This memo describes in detail the requirements for upgrading existing Mark IIIA systems to Mark IV capability, and outlines what is needed to upgrade a VLBA system. The key to the Mark IV upgrade lies in the capabilities of the formatters, and these capabilities are compared in Table I.

### FORMATTER CAPABILITY COMPARISON

<table>
<thead>
<tr>
<th></th>
<th>Mark III Mark IIIA</th>
<th>Mark IV</th>
<th>Mark IVA</th>
<th>Mark IVB</th>
<th>Standard VLBA</th>
<th>Augmented VLBA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-bit Samplers</td>
<td>28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>2-bit Samplers</td>
<td></td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>16</td>
<td>16</td>
</tr>
<tr>
<td>Sample Rate, MHz</td>
<td>8</td>
<td>16</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Output Channels</td>
<td>28</td>
<td>64</td>
<td>64</td>
<td>128</td>
<td>64</td>
<td>28 or 32</td>
</tr>
<tr>
<td>Data Rate/Track</td>
<td>9</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Msamples/sec</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Augmented VLBA System is fully compatible with either Standard VLBA or Mark IIIA depending on which set of sampler output connectors are used as described in VLBA Acquisition Memos #89, #167, and #182. This chart shows the Mark IV upgrade path, first to 32 Msamples/sec, and then to 128 output channels for a total output data rate of 2,048 Mb/s.

The data acquisition capabilities of the various systems are shown in Table II, where a Mark IIIA System with a Mark IVA Formatter has been called Mark IIIIB.
The upgrade of a Mark IIIA system to a basic Mark IV capability requires the following items:

- Mark IV Field System Computer
- Mark IV Formatter
- Mark IV I/O Board
- Mark IV Power Distributor
- 2 VLBA Write Modules (PC version, or modified wire-wrap)
- VLBA Read Module
- VLBA Read/Write Head Interface, modified
- VLBA Read preamplifiers
- 28 8-MHz filters installed in the Video Converters

In addition, for full 32-channel operation, two more video converters are required, with additional wiring in the rack to accommodate them.

The upgrade of a Standard VLBA system to basic Mark IV operation requires:

- Mark IV Field System Computer
- 6 additional Base-Band Converters
- 2 additional 2-bit sampler boards
- A formatter upgraded for 18-MHz output data rate per track
- A Write Module with transformerless monitor circuits
- A second, upgraded, Write Module
- A Read/Write Interface, modified for 18 Mb/s operation
- A second head stack with a Mark IIIA Write-only Interface

For full 32-channel operation, two more Base-Band Converters are required, if space can be found for them in the Data Acquisition Rack.