td>
</tr>
<tr>
<td></td>
<td>300mA</td>
<td>0.5</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
<td>-17</td>
<td>0.5127 x 0.5041</td>
</tr>
</tbody>
</table>

### QA Life Test "Failures" — 1000 hr Tests

| Product | Temperature | Total Units | Total Yield % | Time to Fail % | Life at 90% | 100% | 200% | 300% | 400% | 500% | 600% | 700% | 900% | 1000% | Comments |
|---------|-------------|-------------|---------------|----------------|--------------|------|------|------|------|------|------|------|-------|----------|
| TA-4500 H B | -10°C      | 1759 7.005%  | 2.000% | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | Low |
| TA-4500 H B | 0°C        | 1759 7.005%  | 2.000% | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | Low |
| TA-1740   | -10°C      | 1759 7.005%  | 2.000% | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | Low |
| TA-1740   | 0°C        | 1759 7.005%  | 2.000% | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | Low |
| TA-1740   | 10°C       | 1759 7.005%  | 2.000% | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 | 0.6 | 0.7 | 0.8 | 0.9 | 1.0 | Low |

**QA LIFE TEST FAILURES — 1000 hr Tests**

- **TA-4500 H B**
  - Temperature: -10°C, 0°C, 10°C
  - Life: 1759 units, 7.005% yield, 2.000% life at 90%, 100%, 200%, 300%, 400%, 500%, 600%, 700%, 900%, 1000%
  - Comments: Low

- **TA-1740**
  - Temperature: -10°C, 0°C, 10°C
  - Life: 1759 units, 7.005% yield, 2.000% life at 90%, 100%, 200%, 300%, 400%, 500%, 600%, 700%, 900%, 1000%
  - Comments: Low
### 4700 PA Mid Development

<table>
<thead>
<tr>
<th>No.</th>
<th>0</th>
<th>60</th>
<th>120</th>
<th>180</th>
<th>240</th>
<th>300</th>
<th>EXP</th>
<th>Trend</th>
<th>Most Extremum Units In % or Change</th>
<th>ZnO (ppm) (VPM-300)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>12</td>
<td>14</td>
<td>14</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>11-15</td>
<td>14-17</td>
</tr>
<tr>
<td>1b</td>
<td>12</td>
<td>14</td>
<td>14</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>11-15</td>
<td>14-17</td>
</tr>
<tr>
<td>3a</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>9-13</td>
<td>9-13</td>
</tr>
<tr>
<td>3b</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>9-13</td>
<td>9-13</td>
</tr>
</tbody>
</table>

### 4700 MV Shallow Structure

<table>
<thead>
<tr>
<th>No.</th>
<th>0</th>
<th>60</th>
<th>120</th>
<th>180</th>
<th>240</th>
<th>300</th>
<th>EXP</th>
<th>Trend</th>
<th>Most Extremum Units In % or Change</th>
<th>Tefo (max) (Hot 720V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>7</td>
<td>16</td>
<td>22</td>
<td>21</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>7-17</td>
<td>7-17</td>
</tr>
<tr>
<td>1b</td>
<td>15</td>
<td>30</td>
<td>20</td>
<td>27</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>7-17</td>
<td>7-17</td>
</tr>
<tr>
<td>3a</td>
<td>11</td>
<td>19</td>
<td>20</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>7-17</td>
<td>7-17</td>
</tr>
<tr>
<td>3b</td>
<td>11</td>
<td>19</td>
<td>20</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>22</td>
<td>7-17</td>
<td>7-17</td>
</tr>
</tbody>
</table>
### 1740 1st MV

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Day</th>
<th>Time</th>
<th>125</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>Mean</th>
<th>Most Ordinate in % of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>No. 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.7</td>
<td>1.7</td>
</tr>
</tbody>
</table>

### 1740 MV Production

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Day</th>
<th>Time</th>
<th>125</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>Mean</th>
<th>Most Ordinate in % of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 16</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>No. 17</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

### 1740 B. W. Ga.

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Day</th>
<th>Time</th>
<th>125</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>Mean</th>
<th>Most Ordinate in % of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>No. 19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### 1741 Early MV Production

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Day</th>
<th>Time</th>
<th>125</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
<th>Mean</th>
<th>Most Ordinate in % of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.7</td>
<td>0.7</td>
</tr>
<tr>
<td>No. 21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.7</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Note: The table contains data for various conditions and days, showing the readings and calculations for the MV production over different periods.
For the long lead yet we need more results, get literature. The use of current sources in A.

Summary of packaging:
Bunami is working on 14 lead T.I. package

We have some that are planned in for one of these:

1st write ready for testing by end of Feb.
Providing full contact PNPN shift cycle structure to understand
and make preliminary design.

Priority:

1. Hit E
2. TIC
3. PNPN contact
4. Memory
5. Diff. Amp.
New ground rule: Ken Kajfez will be working on a Zen (officially)
by the end of Feb. Then we will be either

a) The low current one
b) The 7.5 ma one
c) Some other one we came up with

d) The one that we design SQA please design with them,
during everything necessary with no only no consultants.

Remove of 100 ppm one:

Have some data on some Ni girded one. We have been using
by ~ 4002 to 4502.

Dave Hillside has some life data on some early 13402. These labeled
like ~ 0.720/15hr for 50% of the points. The other shelf shifted shifted
more. During the first 100 hours the shift only they will be
quite a bit more.

Units aged at 110C all drifted.

Data is not coming out because we do not have the necessary
digital equipment.

We gave ~ 50 units to San Rafael
" have ~ 20 left. We can make an arbitrarily large number.

We will pass age, temperature,OPER, temperature cycle and try to stabilize.
San Rafael diffusion looks like the way to fly. We will hold off until then.

Dave Hillside will put together the outline of a few applications notice
for this circle.

We have some data on the noise spectrum of this device—but not
very much.

This product still looks good. It will be in San Rafael by
the end of Feb.
Zener (Project 171, cont.)

7.5 ma Zener

The 1st guess here is 13.5 pF Zener impendence (can spontan
ously), [Competition in this range is 10-15. Can get <10 (but
77.5 pF) on special order.] We are at least 50 higher, than we
should be.

When jumped using spontaneous fusion we get 4-5 pF

Spontaneous fuses if we can make a 10% guarantee will be thru
in 2 weeks. We then can schedule them on a product.

By definition, this will make the std 10% Zener fuses.

Parent schedule looks like we probably have a product. 90% of the devices
will be in the ±0.005% range, but very few in the ±0.005% range.

Pierre will summarize data, date on diagrams and the
competition in ±3 weeks when he gets the data, with a
recommendation of regarding the product and a date scale.

We will fill their family out with C.P. slides and
late, with some packages. Can get 90% of Zener market
coverage by end of year.

Pride input is that other things being equal that they
would prefer the C.P. family before the 720.
Nuclear reactor:

Contact reliability:
All our thin films have good reliability
5000 hrs at 80°C on sealed units. In general (except failures), the resistance has not changed more than 1%. Plus have at least one wedge break.

No data exists with the lead!!
Nuclear cission may well be 3% O2 - can't match half-lives, it has not pulled off in centrifuge.

Kama: Nuclear run 100-250 ppm/°C.

Kama: " 25-250 ppm/°C.

Write a description of the system including the air-jar, jiggery and the deposition stage.

Control:
Some trouble with monitors. The monitor is always less than 100 ppm.
Have done better than 1.3% in 5 runs 12 wafers.
Replicability is probably ~5%.
The monitors must be made to agree with the run.

Etching: Must use KER. Each will etch from black chip

\[
\text{Plan} \quad \text{Plan} \\
\text{Etch} \quad \text{Etch}
\]

20-50 sec c.c.

Take ~ 15 min to etch a wafer.

A-10,000, 0.01% or not at all

Limit

Make ~100 each of similar components at least 5
expected runs for distribution purposes.
b) Ti - Ta reaction

For Ti one can get up to several hundred S/15
\( \ldots \) probably up to 1000 S/15

It looks like the Ti is the best possibility.

We have spotted Ti and Nickel filaments. Continuing results
look encouraging.

The thinnest film of Ti had a - 1/8, the thickest
was a +.

c) High reaction in small area?

Some Ta - has suffered somewhat from lack of time.

Coming line perfect [Sn Al, Sn Cr, HCl, ETOH KO] onto flat
glass. They two + 50% have in contact.

In batch liquid film [the TCl on low
resistance and stable in dryg atmosph].

Our results in the tube furnace in pink and mild - [adequately]

PD

We got 2.5x 3*/15 with TCR < 100 ppm

catalyst pure ok.

Stability with temperature fine, problems.

d) Film for heat reaction - we will do and supply to

With thin ta fill screen points and minimum furnace

Summary of reaction prep:

<table>
<thead>
<tr>
<th>Entry</th>
<th>D1/5</th>
<th>Linewidth</th>
<th>TCR</th>
<th>Recrystallization</th>
<th>TCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30-300</td>
<td>1ml</td>
<td>n/200</td>
<td>5/100</td>
<td>5/10</td>
</tr>
<tr>
<td>2</td>
<td>&gt; 100,000 in a</td>
<td>10 x10 mil area</td>
<td>&lt;5000</td>
<td>2/2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>30-300</td>
<td>1mil</td>
<td>n/40</td>
<td>190</td>
<td>190</td>
</tr>
<tr>
<td>4</td>
<td>30-300</td>
<td>1mil</td>
<td>n/10</td>
<td>10.3</td>
<td>10.3</td>
</tr>
</tbody>
</table>
Capacitors:

- O.M. typically 0.1, 0.01, 0.001 for 10v breakdown.

- MOS: Vg = 0.8, Vfd = 0.7 (Vff?)

131/62 - 172, cont.

Diode Matrix:

- 8x8 with double isolation

- Yield of isolated region is 91% at night, much higher at daylight.

- With 0.5 cm o.c. in type, we get ~ 98% yield

- 10x - cm o.c. ... > 97.5% ~ (see ref.)

This is isolating 64 separate areas.

In the old technique, use reverse side of column.

Fusing Technique:

1. Thin metal film - a problem in making.
   - Use big fuses; it looks better, but we still need better.
2. Reverse bias leads destruction
3. Oxide breakdown

   - Yield of capsule is adequate. One big problem is the
   - fact that these can't be checked.

We are ready to try to make a preparatory array. As an object,

- After:
  - BU = 10v @ 10mA
  - BU < 10v @ 50mA
  - All lines to cathode ≤ 10mA
  - Each line to anode ≤ 1mA @ 1v

After:
Project Objectives

1. Resistor Technology - Development of a resistor technology capable of integration with our regular microcircuitry techniques. An arbitrary test vehicle is to be a Y-shaped array of three resistors having values of 1 megohm, 100 kilohms, and 1 kilohm, all to tolerances of ±10% and having temperature coefficients of ±100 ppm/°C. This array is to be within a 50 mil square.

2. Capacitor Technology - Development of a capacitor technology capable of integration with our present microcircuitry technology. An arbitrary test vehicle is to be a .01 μF capacitor having a 10 volt rating within a 50 mil square.

3. Diode Matrix - Development of an array of diodes, each having a forward equivalent resistance less than 20 ohms at 1 ma current and having a reverse breakdown of 20 volts or greater. The array will have several hundred such diodes with the X and Y coordinates brought out and so designed that by pulsing the proper combination of lines a desired pattern of open diodes may be established.

4. Evaporated Field-Effect Devices - Development of a field-effect device having all components, including the active regions, formed by the evaporation of material onto an appropriate substrate.

Proposals for Continued Projects

1. Resistor Technology
   a. Nichrome-Nichrome resistors can presently be made having surface resistivities in the range of 25-300 Ω/□. These resistors have been shown to be reliable, are easily made, and are compatible with aluminum contacts.
b. Tin Oxide - Furnace deposited films have been made having good apparent quality, and the films can be etched to form devices. Control of the resistivity is impossible at present, however, and the films appear to be incompatible with aluminum contacts. A "chicken-cooker" apparatus originally conceived to overcome difficulties of control has been virtually abandoned. Further efforts will be concentrated along the lines of furnace deposition using an organic tin compound both at atmospheric and reduced pressures, and along the classical spray deposition lines.

c. Resistor Compositions - It is proposed that a feasibility study be made of the resistor compositions being made by DuPont and others, applied by means of silk-screening techniques. This sub-project will be concerned with two main problems: the quality and controllability of resistors using the composition and the resolution and registration problems associated with the silk-screen process.

d. Ti, Ta Resistors - It is proposed that a feasibility study be carried out on the use of evaporated or sputtered Titanium or Tantalum films for use as resistors. This study will be carried out within the outline of the general project objectives.

2. Capacitor Technology

a. Junction capacitors - A short series of runs has given us some feel for the properties and problems of large area junction capacitors. Standard predep and diffusion cycles have been followed. Success has been variable in that control of capacitance has been rather poor and yields of high breakdown units (>10 volts) often low. Capacitance of course is voltage and temperature sensitive. This project has been idle the past two months.

b. MOS Capacitors - Results of the MOS project appear encouraging. Thin uniform oxides can be grown to give capacitors of 0.8 pf/mil, breakdowns > 20 volts, and yields above 60% for 50 mil square devices.
Typical value of Q is $1800$. Diffusing under the oxide eliminates the minor voltage sensitivity experienced with 0.5 $\Omega$-cm N type material. Temperature coefficient up to $150^\circ$C is unmeasurable, though Q is reduced a factor of two or three. It appears that the capacity value for this system has almost reached its limit. Better handling techniques could be employed to improve the yield.

c. Titanium Dioxide Capacitors - It is proposed that the feasibility of TiO$_2$ as a dielectric material be studied. This project should be broken into several parts, each concerned with a method of formation of the film: evaporation of TiO$_2$, sputtering of TiO$_2$, anodizing of Ti film, thermal oxidation of Ti film. The study should determine the feasible values of capacitance per unit area and of the temperature coefficient for the different methods.

3. Diode Matrix

Present work is concentrated on an $8 \times 8$ matrix with "double-isolation" between diodes. High resistivity substrate material is advantageous with respect to diode yield and higher breakdown voltages, but at present poses problems in isolation diffusion technology.

Future work on the diode matrix involves a solution of the problem of isolation diffusion into high-resistivity material, evaluation of the long-term reliability of the matrix and in particular of the silver fuses, evaluation of a matrix with base-emitter type diode configuration, this being a single-sided structure, involving lead cross-overs utilizing either the substrate material as a cross-conductor or by means of oxide insulating layers.

Three distinct fusing systems have been considered, (1) thin metal films, (2) reverse-biased diodes, and (3) thin oxide films.

Good silver fuses have recently been fabricated: no figures as to yield are available so far. Reverse biased diodes and thin oxide films are both "inverse fuse" systems: the former involves fabricating twice as many good diodes on the matrix, with a consequent reduction in yield, the latter system appears to be highly reliable, but involves problems in testing the matrices for good diodes.
4. Evaporated Field-Effect Devices

Silicon has been evaporated in thicknesses up to 2 1/2 microns onto quartz substrates, and it has been demonstrated that such films remain adherent after a standard furnace treatment (gallium predeposition). The films are amorphous by X-ray diffraction before such heat treatment. The resistivity of the films is too high to measure, but they are N-type, when N-type material of .72 ohm cm is used. N-type material of \( \sim 100 \) \( \mu \)-cm produces similar results. An attempt to reduce the resistivity by using a gallium predeposition eroded the film badly, apparently removing about 2 microns of the film. The resultant films were P-type, but the resistance was too high to measure. Future work will aim at the production of films of controlled resistivity, by protection of the film during predeposition with a pyrolytic oxide layer, and (alternatively) by the use of boron-doped starting material. Feasibility studies of the device can follow.

Project Schedules

1. Resistor Technology
   a. Nichrome - Transfer to Microelectronics Engineering Section by 4-1-62.
   b. Tin Oxide
      Design and construction of glassware for low-pressure furnace - 3-1-62.
      Evaluation of atmospheric pressure furnace technique - 3-1-62.
      Feasibility study completion - 5-15-62.
   c. Resistor Compositions
      Purchase of silkscreen machine, compositions, construction of sample masks - 3-15-62.
      Feasibility study completion - 5-1-62.
   d. Ti, Ta Resistors
      Feasibility study completion - 5-15-62.
2. Capacitor Technology
   b. MOS Capacitors - terminated.
   c. TiO₂ Capacitors - same as for Ti, Ta resistors.

3. Diode Matrix
   Life tests on silver fuses - 3-1-62.
   Preliminary life tests on matrices - 3-1-62.
   Tests on matrices (in large quantities) - 5-1-62.

4. Evaporated Field-Effect Device
   Evaluation of oxide-coated films - 3-1-62.
   Evaluation of boron-doped films - 3-1-62.
   Feasibility study completion - 5-15-62.

Personnel
1. Resistor Technology
   a. Nichrome
      R. Martin, Engineer  60 hours
   b. Tin Oxide
      J. Campbell, MTS  500 hours
      M. Parker, Tech.  150 hours
   c. Resistor Compositions
      J. Price, Engineer  500 hours
      M. Parker, Tech.  150 hours
   d. Ti, Ta Resistors
      R. Waits, Engineer  500 hours
      M. Parker, Tech.  150 hours
2. Capacitor Technology

   b. MOS Capacitors - terminated.

   c. TiO$_2$ Capacitors - same as for Ti, Ta resistors.

3. Diode Matrix
   Life tests on silver fuses - 3-1-62.
   Preliminary life tests on matrices - 3-1-62.
   Tests on matrices (in large quantities) - 5-1-62.

4. Evaporated Field-Effect Device
   Evaluation of oxide-coated films - 3-1-62.
   Evaluation of boron-doped films - 3-1-62.
   Feasibility study completion - 5-15-62.

Personnel
1. Resistor Technology
   a. Nichrome
      R. Martin, Engineer  60 hours

   b. Tin Oxide
      J. Campbell, MTS  500 hours
      M. Parker, Tech.  150 hours

   c. Resistor Compositions
      J. Price, Engineer  500 hours
      M. Parker, Tech.  150 hours

   d. Ti, Ta Resistors
      R. Waits, Engineer  500 hours
      M. Parker, Tech.  150 hours
2. Capacitor Technology
   a. Junction Capacitors - terminated
   
   b. MOS Capacitors - terminated
   
   c. TiO₂ Capacitors
      R. Waits, Engineer 500 hours
      M. Parker, Tech. 150 hours

3. Diode Matrix
   J. Price, Engineer 500 hours
   M. Parker, Tech. 150 hours

4. Evaporated Field-Effect Device
   J. Campbell, MTS 500 hours
   M. Parker, Tech. 150 hours

Equipment Needs
Silkscreen apparatus $600
Belt Furnace N.A.
Shop Time 400 hours
Silkscreen manufacture 75 hours
Others useful data ranges:

1. A full 1-bit adder.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>Cn-1</th>
<th>Cn-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Thru thru a 6X16 matrix to 2 output lines and 6 input lines.

A new plan is a linear liquid part. We will divide this area and will make it with all liquid contents, metal leads coming.

Proposed field-effect device:

\[
\begin{align*}
\text{d} & \quad \text{g} \\
\text{S} & \quad \text{S} \\
\text{S} & \quad \text{S} \\
\text{S} & \quad \text{S} \\
\end{align*}
\]

Get 25 g of S in 15 min.

Extremely high sensitivity plan analysis!!
Recent data on 3501's taken by the personnel of the RED lab.

- All tests show orders of magnitude change (low range). We don't believe the data.

Critical survey of PNP life data to date:
- 9500 300° lab data in gas.
- High current degradation can be ignored.
- No 200° lab data possible, poor compound.

- 4700 done with 300° age, about essentially no β change at 6000 lives operation.
- BUT 6000 lives, they didn't increase much (12-15" 100cm).

Our data on 3501 is sick — sick — sick (very early unit).

1741 1/2 seem to hold for 600 live under power and thermal shift for 600-1500 lives.

β, this seems to be real, but the curve may fit a time curve.

PNP problem summary:

1. β degradation (on current age (after 300°))
2. β increase, especially at low current, on β treated units under poor age - can these - 600 hours induction time.
3. Chemically form and increase on poor age, all except occurred to treated units - or maybe only occurred to treated units and others.
4. Softness (β°) form a plane on (as mean data) in high temperature storage (720°) and poor age.
5. PNP's short form that may be related to after age.
Review of data on thick layers

1 group 48 to 52 (from my paper). Asynodal solution 3001, 3003, 3006.

They were all like the (100) and (100) of Figure 1.

He thought that the contamination problem is an important part of the problem.

There is really no evidence that our thick material is worse than their material. The real problem is that our thick material has never given any yield with 10.

Except on the 2001, we did get some yield usually, but not always.

All data has been fed in for Hebe to copy numbers. I think that evaluation is needed.

The old mechanically polished work on CrC O gave a surface that is pitless, very good upon polishing. Also, minor pick 0.1 in this. On the other hand, we got to give on that is not as minor of a like, but it doesn't stick badly.

We have only 1 set of plates. - Can

There are 5 substitute preparations to consider:

A Chem. etch
B Alumina sand, polished
C CrO3 Wash polished
D BrC + SiO2 - etch method
E Etch polish
Project divided into two parts:

a) get high voltage insulation

b) make device

Next on making high voltage units using the printed plate.

Objective

\[ V_{100} > 400 \]

\[ V_{200} > 800 \]

\[ I_{0.5} \sim 20 \text{ amp} \]

\[ T - 175^\circ \text{C} \text{ of possible} \]

Plan - Study breakdown voltage of stuff for a month or so

Low out the available volume if a sufficient space.

Meet April 1 to review and lay out detailed plot.

Transfer - 1st Denis about Sept 1.
Project 170 - Photodens Development

Review of KP-3:

- On top of Al(10) + try in an amyl alcohol
- Heat the enamel will not stick to the front
- Metallic 60% silver, all 5 purity at 550°C
- Soda ash
- An etch

Some done by a blunt, glass razor, and last cool.

There are several areas of strike here.

1. Plating
2. Etching
3. Etch
4. Etching beyond the capability of an etch
5. Machining (popp)

Get everything together so that we can make 1000 good ones.

This requires that I grease the strike to get

a) Plating
b) Etching
c) Ship for molten & bending jig.

As back up order the heads (experimental)

Plotted drawings:

We need 2-400 volt, the one yield @ 250V. One can come through out up to 1000 volt.

The problem to solve is the mounting.
MICROELECTRONICS RESEARCH SECTION
PROJECT PLAN

Date: 2-6-62

Project #126 - Masking Technique Development

Project Engineer: Samuel S. M. Fok

Approved Section Head: __________

Approved Office of Director: __________

PROJECT OBJECTIVES

1. Maintaining our technological leadership in the photolithographic field.

2. Preparation of original masks, working plates and the use of these masks to etch structures in metal and silicon oxides.

3. Advancing as well as maintenance of mask making service and the R&D photoresist services.

4. Provide consultation and transferring technological advances in mask making and new photoresist techniques for Transistor Plant in M.V.

I. MASK MAKING TECHNOLOGY

A. Technical Status

<table>
<thead>
<tr>
<th></th>
<th>Past</th>
<th>Present</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Finest working mask</td>
<td>0.5 mil</td>
<td>0.25 mil</td>
<td>0.1 mil</td>
</tr>
<tr>
<td>2. Alignment tolerance</td>
<td>0.5 mil</td>
<td>0.25 mil</td>
<td>0.1 mil</td>
</tr>
<tr>
<td>3. Master resolution</td>
<td>0.3 mil</td>
<td>0.2 mil</td>
<td>0.1 mil</td>
</tr>
</tbody>
</table>

B. Specific Tasks

1. New step-and-repeat camera with Farrand Control should be on the air 4/62.


3. New copy camera to be ordered 2-62, approximately 60-90 days delivery, installed in new R&D building in 5-62.

4. Check out and consult with M.V. on total mask making capability.
   Including the following:
Microelectronics Research Section
Project Plan #126

Coordinagraph
Copy camera with step and repeat back
Step and repeat camera
Printing technique
Inspection technique
Process checking, control and scheduling

5. New technique development:
Lens resolution and aberration tests
Exposure and focusing control
New photographic processing techniques

II. MASK MAKING SERVICE
A. Status
   1. Capacity (sets/wk)  Past  Present  Future
      1-2                2-3    3-4
   2. Residence time (weeks)  Past  Present  Future
      2-3                1-2    < 1

B. Specific Tasks
   1. Up-grade present drawings in more permanent forms.
   2. Cataloguing and cross-indexing of drawing file.
   3. Provide alignment proofs in various checkpoints.

III. PHOTORESIST TECHNOLOGY
A. Technical Status
   1. Sharpness or edge definition (mils)  Past  Present  Future
      0.15  0.05  0.02
   2. Line resolution (mils)              0.5    0.25   0.1
   3. Cleanliness
      Very poor  Poor  Better
   4. Alignment tolerances (mils)         0.5    0.23   0.1
   5. Resist removal: oxide               Difficult Easy  Easy
      metal                           Difficult Some problem Easy
   6. Pin holes and imperfections         Very poor Poor  Better
   7. New resists handling techniques     KPR  KPR  KPR
      KMER  KMER  KPL
      New KMER
Microelectronics Research Section
Project Plan #126

B. Exposure Methods

Past | Present | Future
---|---|---
Carbon arcs, poor | High pressure Hg, (good), and carbon arcs | Completely on Hg lamps

B. Specific Tasks
1. Optimizing developing techniques.
2. Increase resolution to 0.1 mil device.
3. Minimum density with optimum exposure.
4. Reduction of pin-holes and imperfections.
5. Optical alignment aids for extremely small patterns, i.e., jigging, reticle, etc.
6. Projection printing directly on wafers.
7. Coating method control.

IV. PHOTORESIST SERVICES

A. Status

<table>
<thead>
<tr>
<th>Past</th>
<th>Present</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity (runs/month)</td>
<td>&lt;600</td>
<td>600-600</td>
</tr>
<tr>
<td>(w/c/month)</td>
<td>&lt;4000</td>
<td>4000-6000</td>
</tr>
<tr>
<td>Residence time (hrs/run)</td>
<td>&gt;20</td>
<td>11-19</td>
</tr>
<tr>
<td>Photoresist workshop</td>
<td>None</td>
<td>Working well, More usage not fully utilized</td>
</tr>
</tbody>
</table>

* Depends on new facility and division of work loads with Device Development.

B. Specific Tasks
1. Complete conversion of all carbon arc lamps into high pressure Hg lamps.
2. Provide enough optical jigs for the service.
3. Provide consultation and assistance in establishing a routine photoresist service in Device Development Section.
4. Provide consultation and assistance in transferring new techniques to Device Development Section of R&D, and Process Development at M.V. plant.
Microelectronics Research Section
Project Plan #126

5. Establish written procedures for approved processing photoresist techniques.

6. Training programs for new operators and new techniques.

V. NEW EQUIPMENT AND FACILITIES IN NEW R&D

A. Mask Making Area
   1. Constant voltage supplies for all printers (5 required at $250)
   2. Processing sinks (need 3 more at $800 ea)
   3. Printers (2 more at $250)
   4. New copy camera (1 at $14,000)
   5. Work benches and cabinets. _______will work out with Plant Engineering.

B. Photoresist Rooms (3 rooms)
   1. Constant temperature baths (need 2 more at $125)
   2. Experimental acceleration control for all spinners (1 required first at $144, possibly 4 eventually)
   3. Air-shield hoods for coating and drying (3 required)
   4. Microscopes DMETR, 3 more required

C. Metal Etching
   1. Spray tank and electrolytic etching tank.
   2. Exposure facility

VI. PERSONNEL

A. Mask Making
   1. Experimental
      C. Van Ness, Dev. Asst.  100% time for 6 mos. = 1000 hours
      M. Hoar, Technician  50%  "  "  "  = 500 hours
      S. M. Fok, MTS  50%  "  "  "  = 500 hours
Microelectronics Research Section
Project #126

2. Service

S. M. Fok, MTS
M. Hoar, Technician
5 women operators

25% time for 6 mos. = 250 hours
50% " " " = 500 "
100% " " " = 5000 hours

B. Photoresist and Metal Etching

1. Experimental

A. Engvall, Res. Engineer
1 woman operator
(Experimental technician to be hired)
S. M. Fok, MTS

60% time for 6 mos. = 600 hours
50% " " " = 500 "
100% " " " = 1000 "
20% " " " = 200 hours

2. Service

C. Gunter, Senior Tech.
13 women operators
A. Engvall, Res. Engineer
S. M. Fok, MTS
M. Focht, Senior Tech.

100% " " " = 1000 hours
100% " " " = 13,000 "
20% " " " = 200 hours
5% " " " = 50 hours
100% " " " = 1000 hours
PROJECT PLAN, NO. \( \# 9 \), ANODIC OXIDATION OF SILICON

**Project Objective:** To produce oxide films on silicon by an ambient temperature process of anodic oxidation. Two primary objectives are to prepare wafers for device fabrication and evaluation, and to characterize oxide properties and assure high quality.

**Applications of Method:** If successful this technique could replace thermally grown oxides for masking against diffusants and for passivating the surface of a finished device. In addition it may be possible to improve the properties of thermally grown oxides, and to incorporate various ionic species controllably in the oxide layer. This last effect may influence channel conductance and capacitance properties of oxide layers.

**Proposed Plan:**

1. **Evaluation of oxides from the anodization process in comparison to the thermal steam oxide prepared at 900 or 1200°C.** This includes empirical determination of best conditions for forming anodic oxide layers, evaluating the thickness, porosity, electrical properties, and resistance to diffusion.

2. **Preparation of a large number of simple p-n junction diodes and evaluating breakdown voltages.** Preliminary studies have indicated breakdown voltages of about 175 - 200 volts can be obtained for anodically formed oxides versus 75 - 100 volts for thermal oxides.

3. **Continuation of investigation of means of filling pinholes in steam oxide.** Use of anhydrous media as anhydrous \( \text{H}_3\text{PO}_4 \), dimethyl formamide, etc.

4. **Continuation of kinetics of anodic oxidation to characterize the physical and chemical properties of oxide and relate to device parameters.**
February 7, 1962

Personnel and Estimated Hours:

Past:  
E. Duffek 1/3 time, approximately 24 hours since January 29, 1962.

Future:  
D. Borror full time - 40 hours/week.  
E. Benjamini full time - 40 hours/week for next 3 - 4 months.  
E. Duffek 1/3 time - 12 hours/week.

Capital Equipment:

Infra-red spectrophotometer with NaCl optics.  
Electrolytic conductivity bridge. (G.R. Impedance Bridge 1650-A - $450.00)  
Also adaptation of a power source on hand to yield constant current at 50 to 500 volts.
Two principal areas:
1. portable
2. are there any interesting properties of thin oxides?

Work done in a 0.1N H<sub>2</sub>SO<sub>4</sub>

Oxide seems to be uniform, except some contact effects exist. We have grown up to ~3000A.

1. Uniform by dip
2. From Bednar P.N.
3. Inductive constant by MOS capacitor.

Potential advantage:
1. elimination of surface breakdown
2. A smooth layer?
3. potential for long term: no change in different

Work done: Eric Carlson

1. pin hole plugging - can be studied by FEI marks
Mid 170 - received

We have replaced the metal mask - plating.

Peter has asked for

Our testing capacity is 125 - 130 metal masks/mo.

Last week 120 sheets of 24 - 10% of the pattern are good.

... now ~ 200/360 - full max capacity.

Possibility of getting Japanese made - by shortening or less.

Peter says that he could get by with ~ 6 sheets/day - 15% good.

Another pair of hands could help - possibility of a few minutes on.

Don't need help quickly.

Plating: [Stop - pending]

Linda is willing (but are they able?).

Concluding at end:

- We will supply 6 - 7 per day.
- We will send samples out for plating.
- We will try to set up a plating area on our 8th street to do this.
- We will continue to supply the plating for the next few weeks from our new section facility.
Feb 27, 1962  SCT review by 142

Review of data since last time.

Can reproduce anything but partly marginal.

Vms from -22 v to 0 v.

Several different types seem to have been life tests - all drifted.

Companion of N2 and forming 90° around - all drifted badly

As is A2 mix - all drifted.

Some thick oxalates showed some similar effects, but the
point of max gms were always at a very large voltage (40 - 25 kV)

17 - 60 gms at 200°, 50 - 70 gms from 240° to 300°.

The changes are always such that the point of max
depressed to the 1/2 came close to 0 v.

\[ U_{eq} = 0 \]

- 300°
- 200°
- 125°
- 90°
<table>
<thead>
<tr>
<th>LOT No.</th>
<th>UNIT No.</th>
<th>UNIT No.</th>
<th>Vc (V)</th>
<th>Ic (mA)</th>
<th>( \frac{I_c}{V_c} )</th>
<th>( \frac{I_c}{V_c} )</th>
<th>Cgt (PF)</th>
<th>DATE</th>
<th>ELAPSED TIME</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2000</td>
<td>1.0</td>
<td>2.3</td>
<td>1.7</td>
<td>8.4</td>
<td>0 HOURS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2000</td>
<td>1.0</td>
<td>3.5</td>
<td>1.8</td>
<td>8.6</td>
<td>17 FEB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1500</td>
<td>1.0</td>
<td>3.5</td>
<td>2.1</td>
<td>6.7</td>
<td>23 FEB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1600</td>
<td>1.0</td>
<td>4.4</td>
<td>3.2</td>
<td>6.1</td>
<td>3000°C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1600</td>
<td>1.0</td>
<td>4.4</td>
<td>3.2</td>
<td>6.1</td>
<td>3000°C (480055)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2500</td>
<td>1.0</td>
<td>1.5</td>
<td>1.4</td>
<td>6.2</td>
<td>49 FEB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>2400</td>
<td>1.0</td>
<td>2.2</td>
<td>1.9</td>
<td>6.1</td>
<td>49 FEB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>2000</td>
<td>1.0</td>
<td>1.7</td>
<td>1.4</td>
<td>6.1</td>
<td>49 FEB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>1700</td>
<td>1.0</td>
<td>1.8</td>
<td>1.6</td>
<td>6.1</td>
<td>49 FEB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>1200</td>
<td>1.0</td>
<td>2.9</td>
<td>2.2</td>
<td>6.1</td>
<td>49 FEB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1300</td>
<td>1.0</td>
<td>2.9</td>
<td>2.2</td>
<td>6.1</td>
<td>49 FEB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>1500</td>
<td>1.0</td>
<td>3.7</td>
<td>3.1</td>
<td>6.1</td>
<td>49 FEB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>2550</td>
<td>1.0</td>
<td>6.2</td>
<td>5.1</td>
<td>6.1</td>
<td>49 FEB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>2700</td>
<td>1.0</td>
<td>6.2</td>
<td>5.1</td>
<td>6.1</td>
<td>49 FEB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>2850</td>
<td>1.0</td>
<td>6.2</td>
<td>5.1</td>
<td>6.1</td>
<td>49 FEB</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Meeting concerning NSA proposal 3/13/62

Phase I - Chip determinate (paper study)
Phase II - fixed board by bit elements
Phase III - Chip fab of one unit.

Who will do Phase I.
Phase I should be compatible with the bit
with characterics later

Bob Nayan should be responsible. (Estimated to complete 6 weeks)
Bob Nayan
Hamed Rizq
Rich Cappes
Jan Pelt
Dick Anderson
Don Fasini

Phase II - Boulboards

- 5 man days (tech)
- 5 man days (tech)

1. Manual drifts alignment & test gear and precision
2. Assemble
3. Test performance
4. Documentation - Submit test reports

divide by two

X9 for 9 clocks

1960 2200
Summary of full-scale PNP product planning meeting 3/12/62.

We have a commitment to make Aerostarics a 132 replacement.

We will make masks for new 3501 - get to end of failure mode and meet CTE.

We will see that material (geometric) will get ordered for delivery.

At 3 weeks we will run in parallel.

4500 - no change
4701 - run as going until 4701 material comes in
4701 - run some until 3501. Make come in
3501 - make masks, run in parallel in 10x-15x. Vvar

3510 - after 5010

1731 - we will need both high voltage and low voltage (cr) just like we did on the 132.


We will work with diffused wafer.

Mr. Kim will work through any external problems.

1741 - do not use LVCEO
1746 - close LVCEO. Use 3501 material (2498)

7500 - Roll will make the first 100 - before the 7500 open. The 7000 will be flying.
The purpose of this memorandum is to summarize the March PNP Product Meeting to assure that staff groups are informed of the general plans concerning new and potential products. Future product meetings will be summarized by the respective product managers and distributed as required.

4500

No changes are anticipated in the near future. Ultimately this product will be replaced with a planar PNP.

4700-4701

Both of these devices are in the line development stage. The planar structure is an immediate requirement to relieve the tap test problem, particularly in the TB package which is not crimped. This product will not meet the requirements of the 2N1132, but it should be a satisfactory replacement for the 2N722 except for 300°C storage. By May 15, the TB-4500 final seal schedule will be made with the TB-4700. The shift to epitaxial will be made as material becomes available.

3501

This product, which is similar to the 3001, is a potential replacement for the 4500 except for 300°C storage. Pilot runs were being made at Mountain View in parallel with R&D, but all 3501 production has been scrapped because of problems on operating life. R&D is preparing new masks which should be available the first week in April. At that time, Mountain View will begin line development. Development of this product is the top priority project of the PNP section.

1740-1741

All production has been shifted to epitaxial on this product. A reasonable inventory of non-epitaxial units is on hand, and the epitaxial version should meet most requirements.

1746

In order to obtain higher voltage devices ($V_{CEO} > 35v$) with the characteristics of the 1741, the 1746 was evolved. This device will utilize 3501 material and the 1740 diffusion processes.
1711-1721-1731

These devices have been designed for maximum speed using low voltage material as it becomes available. They are all variations of the interdigitated structure. The 1731 (3 emitters, 2 bases) will replace the other types and is the only one being started.

3510

This device is still in R&D scheduled for line development after the 3501 is optimized.

7500

This device is still in R&D scheduled for line development after the 7000 is optimized.

General Comments

We intend to shift as rapidly as possible to a series of planar, epitaxial PNP transistors which will range from a fast switching device for computer applications to power devices. Additional emphasis will be placed on types which can replace germanium units in existing designs, but in general we will have more success in new and redesigned equipment.

It should be emphasized here that no planar PNP devices will be guaranteed to meet 300°C storage and that they will not receive our normal 60 hour bake. A storage temperature of 200°C should present no problems.

GL/sm

List:
T. Bay
J. Farley
J. Magarian
G. Moore
W. O'Keefe
C. Sporck
N. Walker

G. Livingston, Head
Mesa Section
Discussions with M. R. Phillips on Automation Facility

March 16, 1962

D-26 - For peening machines - TI is still in this

D-28 - Either 1 MC, low power or

1 OM -

They have proposed in this area, but they have
yet no contract.

MM (advanced) - Anticipated but not in hand.

Tissue - Asked to bid.

Rough Schedule (10 MC)

1st design sample in July-August to them of parts.
By June 1 we will be ready to design full.
Sample during 3rd quarter.
Low level, 1st block samples, by Aug.
PRESSURE TRANSDUCER SERIES P01

The P01BG5 Pressure Transducer offers the following features for extremely high pressure requirements:

- High Accuracy
- Exceptional Overload Capability
- Small Size
- High Output
- Rugged Design
- Uni-Body/Sensor Construction

The P01 series pressure transducers are machined from 17-4 PH steel with an extremely small sensor volume to minimize stored energy problem. Micro Sensor™ Semiconductor Strain Gages are arranged in a wheatstone bridge to produce a high level output signal. Unusually large overload protection is afforded from the design utilized.

SPECIFICATIONS - Type P01BG5

Ranges

0-10,000 PSIG, 0-25,000 PSIG
0-50,000 PSIG, and 0-100,000 PSIG

Maximum Allowable Pressure

1.5 times rated capacity (over 3 times to burst)

Pressure Media

Liquids and gases compatible with 17-4 PH steel

Bridge Resistance

500 ohms nominal

Excitation

10 volts

Output

0.5 volt nominal at full scale

Non-Linearity and Hysteresis combined

±1% of full scale

Resolution

Continuous

Acceleration Sensitivity

Less than 0.01% of full scale per G

from 0-100 G in any plane

Operable Temperature Range

-65°F to +250°F

Compensated Temperature Range

-30°F to +130°F

Thermal Zero Shift

2% of full scale over 100°F

Thermal Sensitivity Change

2% of reading over 100°F

Pressure Connection

Standard super pressure fitting with 60° chamfer seal

Electrical Connection

Cannon WK5 case mounted connector, mating connector supplied

Physical Configuration

1.5 inches O.D. x 2 inches long

Price Schedule

Approximately 7 ounces

Portable self contained readout unit available.

1 - 4 units $395.00
5 - 9 units $370.00
10 - 19 units $350.00
PRESSURE TRANSDUCER, TYPE PO3BA4

The Type PO3BA4 pressure transducer represents a state-of-the-art advance in transducer concept. Within its miniature housing solid-state strain elements are bonded to the back side of the pressure sensing diaphragm and wired in a full-bridge circuit to convert pressure induced strains to a high-level electrical output. The RC-01 Transducer Driver, supplied with each PO3BA4, allows precision operation from an unregulated 28-volt dc source. The Transducer Driver is stackable for minimum space consumption, and can be located remotely up to 500 feet (AWG-20 wire) from the transducer without sacrificing performance. In many applications, the use of amplifiers can be eliminated, resulting in improved system reliability. The exceptionally high natural frequency resulting from the 1/4-inch flush diaphragm eliminates response to vibration encountered in most severe applications.

The integral flange allows custom installation of the PO3BA4 with minimum case distortion. Mounting adapters are available if desired, to suitably connect the PO3BA4 for either flush mounting, or conventional pressure fitting applications. (See back side of bulletin for adapter information.)

SPECIFICATIONS

Ranges ........................................ 0-100, 0-200, 0-500, and 0-1000 psia
Material in Contact with
   Working Fluid ............................. NI-SPAN C
   Overpressure ...................... 150% without recalibration
   Burst Pressure .............. 300% minimum
Bridge Resistance (Input or
   Output) .................................. 500 ohms ±20%
Zero Balance .................. ±5% of full scale
Excitation .................. 28-volts dc ±10% to driver (approx. 10 volts to
                            transducer)*
                            30 milliamperes
Open Circuit Output ........... 0.5 volts full scale (minimum)
Non-Linearity and Hysteresis .. 0.75 volts full scale (maximum)
Resolution .................. ±1% of full scale
Natural Frequency ................ Continuous
                            100 psia = 40 k cps, 200 psia = 55 k cps,
                            500 psia = 75 k cps, 1000 psia = 100 k cps
(over)
Acceleration Response
(to 2300 G) .......................... 0.002% of full scale/G max. in any plane
Vibration Response (all axes) ...... 0.002% of full scale/peak G (35 G, 0-10,000 cps)
Operable Temperature Range ...... -65°F to +250°F
Compensated Temperature Range ..............................................
Thermal Zero Shift .............................................. within 2% of full scale over compensated range
Thermal Sensitivity Shift .............. within 1% of full scale over compensated range
Repeatability .......................... ±0.5% of full scale
Weight
Transducer .......................... 0.05 ounce
Transducer Driver RC-01 ......... 1.0 ounce
Electrical Connections ............. hermetic seal header, solder terminals, supplied with 2-feet of four conductor cable
Price .......................... $395.00 each

*Transducer, less RC-01 driver, can be operated from an ac source, but temperature compensation specifications will be somewhat poorer.

PO3B

RC-01

PO3BA4 MOUNTING ADAPTERS*

TYPE CO8-003 (For Flush Mounting Application)
The CO8-003 mounting adapter allows flush mounting of the PO3BA4 pressure transducer in materials of varying thickness from 0.06-inch to 0.6-inch. A teflon seal is provided between the adapter and shell to which the PO3BA4 is to be mounted. 300 series stainless steel is used.

Price .......................... $17.50 each

TYPE CO8-004 (For Conventional Application)
The CO8-004 mounting adapter allows use of the PO3BA4 in conventional “plumbing” applications, such as standard AN fittings. Minimum volume is maintained through its use, thus preserving the high natural frequency of the PO3BA4 to as great an extent as is possible. 300 series stainless steel is used throughout.

Price .......................... $15.00 each
(CO8-004-1 and CO8-004-2)

*Adapters with electrical connectors available upon special request.
DISPLACEMENT TRANSDUCER, SERIES D01 FOR STRUCTURAL TEST APPLICATIONS

The D01 AU5 transducer constitutes a significant improvement in displacement measurement for structural tests over existing pot type or differential transformer type sensors with the following outstanding features:

- Ruggedness
- Infinite Resolution
- No Wearing Parts
- Built-in Deflection Stops
- High Output
- Simple Associated Circuitry

The type D01 AU5-2000 displacement transducer is an extremely rugged and reliable precision instrument composed of a bending beam in a cast aluminum housing. The beam is instrumented with solid state strain gages arranged in a full Wheatstone bridge to give high sensitivity as well as infinite resolution over the entire operating range. The housing provides two surfaces at 90° to each other for easy mounting. Overload protection is incorporated in the transducer to allow no more than 15 pounds force to be applied before the loading hook or wire will break. The loading hook and wire can be replaced in a matter of minutes.

SPECIFICATIONS, TYPE D01 AU5

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Scale Range</td>
<td>0-2 inches or ±1 inch (other ranges available)</td>
</tr>
<tr>
<td>Bridge Resistance</td>
<td>350 ohms, nominal</td>
</tr>
<tr>
<td>Excitation</td>
<td>10 volts</td>
</tr>
<tr>
<td><em>Sensitivity</em></td>
<td>2 volts nominal at full scale</td>
</tr>
<tr>
<td>Linearity, Hysteresis and Repeatability combined</td>
<td>Less than ±0.75% of full scale</td>
</tr>
<tr>
<td>Resolution</td>
<td>Continuous</td>
</tr>
<tr>
<td>Zero Balance</td>
<td>±2% of full scale</td>
</tr>
<tr>
<td>Operable Temperature Range</td>
<td>-65°F to +180°F</td>
</tr>
<tr>
<td>Compensated Temperature Range</td>
<td>+50°F to +150°F</td>
</tr>
<tr>
<td>Thermal Zero Shift</td>
<td>1% of full scale over 100°F</td>
</tr>
<tr>
<td>Thermal Sensitivity</td>
<td>1% of deflection over 100°F</td>
</tr>
<tr>
<td>Loading Force</td>
<td>Approximately 3 lbs</td>
</tr>
<tr>
<td>Full Scale Break Out</td>
<td>Approximately 1 lb</td>
</tr>
<tr>
<td>Physical Configuration</td>
<td>8” (L) x 2&quot; (W) x 2-1/2&quot; (H)</td>
</tr>
<tr>
<td>Electrical Connection</td>
<td>Case mounted connector type WK5 mating connector supplied</td>
</tr>
</tbody>
</table>

* Dropping resistors to attenuate output to other standard values optional.

Price Schedule

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Price</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 - 4 units</td>
<td>$325.00</td>
<td>25 - 99 units</td>
</tr>
<tr>
<td>5 - 24 units</td>
<td>$290.00</td>
<td>100 - units or more</td>
</tr>
</tbody>
</table>

EMT-2 9/61-5M
SPECIFICATION
FOR
PRESSURE TRANSDUCER
INSTRUMENTATION SYSTEM

PI-120
(former designation
AFF-SAC-2011)
November 1957

Approved:

P.F. Rošč, Jr., Manager
Architect Engineer Division

AEROJET GENERAL CORPORATION
Architect-Engineer Division, Covina, California
SECTION 1. GENERAL REQUIREMENTS

1-01. SCOPE. Furnish and deliver pressure transducers in accordance with this specification.

1-02. CODE CONFORMANCE. Electrical components, materials and details of construction and assembly shall conform with requirements of latest issue and revisions of "National Electrical Code" of National Board of Fire Underwriters and "National Electrical Safety Code" of United States Department of Commerce. Approval of above agencies is not required, but equipment shall be designed, constructed and assembled so that intent of Codes will be fulfilled at least to extent that equipment shall not constitute fire hazard nor unguarded source of electrical shock to operating personnel.

1-03. DRAWINGS. Submit six (6) certified prints showing dimensions and mounting details.

1-04. DESIGN AND WORKMANSHIP. The design and construction of all components, assemblies and associated wiring shall reflect the most modern practice and finest degree of workmanship for this type and class of equipment. Construction and workmanship of components, assemblies and wiring not so specified shall conform to the highest standards of practice as regards ease of maintenance, mounting rigidity and neat appearance.

1-05. DEVIATIONS from these specifications may be made only after written authorization is obtained from Buyer. No change in work involving an increase or decrease in Contract price will be authorized except by Purchase Order change.

1-06. INSPECTION AND ACCEPTANCE. Seller shall furnish a certificate to show full compliance with specifications. Final inspection and acceptance will be made after installation at Buyer's facility.

1-07. WARRANTY. Seller shall warrant performance of equipment to meet or exceed the requirements of this specification, and in addition, shall warrant complete unit to be free of defects in material and workmanship for one year of operation. Defects found during warranty period shall be repaired or replaced by Seller without delay and at no additional cost to Buyer.
SECTION 2. TECHNICAL PROVISIONS

2-01. GENERAL CONDITIONS.

(a) Pressure of 25 per cent above nominal range shall not cause a change in signal greater than 0.5 per cent of full scale at zero gage pressure. An overpressure of 100 per cent shall not cause permanent damage.

(b) Shock of 50 g peak intensity and 10 millisecond duration shall not cause permanent damage.

(c) Materials exposed to pressure medium may be AISI Types 302, 303, 304, 350, 410 or 416 stainless steel, iso-elastic, ni-span 6, and Teflon impregnated Fiberglass.

(d) Connector: Cannon WKH-5-32, or equal, mounted on transducer case with suitable seal. Sealing gasket shall be satisfactory for use in hydrocarbon atmosphere, liquid oxygen, and nitric acid fumes, and provide a water tight seal. No connection shall be made from cable shield to a connector shell or transducer case.

The wiring code shall read:

<table>
<thead>
<tr>
<th>Connector</th>
<th>Transducer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Positive Signal</td>
</tr>
<tr>
<td>2</td>
<td>Negative Signal</td>
</tr>
<tr>
<td>3</td>
<td>Negative Excitation</td>
</tr>
<tr>
<td>4</td>
<td>Positive Excitation</td>
</tr>
<tr>
<td>5</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

(e) Leakage Resistance to case or shield shall be 1000 megohms minimum when tested at a potential of 50 volts DC.

2-02. CONDITION AT 80 DEGREES F,

(a) Input Impedance: 350 ohms plus or minus 3.5 ohms.

(b) Output Impedance: 350 ohms plus or minus 35.0 ohms.

(c) Rated Excitation: 10 volts DC.

(d) Output Signal at zero gage pressure shall not exceed plus or minus 2.5 per cent full scale at rated excitation.

(e) Pressure Sensitivity: 3 mv/v plus or minus 0.015 mv/v for full range. Determine by change in output signal produced by increase in applied gage pressure from zero to full range pressure level.
(f) **Accuracy**: Error, including hysteresis and non-linearity, shall be within 0.5 per cent of full scale.

(g) **Difference in Pressure Sensitivity** due to non-repeatability under identical conditions shall not exceed 0.3 per cent. This value is based upon an estimated 0.15 per cent test error and 0.15 per cent instrument error.

(h) **Terminals for keying in a shunt type calibrating resistor** shall be 2 and 3. The calibrating resistors shall provide outputs as indicated below.

<table>
<thead>
<tr>
<th>Calibrating Resistor (ohms)</th>
<th>Output Provided - (Fraction of positive full scale)</th>
<th>Tolerance (% of output)</th>
</tr>
</thead>
<tbody>
<tr>
<td>37,280</td>
<td>0.75</td>
<td>+ 0.20</td>
</tr>
<tr>
<td>56,000</td>
<td>0.50</td>
<td>+ 0.25</td>
</tr>
<tr>
<td>112,200</td>
<td>0.25</td>
<td>+ 0.30</td>
</tr>
<tr>
<td>280,700</td>
<td>0.10</td>
<td>+ 1.00</td>
</tr>
</tbody>
</table>

(i) **Static Acceleration Sensitivity** at a maximum level of 10 G shall not exceed 0.02 per cent of full scale per G along any axis.

(j) When **Pressure Transducer** is vibrated linearly along any axis according to the following schedule, acceleration response shall not exceed 0.3 per cent of full scale at any time.

- 0.25 in. peak-to-peak displacement 10 cps to 20 cps
- 10 G peak 20 cps to 1000 cps

Note: Applies to 500 psi ranges and above.

2-03. **CONDITIONS UNDER TEMPERATURE EXTREMES.**

(a) **Pressure Sensitivity** shall not vary more than 0.25 per cent of plus 80 degrees F value between plus 30 degrees F and plus 130 degrees F and 1 per cent between minus 65 to plus 30 and plus 130 to 250 degrees F.

(b) **Output Level** at zero applied pressure shall not change more than 1.0 per cent of full scale per any 100 degree F range between minus 65 to plus 250 degrees F.

(c) **Output produced by application of any one calibrating resistor** shall not vary between plus 30 degrees F and plus 130 degrees F by more than 0.3 per cent of the reading.

2-04. **TEST EQUIPMENT.** Standards for determining conformance to specifications shall be:

(a) **Electrical**: Leads and Northrup type K2 potentiometer, or equal, with Eppley Laboratory's standard Weston type cell and a suitable null indicator.
(b) **Gage Pressure:** A precision dead-weight tester with manufacturer's rating of 0.1 per cent accuracy. Ashcroft Gauge Tester Type 1313-A or equal.

2-05. **PREPARATION FOR SHIPPING.** Pack and crate equipment as a unit in such a manner that will insure it against damage due to mechanical vibration, shock or strain in transit and handling. Equipment shall be so enclosed and protected as to preclude damage by exposure to ambient temperature and humidity while in transit and storage.
SECTION 1. GENERAL REQUIREMENTS

1-01. SCOPE. Furnish and deliver Taber Instrument Corporation Model 176 strain gage pressure transducers, or equal, in accordance with this specification. Transducers shall have a ni-span C. strain sensitive element.

1-02. CODE CONFORMANCE. Electrical components, materials and details of construction and assembly shall conform with requirements of latest issue and revisions of "National Electrical Code" of National Board of Fire Underwriters and "National Electrical Safety Code" of United States Department of Commerce. Approval by above agencies is not required, but equipment shall be designed, constructed and assembled so that intent of Codes will be fulfilled at least to extent that equipment shall not constitute fire hazard nor unguarded source of electrical shock to operating personnel.

1-03. DRAWINGS. Submit six (6) certified prints showing dimensions and mounting details.

1-04. DESIGN AND WORKMANSHIP. The design and construction of all components, assemblies and associated wiring shall reflect the most modern practice and finest degree of workmanship for this type and class of equipment. Construction and workmanship of components, assemblies and wiring not so specified shall conform to the highest standards of practice as regards ease of maintenance, mounting rigidity and neat appearance.

1-05. DEVIATIONS. From these specifications may be made only after written authorization is obtained from Buyer. No change in work involving an increase or decrease in Contract price will be authorized except by Purchase Order change.

1-06. INSPECTION AND ACCEPTANCE. Seller shall furnish a certificate to show full compliance with specifications. Final inspection and acceptance will be made after installation at Buyer's facility.

1-07. WARRANTY. Seller shall warrant performance of equipment to meet or exceed the requirements of this specification, and in addition, shall warrant complete unit to be free of defects in material and workmanship for one year of operation. Defects found during warranty period shall be repaired or replaced by Seller without delay and at no additional cost to Buyer.
SECTION 2. TECHNICAL PROVISIONS

2-01. GENERAL CONDITIONS.

(a) Pressure of 25.0 per cent above nominal range shall not cause a change in signal greater than 0.5 per cent of full scale at zero gage pressure. An overpressure of 100 per cent shall not cause permanent damage.

(b) Shock of 50 G peak intensity and 10 millisecond duration shall not cause permanent damage.

(c) Materials exposed to pressure medium may be AISI types 302, 303, 350, 3l7, 410 or 416 stainless steel, iso-elastic, ni-span C, and Teflon impregnated Fiberglass.

(d) Strain Sensitive Element: Ni-span C.

(e) Electrical Connection to Transducer: Cannon WKH-5-32, or equal, hermetically sealed connector attached to transducer case. Provide a waterproof gasket seal between connector and transducer. Seal shall be satisfactory for use in hydrocarbon atmosphere, liquid oxygen, and nitric acid fumes. The wiring code shall read:

<table>
<thead>
<tr>
<th>Connector</th>
<th>Transducer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Positive Signal</td>
</tr>
<tr>
<td>2</td>
<td>Negative Signal</td>
</tr>
<tr>
<td>3</td>
<td>Negative Excitation</td>
</tr>
<tr>
<td>4</td>
<td>Positive Excitation</td>
</tr>
<tr>
<td>5</td>
<td>No Connection</td>
</tr>
</tbody>
</table>

(f) Leakage Resistance to case or shield shall be 100 megohms minimum when tested at a potential of 50 volts DC.

2-02. CONDITIONS AT 80 DEGREES F.

(a) Input Impedance: 350 ohms plus or minus 3.5 ohms.

(b) Output Impedance: 350 ohms plus or minus 35.0 ohms.

(c) Rated Excitation: 10 volts DC.

(d) Output Signal at zero gage pressure shall not exceed plus or minus 2.0 per cent full scale at rated excitation.

(e) Pressure Sensitivity: 3.0 mv/v plus or minus 0.015 mv/v for full range. Determine by change in output signal produced by increase in applied gage pressure from zero to full range pressure level.

(f) Accuracy: Error, including hysteresis and non-linearity, shall be within 0.5 per cent of full scale.
(g) Differences in Pressure Sensitivity due to non-repeatability under identical conditions shall not exceed 0.3 per cent. This value is based upon an estimated 0.15 per cent test error and 0.15 per cent instrument error.

(h) Terminals for keying in a shunt type calibrating resistor shall be 2 and 3. The calibrating resistors shall provide outputs as indicated below.

<table>
<thead>
<tr>
<th>Calibrating Resistor (ohms)</th>
<th>Output Provided (Fraction of Positive Full Scale)</th>
<th>Tolerance (% of Output)</th>
</tr>
</thead>
<tbody>
<tr>
<td>37,280</td>
<td>0.75</td>
<td>± 0.20</td>
</tr>
<tr>
<td>56,000</td>
<td>0.50</td>
<td>± 0.25</td>
</tr>
<tr>
<td>112,200</td>
<td>0.25</td>
<td>± 0.30</td>
</tr>
<tr>
<td>280,700</td>
<td>0.10</td>
<td>± 1.00</td>
</tr>
</tbody>
</table>

(i) Static Acceleration Sensitivity at a maximum level of 10 G shall not exceed 0.02 per cent of full scale per G along any axis.

(j) When Pressure Transducer is vibrated linearly along any axis according to the following schedule, acceleration response shall not exceed 0.3 per cent of full scale at any time.

- 0.25 in. peak-to-peak displacement 10 cps to 20 cps
- 10 G peak 20 cps to 1000 cps.

Note: Applied to 5000 psi ranges and above.

2-03. CONDITIONS UNDER TEMPERATURE EXTREMES.

(a) Pressure Sensitivity shall not vary more than 0.25 per cent of plus 80 degrees F value between plus 30 degrees F and plus 130 degrees F and 1 per cent between minus 65 to plus 30 and plus 130 to 250 degrees F.

(b) Output Level at zero applied pressure shall not change more than 1.0 per cent of full scale per any 100 degree F range between minus 65 to plus 250 degrees F.

(c) Output produced by application of any one calibrating resistor shall not vary between plus 30 degree F and plus 130 degree F by more than 0.3 per cent of the reading.

2-04. TEST EQUIPMENT. Standards for determining conformance to specifications shall be:

(a) Electrical: Leeds and Northrup Type K2 potentiometer, or equal, with Eppley Laboratory's standard Weston Type cell and a suitable null indicator.

(b) Gage Pressure: A precision dead-weight tester with manufacturer's rating of 0.1 per cent accuracy. Ashcroft Gauge Tester Type 1313-A, or equal.
2-05. PREPARATION FOR SHIPPING. Pack and crate equipment as a unit in such a manner that will insure it against damage due to mechanical vibration, shock or strain in transit and handling. Equipment shall be so enclosed and protected as to preclude damage by exposure to ambient temperature and humidity while in transit and storage.
SPECIFICATION

FOR

UNBONDED STRAIN GAGE ACCELEROMETER

INSTRUMENTATION SYSTEM

Approved:

B. F. Rose, Jr., Manager
Architect-Engineer Division

AEROJET-GENERAL CORPORATION

Architect-Engineer Division - Covina, California
SPECIFICATION
FOR
UNBONDED STRAIN GAGE ACCELEROMETER
INSTRUMENTATION SYSTEM

SECTION 1. GENERAL REQUIREMENTS

1-01. SCOPE. Furnish and deliver Statham Laboratory's unbonded strain gage accelerometer, or equal, in accordance with this specification.

1-02. CODE CONFORMANCE. Electrical components, materials and details of construction and assembly shall conform with requirements of latest issue and revisions of "National Electrical Code" of National Board of Fire Underwriters and "National Electrical Safety Code" of United States Department of Commerce. Approval by above agencies is not required, but equipment shall be designed, constructed and assembled so that intent of Codes will be fulfilled at least to extent that equipment shall not constitute fire hazard nor unguarded source of electrical shock to operating personnel.

1-03. DRAWINGS. Submit six (6) certified prints showing dimensions and mounting details.

1-04. DESIGN AND WORKMANSHIP. The design and construction of all components, assemblies and associated wiring shall reflect the most modern practice and finest degree of workmanship for this type and class of equipment. Construction and workmanship of components, assemblies and wiring not so specified shall conform to the highest standards of practice as regards ease of maintenance, mounting rigidity and neat appearance.

1-05. DEVIATIONS from these specifications may be made only after written authorization is obtained from Buyer. No change in work involving an increase or decrease in contract price will be authorized except by Purchase Order change.

1-06. INSPECTION AND ACCEPTANCE. Seller shall furnish a certificate to show full compliance with specifications. Final inspection and acceptance will be made after installation at Buyer's facility.

1-07. WARRANTY. Seller shall warrant performance of equipment to meet or exceed the requirements of this specification, and in addition, shall warrant complete unit to be free of defects in material and workmanship for one year of operation. Defects found during warranty period shall be repaired or replaced by Seller without delay and at no additional cost to Buyer.
SECTION 2. TECHNICAL PROVISIONS

2-01. GENERAL CONDITIONS.

(a) Static Acceleration of 300 per cent above nominal full scale shall not cause permanent damage. Positive limit stops shall be provided.

(b) Attached Cable 2 feet long shall be provided. Cable shall be Tensolite Insulated Wire Company, Inc., or equal, Specification No. 20030-LH, 4 conductor, teflon jacket, tinned copper shield, teflon insulation. Cable connector shall be Cannon No. WK-5-21C-3/8, or equal, with melamine inserts.

The wiring code shall be as indicated below:

<table>
<thead>
<tr>
<th>Wire Color</th>
<th>Connector</th>
<th>Transducer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Black</td>
<td>1</td>
<td>Positive signal) for positive acceleration</td>
</tr>
<tr>
<td>Red</td>
<td>2</td>
<td>Negative signal)</td>
</tr>
<tr>
<td>White</td>
<td>3</td>
<td>Negative excitation</td>
</tr>
<tr>
<td>Green</td>
<td>4</td>
<td>Positive excitation</td>
</tr>
<tr>
<td>Shield</td>
<td>5</td>
<td>No connection</td>
</tr>
</tbody>
</table>

Cable connection to transducer case shall be waterproof. No connection shall be made from cable shield to connector shell or transducer case.

(c) Leakage Resistance from conductors to case or shield shall be 1000 megohms minimum when tested at a potential of 50 volts DC.

2-02. CONDITIONS AT 80 DEGREES F.

(a) Input Impedance: 350 ohms plus or minus 3.5 ohms.

(b) Output Impedance: 350 ohms plus or minus 35.0 ohms.

(c) Rated Excitation: 10 volts DC.

(d) Output Signal at zero acceleration shall not exceed plus or minus 2 per cent full scale at rated excitation.

(e) Acceleration Sensitivity: 3 mv/v plus or minus 0.030 mv/v for full scale (either positive or negative).

(f) Accuracy: Error, including hysteresis and non-linearity, shall be within 1.0 per cent of full scale.
(g) Differences in Acceleration Sensitivity due to non-repeatability under identical conditions shall not exceed 0.5 per cent full scale.

(h) Response to Transverse Acceleration shall not be more than 2 per cent of sensitive axis response for similar acceleration.

(i) Accelerometer: Damped with silicon fluid to 0.6 to 0.8 of critical damping.

(j) Terminals for keying in a shunt type calibrating resistor shall be 2 and 3. The calibrating resistors shall provide outputs as indicated below.

<table>
<thead>
<tr>
<th>Calibrating Resistor (ohms)</th>
<th>Output Provided - (fraction of positive full scale)</th>
<th>Tolerance (per cent of output)</th>
</tr>
</thead>
<tbody>
<tr>
<td>37,280</td>
<td>0.75</td>
<td>± 0.20</td>
</tr>
<tr>
<td>56,000</td>
<td>0.50</td>
<td>± 0.25</td>
</tr>
<tr>
<td>112,200</td>
<td>0.25</td>
<td>± 0.30</td>
</tr>
<tr>
<td>280,700</td>
<td>0.10</td>
<td>± 1.00</td>
</tr>
</tbody>
</table>

2-03. CONDITIONS UNDER TEMPERATURE EXTREMES:

(a) Output Signal at zero acceleration shall not change more than 1 per cent full scale between plus 30 degrees F. and plus 130 degrees F.

(b) Damping Co-efficient shall not vary by more than a factor 2 from plus 80 degrees F. value between plus 30 degrees F. and plus 130 degrees F.

2-04. DEFINITIONS.

(a) Positive Acceleration is acceleration in direction of base of accelerometer.

(b) Acceleration Sensitivity is minimum detectable change in output signal from zero acceleration to full range acceleration.

(c) Positive Full Scale Output is the base used for calculations.

2-05. PREPARATION FOR SHIPPING. Pack and crate equipment as a unit in such a manner that will ensure it against damage due to mechanical vibration, shock or strain in transit and handling. Equipment shall be so enclosed and protected as to preclude damage by exposure to ambient temperature and humidity while in transit and storage.
SPECIFICATION

FOR

LOAD CELL

AEROJET-GENERAL CORPORATION

Architect-Engineer Division - Covina, California
SPECIFICATION FOR LOAD CELL

SECTION 1. GENERAL REQUIREMENTS

1-01. SCOPE. Furnish and deliver Baldwin-Lima Hamilton Corporation Type U-1 Load Cells, or equal, fabricated in accordance with Baldwin-Lima-Hamilton Corporation specifications with the following modifications.

1-02. CODE CONFORMANCE. Electrical components, materials and details of construction and assembly shall conform with requirements of latest issue and revisions of "National Electrical Code" of National Board of Fire Underwriters and "National Electrical Safety Code" of United States Department of Commerce. Approval by above agencies is not required, but equipment shall be designed, constructed and assembled so that intent of Codes will be fulfilled at least to extent that equipment shall not constitute fire hazard nor unguarded source of electrical shock to operating personnel.

1-03. DRAWINGS. Submit six (6) certified prints showing dimensions and mounting details.

1-04. DESIGN AND WORKMANSHIP. The design and construction of all components, assemblies and associated wiring shall reflect the most modern practice and finest degree of workmanship for this type and class of equipment. Construction and workmanship of components, assemblies and wiring not so specified shall conform to the highest standards of practice as regards ease of maintenance, mounting rigidity and neat appearance.

1-05. DEVIATIONS from these specifications may be made only after written authorization is obtained from Buyer. No change in work involving an increase or decrease in contract price will be authorized except by Purchase Order change.

1-06. INSPECTION AND ACCEPTANCE. Seller shall furnish a certificate to show full compliance with specifications. Final inspection and acceptance will be made after installation at Buyer's facility.

1-07. WARRANTY. Seller shall warrant performance of equipment to meet or exceed the requirements of this specification, and in addition, shall warrant complete unit to be free of defects in material and workmanship for one year of operation. Defects found during warranty period shall be repaired or replaced by Seller without delay and at no additional cost to Buyer.
SECTION 2.  TECHNICAL PROVISIONS

2-01.  SPECIAL REQUIREMENTS.

(a) Input Resistance: 350 plus or minus 3.5 ohms.

(b) Output Resistance: 350 plus or minus 5.0 ohms.

(c) Open Circuit Electrical Output: 3 mv/v in compression plus or minus .015 mv/v for full range load applied. Load cell shall be tagged with output for tensile load.

(d) Rated Excitation: 10 volts DC.

(e) Full scale Load Rating: 50,000 pounds.

(f) Terminals for keying in a shunt type calibrating resistor shall be 2 and 3. The calibrating resistors shall provide outputs as indicated below.

<table>
<thead>
<tr>
<th>Calibrating Resistor (ohms)</th>
<th>Output Provided (Fraction of positive full scale)</th>
<th>Tolerance (per cent of output)</th>
</tr>
</thead>
<tbody>
<tr>
<td>37,280</td>
<td>0.75</td>
<td>± 0.20</td>
</tr>
<tr>
<td>56,000</td>
<td>0.50</td>
<td>± 0.25</td>
</tr>
<tr>
<td>112,200</td>
<td>0.25</td>
<td>± 0.30</td>
</tr>
<tr>
<td>280,700</td>
<td>0.10</td>
<td>± 1.00</td>
</tr>
</tbody>
</table>

(g) Electrical Output produced by application of any one calibrating resistor shall not vary more than 0.3 per cent of reading between plus 30 degrees F. and plus 130 degrees F.

(h) Electrical Connection to Transducer: Cannon WHH-5-32, or equal, attached to transducer case. Provide a waterproof gasket seal between connector and transducer. Seal shall be satisfactory for use in hydrocarbon atmosphere, liquid oxygen and nitric acid fumes.

The wiring code shall be as indicated below:

<table>
<thead>
<tr>
<th>Connector</th>
<th>Transducer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Positive Signal) For Compression</td>
</tr>
<tr>
<td>2</td>
<td>Negative Signal) Loading</td>
</tr>
<tr>
<td>3</td>
<td>Negative Excitation</td>
</tr>
<tr>
<td>4</td>
<td>Positive Excitation</td>
</tr>
<tr>
<td>5</td>
<td>No Connection</td>
</tr>
</tbody>
</table>
2-02. PREPARATION FOR SHIPPING. Pack and crate equipment as a unit in such a manner that will insure it against damage due to mechanical vibration, shock or strain in transit and handling. Equipment shall be so enclosed and protected as to preclude damage by exposure to ambient temperature and humidity while in transit and storage.
March 19, 1962 - Proj 177: Chromium Tantalum

Project review: (Jeno)

1. Make reproducible M-I-M film standards
   a) Yoke has been done on amorphous Ta, large grain structure was made and Au coated after annealing.
      The variable parameters are the thickness and furnace
      \[ I = I_0 e^{\left(\frac{V}{kT}\right)} \] - fit well
   b) Si thermal oxide growth altered once
   c) Would like to try Be-
   d) New fast Se-Fe - get some results

2. Temp curve of annealing & M-I-M parallel device

3. Smear test - study among standard
   \[ \text{Ta - Ta, O, A}_n \]
   \[ \text{Ta - Ta, O - Ta} \]
   \[ \text{A}_n - \text{Al, O}_3 - \text{An} \]
   \[ A_n - \text{Be, O}_3 - A_n \]
   \[ \text{Be - Be, O}_3 - A_n \]
   etc.

4. Electron emission studies
   a) Measure for packed copper, metal films
   b) Metal - metal, air functions

5. New materials
6. 3 - terminal
7. Potted work

Apparatus needed:
1. Clean vacuum system
2. \[ \text{for emission studies} \]
3. \[ \text{Electrode} \]
4. \[ \text{Bottom half (anode electrode)} \]
5. \[ \text{Special glass holder} \]
6. \[ \text{Ox} \]
7. \[ \text{Vacuum} \]
8. \[ \text{Electrode} \]
   Copper
   Platinum
   Iron Nipples, et
Study the MEM sandwich.

1. Mount zone for detail view.
2. Add small, smaller dots (2-3 mil).
3. Add second thinner film, Vf ~ 1 volt order.
March 20, 1962, Project 162  Epitaxial Growth  Werner, Ferguson

Project Review:
E-C plate temp at 1588°C channel melt.

So far we have only a couple of good wafers out of 7,600 runs.

This is a substrate problem.
- High in substrate P problem.

1. ab 2 = 20% start today.
2. furnace small - don't need.
3. ab 2 = 10% start today.
4. Time is an indicator that the substrate surface is important, but the thin people have not been able to supply more than standard samples.

On substrate, the distortion count has gone from 2000-20,000

Hank and Eric will get set up to count distortion.

Our growing heat cycle of stuff introduces ~10,000 distortion.

Hank will continue to try to make thinner as good as the bulk material, but the thin and the March. Hank will supply the surface in any convenient thickness to Dr. Per to produce with some priority through 2000 wafers.

Hank is still on outside of growth at an optimal temperature of 1200°C (340°-330°C) for 7 runs per month. At
March 21, 1962  Project 100  SCR's  JFP

Chip has been made in run of 600. 5200 V units. OK
He got ~ 40% yield.

Drawing (6 M.) new Darlington in a PNP11

Emitter

This gives a high turn-on voltage, but extremely low turn-off current.

eq. ch4

Lnd. spec.

Vce: 400 - 600
Ve = ..
Ic = 1 ma
Aim of 705 - C packages.
This is the general structure of all of them.

Some have been made with the device shown as a flat ceramic washer and lead bonds. Spotting on the ceramic surface that the thin oxide does not hold up to the paper was. It is not known if the potted can as potted.

No info on the humidity.

Cannot find the lead bonds in the package or top. Most seems as potted in glass. Most difficult in the field upsidedown.

Some work with bonding leads to TiCl4 fumes. Problem of common emitter base and Si makes it pop off.

Some propose Ag or Ca metallizing. Family black Ag or a big fat Ca lamp. Makes very low resistance ohm.

Adding needs KNO3 Ag or Fe(NO3)3. Can also CO2 Here are effects.

M.D. is anxious to get deem (400?) for testing.

M.D. ought also to look at the pyrolitic oxide.
Program:
1. Met (CBA) alloy
2. High temp metal
3. Beyer - Brake system
4. Rop grip lead system
5. Systems proof of hi-temp melts
April 10, 1962  Meeting with V.H.C. - J.P.F. on

Problem: We are not cutting the detail card and finding
no place for a date at anyplace near the note
we should be.

After discussion, it was decided that the following
solutions were reasonable:

1. Drop the R of necessary for a new card - we are
not now learning anything from at. It would have
to be completely re-done to be worth considering for
production.

2. Continue to list along on 1T6 with both cards,
for - dump and mechanism. Jim Campbell will be
happy to arrange for several crews to go through
the tests.

3. Run through from new set of cards by the time
I get back from Germany - April 23. The will hold
two that require new technique:

A. PNPN shift resist.

B. Diffused amplifier using microspore, etc. types.

and two that are greatly technique first were made

C. A high level gate (M1) using the thrust
counter under the emitter for the whole resistance
at 150 m delay on 0 to 50°C - room/mode and 30 per cycle.

D. A QH chip diffused porous memory device, to
speed up more by as fast we can.

[Signature]

4/10/62
April 24, 1962

Review:

As a couple of weeks ago the danger was
degression in photo response.
The Dutch seem exorcised, because the leader of our
group fells well.

The Ulman eyeglasses, shown yesterday, are it seem
almost certain that the low cannot be going to get.

This uncertainty is the problem.

Usually has been still not are open and alert. The alert
are mostly the planting at the edge of the three.

The problem is pin holes - desert yield is 1-2%.

We still do not have data on what changes - is it just
fine, in it college, or is it light?

The data on this will be out within ~1 week or so.

We still have the back up, perhaps using std. addendum and
Feedback. This is now doubly checked.
May 1, 1962 - Mammalian Res Sec. Meet

Richard:

We're making a good job.

Talk to Mr. Spalding.

Fallout is not intended for many uses - in fact following spring, we'll make some definite attacking dies.

The Fellabits contract.

John Campbell:

SnO2: Bad supercritical color. Think a special type.

Si-Film:

1/4 - 1/2 is new, hot treated doesn't seem to work well. We're giving up.

One type of the film has completely different behavior of the first treatment. This film is original, better. Diffraction is absolutely.

Date Book: Lanie, Campbell, Mike, Finall

Make corrections on photo setup - also slid plans.

Cut on May 2, 1962.

John Lanie:

Jak film preparation - 10 rings here as compared to 65 rings. 54/0.5 wish to 10/0.

Bath film is getting - 80 A/0.

First at 730°C for 30 min.
Pars, it is fine. Click me and read a page. After all, on december, there will be nothing special on this page.

If we can't understand the marks, we need to understand all. The problem is, if we can't understand the marks, we need to understand all. The problem is, if we can't understand the marks, we need to understand all. The problem is, if we can't understand the marks, we need to understand all.
<table>
<thead>
<tr>
<th>TRANSISTOR &amp; DIODE</th>
<th>MISC. DEVICE DEVELOP.</th>
<th>OTHER PROJECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>108 7000 Series Dev.</td>
<td>117 Exploratory Dev. Research</td>
<td>161 Analytical Technique Dev.</td>
</tr>
<tr>
<td>143 1000 Series Dev.</td>
<td>118 Parametric Amplifier</td>
<td>165 Comparator Device Eval.</td>
</tr>
<tr>
<td>144 1500 Series Dev.</td>
<td>118 Diode Dev.</td>
<td></td>
</tr>
<tr>
<td>136 2000 Series Dev.</td>
<td>121 Data Storage Devices</td>
<td></td>
</tr>
<tr>
<td>145 2500 Series Dev.</td>
<td>125 Microwave Devices</td>
<td></td>
</tr>
<tr>
<td>147 4000 Series Dev.</td>
<td>142 S.C.T. Device</td>
<td></td>
</tr>
<tr>
<td>148 Diode Development</td>
<td>150 Tunnel Diode Dev.</td>
<td>193 Factory Specification Engineering</td>
</tr>
<tr>
<td>191 Epitaxial Transistor Dev.</td>
<td>170 Photo Transistor Dev.</td>
<td>194 Circuit Development</td>
</tr>
<tr>
<td>171 Zener Diode Dev.</td>
<td>179 Exploratory Photo</td>
<td>195 Application Reliability</td>
</tr>
<tr>
<td>169 Multiple Diode Dev.</td>
<td>Sensitive Device</td>
<td></td>
</tr>
<tr>
<td>188 improvement of standard techniques</td>
<td>189 Field Effect Transistors</td>
<td>196 Customer Applications</td>
</tr>
<tr>
<td>IMPROVEMENT OF STANDARD TECHNIQUES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>109 Diffusion Tech. Dev.</td>
<td>114 Special Diffusion Research</td>
<td>178 Ferromagnetic Films</td>
</tr>
<tr>
<td>125 Masking Tech. Dev.</td>
<td>Noise Research</td>
<td></td>
</tr>
<tr>
<td>150 Packaging Tech. Dev.</td>
<td>Basic Alloying Studies</td>
<td></td>
</tr>
<tr>
<td>156 Contact Tech. Dev.</td>
<td>Surface Research</td>
<td></td>
</tr>
<tr>
<td>PIEZORESISTOR DEVELOP.</td>
<td>Silicon Material Research</td>
<td></td>
</tr>
<tr>
<td>140 Strain Gauge Element</td>
<td>Pipes &amp; Related Phenomena</td>
<td></td>
</tr>
<tr>
<td>110 Glass &amp; Ceramics Dev.</td>
<td>Etching Studies</td>
<td></td>
</tr>
<tr>
<td>113 New Materials Prep &amp; Eval</td>
<td>MICROCIRCUITRY</td>
<td></td>
</tr>
<tr>
<td>141 Microwave Physics</td>
<td>Micrologic-Advanced Dev.</td>
<td>172 Advanced Microcircuitry Tech.</td>
</tr>
<tr>
<td>158 Gallium Arsenide Exploratory Device &amp; Techniques</td>
<td></td>
<td>Revised 7/8/61</td>
</tr>
<tr>
<td>159 Surface Coating Dev.</td>
<td>174 Saleable Micrologic Hardware</td>
<td></td>
</tr>
<tr>
<td>162 Semiconductor Film Growth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>158 Surface Protection Eval.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*New projects assigned—effective 7/7/61.*
143

15,000 Series Development
7/16 - Project Review - p. 3
dated 21-3

144

2,000 Series Development
7/16 - Project Review - p. 2
dated 24-3

136

4,500 Series Development
7/16 - Project Review - p. 3
dated 27-9

147

6,000 Series Development
7/16 - Project Review - p. 50-51
dated 30-4

148

10,000 Series Development
7/16 - Project Review - p. 6-7-89
dated 9/16 - Revised - p. 50-51

106

Controlled Rectifiers
7/16 - Project Review - p. 14-9
dated 30-12 - Revised - p. 19-5
JOB No.

[TITLES FOR DEVICES - CONTD]

111  [Device Title Development]
1/21/41  Project Review  - p. 12-13
1/21/42  Prep. Rev.  - p. 11, 112

149  Multiple Title Development
Not Reviewed

(ENHANCEMENT OF STANDARD TECHNIQUES)

109  Diffusion Technology Development
1/27/41  Project Review  - p. 5.5
10/4/41  Review Cont'd  - p. 5.9

126  Molding Techniques Development
7/20/41  Project Review  - p. 32-33
7/31/41  Review Cont'd  - p. 32, 33, 34
7/6/42  Prep. Rev.  - p. 121

160  Pacelasing Techniques Development
8/11/41  Project Review  - p. 41, 42, 43
11/27/41  Review  - p. 76
9/2/42  Review  - p. 136, 137

164  Contact Techniques Development
7/2/41  Project Review  - p. 37
<table>
<thead>
<tr>
<th>Job No.</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>140</td>
<td>1/16</td>
<td>Project Review - p. 19</td>
</tr>
<tr>
<td></td>
<td>1/16</td>
<td>Review - p. 94-94A</td>
</tr>
<tr>
<td>143</td>
<td>1/16</td>
<td>Project Review - p. 53</td>
</tr>
<tr>
<td>143</td>
<td>1/16</td>
<td>Review - p. 65</td>
</tr>
<tr>
<td>144</td>
<td>1/16</td>
<td>Miscellaneous - p. 35-36</td>
</tr>
<tr>
<td>158</td>
<td></td>
<td>Laboratory Gravide Exploratory - p. 99-100</td>
</tr>
<tr>
<td>159</td>
<td></td>
<td>Surface Testing Development</td>
</tr>
<tr>
<td>162</td>
<td>1/19</td>
<td>Project Review - p. 17-18</td>
</tr>
<tr>
<td>1/19</td>
<td>1/19</td>
<td>Review of status of Si work - p. 85-101</td>
</tr>
<tr>
<td>167</td>
<td></td>
<td>Surface Protection Evaluation</td>
</tr>
</tbody>
</table>
146

TITLE

Microphone Development

11/7 Exploratory Design Research

1/25/61 Project Review - p. 25

1/31 Data Storage Devices

7/25/61 Project Review - p. 29, 30

12/2 Exploratory Design

7/25/61 Project Review - p. 1
4/16 Exploratory Design Review - p. 57
11/16-12/1 Review - p. 68, 69

50

21/8/61 Project Review - p. 21

51 State Transistor Development

11/18/61 Project Review - p. 24 - 25
6/4/62 p. 120, 123
7/4/62 p. 137

179 Exploratory Photodetector Device

1/24/61 Project Review - p. 25

89 Fill Effect Transistors

1/31/61 Project Review - p. 14, 15, 16
9/11/61 Review - p. 52
1/7/62 Maj Plan - p. 97
114 Research Development
Project Review - p. 44, 45, 46
p. 45, 46

115 Testing Research
Project Review - p. 47
p. 48

116 Basic Modeling Studies
Project Review - p. 37, 38

117 Surface Research
Project Review - p. 26, 27, 28

120 Nuclear Material Research
Not Reviewed

123 Safety Emission Control
Project Review - p. 44, 45, 46

164 Basic Laboratory Research
Not Reviewed

173 Etching Studies
Project Review - p. 94

175 Microwafer Reactor
Project Review - p. 83, 84, 85

177 Advanced Instrument Technology
Project Review - p. 93, 94

178 Advanced Logic Hardware
Not Reviewed

179 Microwafer Reactor Development
Plg. 109, 110

188 Project Review - p. 109, 110
(OTHER PROJECTS)
161 Analytical Business-Productivity
7/3/61 Project Review - p. 5

165 Competitor Product Evaluation
8/3/61 Project Review - p. 69

(Application Engineering)
193 Factory Specification Engineering

194 Circuit Development
Cancelled

195 Application Reliability

196 Customer Applications

197 Morphologic Application
PROJECT PLAN FOR PROJECT 170

Photodevice Development

Project Leader: ..................

Approved Section Head: ..................

Approved Directors Office: ..................

PROJECT OBJECTIVE:

The development of new photodevices, the evaluation and product design necessary for transferring the devices to a manufacturing facility, and the support of manufacturing and marketing activities. This project consists of five main tasks at this time.

Task 1. Development of the XP-3 family of photodevices
Task 2. Development of photodiode arrays
Task 3. Development of light emitting devices
Task 4. Investigation and development of special photodevices
Task 5. Support of manufacturing and marketing activities

TASK 1. DEVELOPMENT OF XP-3 FAMILY OF DEVICES

Task Objective: The development of a photodiode and phototransistor that can be manufactured for a prime cost of 10 cents maximum. The devices to be mounted in plastic and/or glass packages. The physical size of the package to be such that the device can be used to read an IBM card in parallel.

Principal Problems:

1) Development of lead attaching methods. Primary methods under consideration:
   a) High temperature die attach
   b) Tin die attach
2) Development of a plastic encapsulation method
3) Development of a glass encapsulation method
4) Diffusing devices with uniform photoresponse characteristics
5) Dicing of devices to tolerance required
6) Evaluation of devices with and without package
Project Plan for Project 170

Schedule: Please see Appendix A.

**TASK 2. DEVELOPMENT OF PHOTODIODE ARRAYS**

**Task Objective:** The development of high density photodiode arrays for use in electrostatic printing and other applications. The devices should have breakdown voltages of approximately 500 volts.

**Principal Problems:**

1) The obtaining of the yield required. The main problems seem to arise in the photoresist and diffusion operation.

2) Slicing of the wafers into strips. Present equipment is inadequate, and new equipment should be developed.

3) Packaging of the arrays. Two methods are being investigated.
   a) This method consists of fabricating the devices on a silicon bar which will be a self-contained unit. The problems with this method are:
      - **Photoresist:** Development of techniques for bringing a contact from the device around a corner of the bar to give a rubbing-type contact to the read out dielectric.
      - **Plating:** The contact to the paper requires a hard surface to withstand wear. Rhodium will probably be used.
      - **Bar Fabrication:** Techniques have to be developed to fabricate the bars in the shape required.
   b) This method consists of fabricating the devices on regular wafers and then attaching the arrays to a bar of silicon (or other material) to make the electrical contact to the dielectric. The problems with this method are basically the same as with method a) above. This method has the additional problem of requiring that electric connections must be made between the arrays and the bar. This connection will require the development of new techniques because conventional lead bonding would be too expensive except for developmental samples. This method has the advantage that the arrays can be built on standard wafers and the material used in the bar does not have to be high grade silicon.
Project Plan for Project 170

Schedule: Please see Appendix B.

TASK 3. DEVELOPMENT OF LIGHT-EMITTING DEVICES

Task Objective: The development of high speed light-emitting devices with maximum light output and efficiency.

Principal Problems:
1) Evaluation of FT 6200 (FSP-102 & 103) light pulser
2) Fabrication and evaluation of FT 7000 for light pulser application
3) Development of measurement techniques. (Project No. 179)
4) Issue Technical Report on light pulsers

Schedule: Please see Appendix C.

TASK 4. INVESTIGATION AND DEVELOPMENT OF SPECIAL PHOTODEVICES

Task Objective: This task consists of development of photodevices for special application and investigation of the various Fairchild techniques and products as photodevices.

Work performed on this task is not scheduled in a formal manner. Most of the work is performed on a time available basis or depends on the time requirements of other projects. Items being covered by this task are as follows:

1) XPT-2 Darlington phototransistor
2) Planar lateral photodevice
3) Photochoppers with associated electronic circuits
4) Special phototransistor array for data storage project
5) Special scanner photodiode for Sam Levine

Problem: Hole in silicon wafer without developing cracks. Fabricating.

TASK 5. SUPPORT OF MANUFACTURING AND MARKETING ACTIVITIES

Task Objective: Assist other activities as required to manufacture and obtain sufficient information to specify and market the devices.
Project Plan for Project 170

This task consists of performing special tests required by other activities; it also includes answering customer inquiries, customer contact, training of application engineering personnel on the properties of photodevice and testing methods, and obtaining information for preparation and registration of devices.

**PERSONNEL:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Job Title</th>
<th>Estimated Percentage of Time</th>
<th>For Estimated Number of Months</th>
<th>Estimated Number of Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Biegel</td>
<td>Sr. Engineer</td>
<td>40%</td>
<td>6</td>
<td>400</td>
</tr>
<tr>
<td>P. Ullman</td>
<td>Sr. Engineer</td>
<td>80%</td>
<td>6</td>
<td>800</td>
</tr>
<tr>
<td>W. Wheeler</td>
<td>Research Assoc.</td>
<td>70%</td>
<td>6</td>
<td>700</td>
</tr>
<tr>
<td>O. Littrell</td>
<td>Sr. Laboratory Technician</td>
<td>80%</td>
<td>6</td>
<td>800</td>
</tr>
<tr>
<td>F. Rittiman</td>
<td>Lab. Technician</td>
<td>80%</td>
<td>6</td>
<td>800</td>
</tr>
<tr>
<td>Research Associate (to be hired)</td>
<td></td>
<td>25%</td>
<td>4</td>
<td>160</td>
</tr>
<tr>
<td>Electro-Mechanical Engineer (to be hired)</td>
<td></td>
<td>50%</td>
<td>4</td>
<td>320</td>
</tr>
</tbody>
</table>

**EQUIPMENT NEEDS:**

1 single bell jar evaporation system; approximately $5000; required approximately 1 June 1962

1 dice scriber for pilot line

2 dice probes with microscope; approximately 600

1 Tektronix square wave generator; approximately 400
<table>
<thead>
<tr>
<th>ITEM</th>
<th>JANUARY</th>
<th>FEBRUARY</th>
<th>MARCH</th>
<th>APRIL</th>
<th>MAY</th>
<th>JUNE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>50 Transistors mounted on headers per prel. spec.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>1000 Transistor dice for Lead attach and encapsulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Lead attach and encaps 75 units each method</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Evaluate 50 units mounted in item 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Evaluate 50 units of each group of item 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Run of XP3 on Epitaxial material and evaluate 50 units on headers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Prepare 900 dice using 2 lead trans. alt. optional unless necessary</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Prepare 500 dice using 2 lead diode with alt. config if reqd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Prepare 600 dice using 3 lead transistor conf. with alt. config if reqd</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Evaluate items produced in 7,8,9 as reqd. (50 units each group)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Dice Decision</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>New Mask Stepped</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Environmental testing and product evaluation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Pkg. and Mbd. decision</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Prototype runs of transistor config</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Evaluate 50 units of each run item 15</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Complete tent. spec. from XP3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Prototype runs of diode config</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Evaluate 50 units of each run item 18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Complete tent. spec. of XP3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>Tooling discussion and spec. eval. of tooling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Product transfer of XP3 and XPD-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Procure and evaluate prototype mounting boards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITEM</td>
<td>JANUARY</td>
<td>FEBRUARY</td>
<td>MARCH</td>
<td>APRIL</td>
<td>MAY</td>
<td>JUNE</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>----------</td>
<td>-------</td>
<td>-------</td>
<td>-----</td>
<td>------</td>
</tr>
<tr>
<td>1. Development of diode arrays on wafers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Development of diode array mounting bar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Complete first prototype mounting bar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Complete first working diode array on mounting bar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Fabricate diode array in silicon bar a fabrication of diodes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. contact techniques</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Transfer operating array to project 190</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Have new mask stepped for diode array-regular</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Investigate shunt writing strip requirements</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Have mask stepped for shunt writing arrays</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Development of diode arrays for shunt writing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Fabricate mounting board for shunt writing diode array</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Complete first working diode array for shunt writing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Transfer shunt writing array to project 190</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Development of diode arrays approx. 30% complete</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITEM</td>
<td>JANUARY</td>
<td>FEBRUARY</td>
<td>MARCH</td>
<td>APRIL</td>
<td>MAY</td>
<td>JUNE</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>----------</td>
<td>-------</td>
<td>-------</td>
<td>-----</td>
<td>------</td>
</tr>
<tr>
<td>1. CHARACTERIZE FLP-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Fabricate light pulsers using FT7000 masks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Fabricate light pulsar diodes using f-material</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Fabricate light pulsar diodes using f-material</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Evaluate Light Pulsar of item 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Evaluate Light Pulsar of item 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Evaluate Light Pulsar of item 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Package investigation of XLP-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Decision on configuration for XLP-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Environmental testing of XLP-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Data Sheet Release for XLP-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Manufacturing process specification release</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Project Review Schedule for week of Jan 29 - Feb 2

Need immediate review:
- 175 Microelectronics product development
- 496 Cadence Director
- 180 Advanced computer technology

Ready for review:
- 143
- 144
- 1453
- 167
- 126
- 160
- 166
- 133

Under review:
- 116
- 121
- 127
- 139
- 141
- 170
- 179
- 116 (?)
- 19
- 161
- 177

Just entered:
- 110
- 113C
- 165

Recently done:
- 140
- 173
- 189
- 142
- 165
- 178
- 109, 114, 163
- 115
- 102
- 105
## RESEARCH & DEVELOPMENT PROJECTS LIST

<table>
<thead>
<tr>
<th>TRANSISTOR &amp; DIODE:</th>
<th>SUPPORTING RESEARCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job. No.</td>
<td>Job Title</td>
</tr>
<tr>
<td>106</td>
<td>Controlled Rectifiers</td>
</tr>
<tr>
<td>107</td>
<td>7500 Series Dev.</td>
</tr>
<tr>
<td>108</td>
<td>Power Trans. Dev.</td>
</tr>
<tr>
<td>143</td>
<td>1000 Series Dev.</td>
</tr>
<tr>
<td>144</td>
<td>1500 Series Dev.</td>
</tr>
<tr>
<td>136</td>
<td>2000 Series Dev.</td>
</tr>
<tr>
<td>145</td>
<td>4000 Series Dev.</td>
</tr>
<tr>
<td>146</td>
<td>4500 Series Dev.</td>
</tr>
<tr>
<td>147</td>
<td>6000 Series Dev.</td>
</tr>
<tr>
<td>148</td>
<td>Diode Development</td>
</tr>
<tr>
<td>169</td>
<td>Multiple Diode Dev.</td>
</tr>
<tr>
<td>171</td>
<td>Zener Diode Dev.</td>
</tr>
</tbody>
</table>

### IMPROVEMENT OF STANDARD TECHNIQUES

<table>
<thead>
<tr>
<th>Job No.</th>
<th>Job Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>109</td>
<td>Diffusion Tech. Dev.</td>
</tr>
<tr>
<td>126</td>
<td>Masking Tech. Dev.</td>
</tr>
<tr>
<td>160</td>
<td>Packaging Tech. Dev.</td>
</tr>
<tr>
<td>166</td>
<td>Contact Tech. Dev.</td>
</tr>
<tr>
<td>110</td>
<td>Glass &amp; Ceramic Dev.</td>
</tr>
<tr>
<td>113</td>
<td>New Materials Prep &amp; Eval</td>
</tr>
<tr>
<td>141</td>
<td>Microwave Physics</td>
</tr>
<tr>
<td>158</td>
<td>Gallium Arsenide Exploratory Device &amp; Techniques</td>
</tr>
<tr>
<td>159</td>
<td>Surface Coating Dev.</td>
</tr>
<tr>
<td>162</td>
<td>Semiconductor Film Growth</td>
</tr>
<tr>
<td>168</td>
<td>Surface Protection Eval.</td>
</tr>
</tbody>
</table>

### MICROCIRCUITRY

<table>
<thead>
<tr>
<th>Job No.</th>
<th>Job Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>152</td>
<td>Micrologic Product Dev.</td>
</tr>
<tr>
<td>172</td>
<td>Advanced microcircuitry Tech.</td>
</tr>
<tr>
<td>174</td>
<td>Saleable micrologic Hardware</td>
</tr>
<tr>
<td>175</td>
<td>Microelectronics Prod. Dev.</td>
</tr>
</tbody>
</table>

### PIEZORESISTOR DEVELOPMENT

<table>
<thead>
<tr>
<th>Job No.</th>
<th>Job Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>140</td>
<td>Strain Gauge Element</td>
</tr>
</tbody>
</table>

### NEW TECHNIQUES & MATERIAL

<table>
<thead>
<tr>
<th>Job No.</th>
<th>Job Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>Glass &amp; Ceramic Dev.</td>
</tr>
<tr>
<td>113</td>
<td>New Materials Prep &amp; Eval</td>
</tr>
<tr>
<td>141</td>
<td>Microwave Physics</td>
</tr>
<tr>
<td>158</td>
<td>Gallium Arsenide Exploratory Device &amp; Techniques</td>
</tr>
<tr>
<td>159</td>
<td>Surface Coating Dev.</td>
</tr>
<tr>
<td>162</td>
<td>Semiconductor Film Growth</td>
</tr>
<tr>
<td>168</td>
<td>Surface Protection Eval.</td>
</tr>
</tbody>
</table>

### OTHER PROJECTS

<table>
<thead>
<tr>
<th>Job No.</th>
<th>Job Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>161</td>
<td>Analytical Technique Dev.</td>
</tr>
<tr>
<td>165</td>
<td>Competitor Device Eval.</td>
</tr>
<tr>
<td>167</td>
<td>Special Fairchild Controls Dev.</td>
</tr>
<tr>
<td>176</td>
<td>Prep. of Proposals for Government Contracts</td>
</tr>
</tbody>
</table>

### MISC. DEVICE DEVELOPMENT

<table>
<thead>
<tr>
<th>Job No.</th>
<th>Job Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>117</td>
<td>Exploratory Dev. Research</td>
</tr>
<tr>
<td>121</td>
<td>Data Storage Devices</td>
</tr>
<tr>
<td>142</td>
<td>S.C.T. Device</td>
</tr>
<tr>
<td>150</td>
<td>Tunnel Diode Dev.</td>
</tr>
<tr>
<td>170</td>
<td>Photo Transistor Dev.</td>
</tr>
<tr>
<td>189</td>
<td>Field Effect Transistors</td>
</tr>
<tr>
<td>179</td>
<td>Explor. Photo Sensitive Dev.</td>
</tr>
<tr>
<td>190</td>
<td>Experimental Hardcopy Dev.</td>
</tr>
</tbody>
</table>

### NEW AREAS

<table>
<thead>
<tr>
<th>Job No.</th>
<th>Job Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>177</td>
<td>Thin Film Tunnel Devices</td>
</tr>
<tr>
<td>178</td>
<td>Magnetic Film Studies</td>
</tr>
</tbody>
</table>

---

**COMPANY PRIVATE**

2/1/62