Rendezvous

STS-125/STS-400

Mission Operations Directorate
Flight Design and Dynamics Division

Final
September 10, 2008

Verify this is the correct version for the pending operation (training, simulation or flight).
Electronic copies of FDF books are available. URL: http://mod.jsc.nasa.gov/do3/FDF/index.html
SIM FDF CHANGE NOTIFICATION

BOOK TITLE

RELENTZ

Change is for flights (Also give SMS load if load dependent):
STS-125/400

SMS UNIQUE?

☐ YES ☑ NO

DEVELOPMENTAL?

☐ YES ☑ NO

FABRICATED ITEM CHANGE?

☒ NONE ☐ CUE CARDS ☐ TRANSPARENCIES ☐ Other

INSTRUCTIONS TO USER:

Replace 2-32a thru 2-56

Delete 2-57 thru 2-62

AUTHORITY FOR CHANGE* (Approved 482 numbers, approved issue at print shop, supervisors deem mandatory, etc.):

Supervisor deems mandatory

OTHER AFFECTED FDF BOOKS

☐ Limited Distribution (List in comments) ☑ NO EARLIER THAN (Date and/or Sim ID)

☒ NO LATER THAN (Date and/or Sim ID) STS-400 Rndz 4/30/09

BOOK MGR (Signature/Date)

SUPERVISOR (If required, Signature/Date)

FDF COORD or PDF MGR (Signature/Date)

COMMENTS:

*Refer to Crew Procedures Management Plan

Are all SIM PACKS submitted? ☑ YES ☐ NO

MOD Form SP-1, AUG 1998
Rendezvous

Change is for flights (Also give SMS load if load dependent):
STS-125/400

INSTRUCTIONS TO USER:
Remove & Replace pages 2-17,18, 2-23 thru 2-26, and 2-29 & 2-30

AUTHORITY FOR CHANGE* (Approved 482 numbers, approved issue at print shop, supervisors deem mandatory, etc.):
Supervisor Deems Mandatory

*Refer to Crew Procedures Management Plan

OTHER AFFECTED FDF BOOKS
None

IMPLEMENTATION REQUIREMENTS

<table>
<thead>
<tr>
<th></th>
<th>Limited Distribution (List in comments)</th>
<th>NO EARLIER THAN (Date and/or Sim ID)</th>
<th>NO LATER THAN (Date and/or Sim ID)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>STS-400 JIS 4/20/09</td>
</tr>
</tbody>
</table>

BOOK MGR (Signature/Date) | SUPERVISOR (if required, Signature/Date) | FDF COORD or FDE MGR (Signature/Date) |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>15/10/09</td>
</tr>
</tbody>
</table>

COMMENTS:
Rendezvous

SIM PACK NUMBER
SIM-125

INSTRUCTIONS TO USER:
Remove & Replace CC 8-7 thru CC 8-10

AUTHORITY FOR CHANGE* (Approved 482 numbers, approved issue at print shop, supervisors deemed mandatory, etc.):
Supervisor deems mandatory

OTHER AFFECTED FDF BOOKS
None

IMPLEMENTATION REQUIREMENTS

BOOK MGR (Signature/Date)  FDF COORD or FDF MGR (Signature/Date)  SUPERVISOR (If required, Signature/Date)

COMMENTS:

*Refer to Crew Procedures Management Plan

MOD Form SP-1, AUG 1998
MISSION OPERATIONS DIRECTORATE

RENEDEVOUS
STS-125/STS-400

FINAL
September 10, 2008

PREPARED BY:

Sean O'Rourke
Book Manager

APPROVED BY:

Steve R. Walker
Lead, Rendezvous Guidance and Procedure Group

ACCEPTED BY:

Scott Dunham
Chief, Orbit Dynamics Branch

This document is under the configuration control of the Crew Procedures Control Board (CPCB). All proposed changes must be submitted via FDF Workflow Crew Procedure Change Request (CR) to DO3/FDF Manager.

Additional distribution of this book, for official use only, may be requested in writing to DO3/PMO Administrator. The request must include justification and requester's name, organization, position, and phone number. Contractor requests are made through the NASA or DOD organization supported. Deletions, reduction in quantity, or change of address may be submitted to DO3/FDF Management Office, 281-244-1184.
Incorporates the following:

<table>
<thead>
<tr>
<th>482#</th>
<th>RNDZ-1315</th>
<th>RNDZ-1316</th>
<th>RNDZ-1321</th>
<th>RNDZ-1322</th>
<th>RNDZ-1323</th>
</tr>
</thead>
<tbody>
<tr>
<td>RNDZ-1324</td>
<td>RNDZ-1325</td>
<td>RNDZ-1327</td>
<td>RNDZ-1328C</td>
<td>MULTI-1825</td>
<td>RNDZ-1329</td>
</tr>
</tbody>
</table>

AREAS OF TECHNICAL RESPONSIBILITY

**STS-125**

- **Book Manager**: DM34/S. O'Rourke 281-244-5522
- **Rendezvous Guidance and Procedures**: DM34/N. O'Dosey 281-483-6178
- **Rendezvous Training**: DM34/A. Fox 281-244-7376
- **Flight Dynamics**: DM32/W. Tracy 281-483-0576
- **Rendezvous Design**: USA/J. Bacher 281-282-2763
- **PROX OPS Design**: USA/J. Pascucci 281-282-2777
- **Flight Design**: USA/D. Gabriel 281-483-1305

**STS-400**

- **Book Manager**: DM34/S. O'Rourke 281-244-5522
- **Rendezvous Guidance and Procedures**: DM34/N. O'Dosey 281-483-6178
- **Rendezvous Training**: DM34/J. Frank 281-244-7846
- **Flight Dynamics**: DM32/J. Mendeck 281-483-8020
- **Rendezvous Design**: USA/T. Stuit 281-282-4456
- **PROX OPS Design**: USA/W. Summa 281-282-3032
- **Flight Design**: USA/R. Moreno 281-483-8040
NOTE
This checklist is the controlling crew document for both STS-125 HST rendezvous and the STS-400 rendezvous with a potentially stranded STS-125 orbiter. The Rendezvous Timelines (Section 4 for STS-125 and Section 2 for STS-400) begin at Ti - 3:00 hr and continue through grapple. Their lighting information is based on a planned rendezvous altitude of 305 nmi. Targeting I-Loads are based on 310 nmi.

This is a complete stand-alone document. STS-125 deploy procedures are in a separate document.
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AZ, AZM</td>
<td>Azimuth</td>
</tr>
<tr>
<td>D/N</td>
<td>Day/Night</td>
</tr>
<tr>
<td>EL, ELEV</td>
<td>Elevation</td>
</tr>
<tr>
<td>IAH</td>
<td>Inertial</td>
</tr>
<tr>
<td>LOS</td>
<td>Line of Sight</td>
</tr>
<tr>
<td>LVLH</td>
<td>Local Vertical, Local Horizontal</td>
</tr>
<tr>
<td>R</td>
<td>Range</td>
</tr>
<tr>
<td>•</td>
<td></td>
</tr>
<tr>
<td>R, RDOT</td>
<td>Range Rate</td>
</tr>
<tr>
<td>R, RBAR</td>
<td>Radius Vector (toward Earth)</td>
</tr>
<tr>
<td>RNDZ</td>
<td>Rendezvous</td>
</tr>
<tr>
<td>RR</td>
<td>Rendezvous Radar</td>
</tr>
<tr>
<td>SK</td>
<td>Stationkeeping</td>
</tr>
<tr>
<td>ST, STRK</td>
<td>Star Tracker</td>
</tr>
<tr>
<td>(\bar{V}, \text{ VBAR})</td>
<td>Velocity Vector (direction of orbital travel)</td>
</tr>
<tr>
<td>±X, Y, ZLV</td>
<td>±X, Y, or Z Local Vertical (±X, Y, or Z toward Earth)</td>
</tr>
<tr>
<td>X, Y, ZPOP</td>
<td>X, Y, or Z orbiter body axis Perpendicular to Orbit Plane (aligned with the angular momentum vector)</td>
</tr>
<tr>
<td>±X, Y, ZVV</td>
<td>±X, Y, or Z orbiter body axis along the LVLH Velocity Vector</td>
</tr>
</tbody>
</table>
# RENDEZVOUS
STS-125/STS-400

## LIST OF EFFECTIVE PAGES

**FINAL 09/10/08**

<table>
<thead>
<tr>
<th>Sign Off</th>
<th>125/FIN</th>
<th>2-31</th>
<th>400/FIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii</td>
<td>125/FIN</td>
<td>2-32</td>
<td>400/FIN</td>
</tr>
<tr>
<td>iii</td>
<td>125/FIN</td>
<td>2-33</td>
<td>400/FIN</td>
</tr>
<tr>
<td>iv</td>
<td>125/FIN</td>
<td>2-34</td>
<td>400/FIN</td>
</tr>
<tr>
<td>v</td>
<td>125/FIN</td>
<td>2-35</td>
<td>400/FIN</td>
</tr>
<tr>
<td>vi</td>
<td>125/FIN</td>
<td>2-36</td>
<td>400/FIN</td>
</tr>
<tr>
<td>vii</td>
<td>125/FIN</td>
<td>2-37</td>
<td>400/FIN</td>
</tr>
<tr>
<td>viii</td>
<td>125/FIN</td>
<td>2-38</td>
<td>400/FIN</td>
</tr>
<tr>
<td>ix</td>
<td>125/FIN</td>
<td>2-39</td>
<td>400/FIN</td>
</tr>
<tr>
<td>x</td>
<td>125/FIN</td>
<td>2-40</td>
<td>400/FIN</td>
</tr>
<tr>
<td>1-1</td>
<td>125/FIN</td>
<td>2-41</td>
<td>400/FIN</td>
</tr>
<tr>
<td>1-2</td>
<td>125/FIN</td>
<td>2-42</td>
<td>400/FIN</td>
</tr>
<tr>
<td>1-3</td>
<td>125/FIN</td>
<td>2-43</td>
<td>400/FIN</td>
</tr>
<tr>
<td>1-4</td>
<td>125/FIN</td>
<td>2-44</td>
<td>400/FIN</td>
</tr>
<tr>
<td>1-5</td>
<td>125/FIN</td>
<td>2-45</td>
<td>400/FIN</td>
</tr>
<tr>
<td>1-6</td>
<td>125/FIN</td>
<td>2-46</td>
<td>400/FIN</td>
</tr>
<tr>
<td>1-7</td>
<td>125/FIN</td>
<td>2-47</td>
<td>400/FIN</td>
</tr>
<tr>
<td>1-8</td>
<td>125/FIN</td>
<td>2-48</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-1</td>
<td>400/FIN</td>
<td>2-49</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-2</td>
<td>400/FIN</td>
<td>2-50</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-3</td>
<td>400/FIN</td>
<td>2-51</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-4</td>
<td>400/FIN</td>
<td>2-52</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-5</td>
<td>400/FIN</td>
<td>2-53</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-6</td>
<td>400/FIN</td>
<td>2-54</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-7</td>
<td>400/FIN</td>
<td>2-55</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-8</td>
<td>400/FIN</td>
<td>2-56</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-9</td>
<td>400/FIN</td>
<td>2-57</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-10</td>
<td>400/FIN</td>
<td>2-58</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-11</td>
<td>400/FIN</td>
<td>2-59</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-12</td>
<td>400/FIN</td>
<td>2-60</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-13</td>
<td>400/FIN</td>
<td>2-61</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-14</td>
<td>400/FIN</td>
<td>2-62</td>
<td>400/FIN</td>
</tr>
<tr>
<td>2-15</td>
<td>400/FIN</td>
<td>3-1</td>
<td>125/FIN</td>
</tr>
<tr>
<td>2-16</td>
<td>400/FIN</td>
<td>3-2</td>
<td>125/FIN</td>
</tr>
<tr>
<td>2-17</td>
<td>400/FIN</td>
<td>3-3</td>
<td>125/FIN</td>
</tr>
<tr>
<td>2-18</td>
<td>400/FIN</td>
<td>3-4</td>
<td>125/FIN</td>
</tr>
<tr>
<td>2-19</td>
<td>400/FIN</td>
<td>3-5</td>
<td>125/FIN</td>
</tr>
<tr>
<td>2-20</td>
<td>400/FIN</td>
<td>3-6</td>
<td>125/FIN</td>
</tr>
<tr>
<td>2-21</td>
<td>400/FIN</td>
<td>3-7</td>
<td>125/FIN</td>
</tr>
<tr>
<td>2-22</td>
<td>400/FIN</td>
<td>3-8</td>
<td>125/FIN</td>
</tr>
<tr>
<td>2-23</td>
<td>400/FIN</td>
<td>3-9</td>
<td>125/FIN</td>
</tr>
<tr>
<td>2-24</td>
<td>400/FIN</td>
<td>3-10</td>
<td>125/FIN</td>
</tr>
<tr>
<td>2-25</td>
<td>400/FIN</td>
<td>3-11</td>
<td>125/FIN</td>
</tr>
<tr>
<td>2-26</td>
<td>400/FIN</td>
<td>3-12</td>
<td>125/FIN</td>
</tr>
<tr>
<td>2-27</td>
<td>400/FIN</td>
<td>4-1</td>
<td>125/FIN</td>
</tr>
<tr>
<td>2-28</td>
<td>400/FIN</td>
<td>4-2</td>
<td>125/FIN</td>
</tr>
<tr>
<td>CC 2-29</td>
<td>400/FIN</td>
<td>4-3</td>
<td>125/FIN</td>
</tr>
<tr>
<td>CC 2-30</td>
<td>400/FIN</td>
<td>4-4</td>
<td>125/FIN</td>
</tr>
</tbody>
</table>

* – Omit from flight book
<table>
<thead>
<tr>
<th>4-5</th>
<th>125/FIN</th>
<th>6-3</th>
<th>125/FIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-6</td>
<td>125/FIN</td>
<td>6-4</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-7</td>
<td>125/FIN</td>
<td>6-5</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-8</td>
<td>125/FIN</td>
<td>6-6</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-9</td>
<td>125/FIN</td>
<td>6-7</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-10</td>
<td>125/FIN</td>
<td>6-8</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-11</td>
<td>125/FIN</td>
<td>7-1</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-12</td>
<td>125/FIN</td>
<td>7-2</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-13</td>
<td>125/FIN</td>
<td>7-3</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-14</td>
<td>125/FIN</td>
<td>7-4</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-15</td>
<td>125/FIN</td>
<td>7-5</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-16</td>
<td>125/FIN</td>
<td>7-6</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-17</td>
<td>125/FIN</td>
<td>7-7</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-18</td>
<td>125/FIN</td>
<td>7-8</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-19</td>
<td>125/FIN</td>
<td>7-9</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-20</td>
<td>125/FIN</td>
<td>7-10</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-21</td>
<td>125/FIN</td>
<td>7-11</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-22</td>
<td>125/FIN</td>
<td>7-12</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-23</td>
<td>125/FIN</td>
<td>7-13</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-24</td>
<td>125/FIN</td>
<td>7-14</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-25</td>
<td>125/FIN</td>
<td>7-15</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-26</td>
<td>125/FIN</td>
<td>7-16</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-27</td>
<td>125/FIN</td>
<td>7-17</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-28</td>
<td>125/FIN</td>
<td>7-18</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-29</td>
<td>125/FIN</td>
<td>7-19</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-30</td>
<td>125/FIN</td>
<td>7-20</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-31</td>
<td>125/FIN</td>
<td>7-21</td>
<td>125/FIN</td>
</tr>
<tr>
<td>4-32</td>
<td>125/FIN</td>
<td>7-22</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-1</td>
<td>125/FIN</td>
<td>7-23</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-2</td>
<td>125/FIN</td>
<td>7-24</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-3</td>
<td>125/FIN</td>
<td>7-25</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-4</td>
<td>125/FIN</td>
<td>7-26</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-5</td>
<td>125/FIN</td>
<td>7-27</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-6</td>
<td>125/FIN</td>
<td>7-28</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-7</td>
<td>125/FIN</td>
<td>8-1</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-8</td>
<td>125/FIN</td>
<td>8-2</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-9</td>
<td>125/FIN</td>
<td>8-3</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-10</td>
<td>125/FIN</td>
<td>8-4</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-11</td>
<td>125/FIN</td>
<td>8-5</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-12</td>
<td>125/FIN</td>
<td>8-6</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-13</td>
<td>125/FIN</td>
<td>CC 8-3</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-14</td>
<td>125/FIN</td>
<td>CC 8-4</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-15</td>
<td>125/FIN</td>
<td>CC 8-5</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-16</td>
<td>125/FIN</td>
<td>CC 8-6</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-17</td>
<td>125/FIN</td>
<td>CC 8-7</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-18</td>
<td>125/FIN</td>
<td>CC 8-8</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-19</td>
<td>125/FIN</td>
<td>CC 8-9</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-20</td>
<td>125/FIN</td>
<td>CC 8-10</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-21</td>
<td>125/FIN</td>
<td>CC 8-11</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-22</td>
<td>125/FIN</td>
<td>CC 8-12</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-23</td>
<td>125/FIN</td>
<td>CC 8-13</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-24</td>
<td>125/FIN</td>
<td>CC 8-14</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-25</td>
<td>125/FIN</td>
<td>CC 8-15</td>
<td>125/FIN</td>
</tr>
<tr>
<td>5-26</td>
<td>125/FIN</td>
<td>CC 8-16</td>
<td>125/FIN</td>
</tr>
<tr>
<td>6-1</td>
<td>125/FIN</td>
<td>CC 8-17</td>
<td>125/FIN</td>
</tr>
<tr>
<td>6-2</td>
<td>125/FIN</td>
<td>CC 8-18</td>
<td>125/FIN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CC 8-19</td>
<td>125/FIN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8-20</td>
<td>125/FIN</td>
</tr>
</tbody>
</table>

* – Omit from flight book
<table>
<thead>
<tr>
<th>TITLE</th>
<th>Ref. Page</th>
<th>Card No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCS BURN (+X, -X, Multi-axis) (Front)</td>
<td>CC 8-3</td>
<td>RNDZ-1a/125/O/A</td>
</tr>
<tr>
<td>RENDEZVOUS PRPLT PAD (Back)</td>
<td>CC 8-4</td>
<td>RNDZ-1b/125/O/A</td>
</tr>
<tr>
<td>KU OPS (Front)</td>
<td>CC 8-5</td>
<td>RNDZ-2a/125/O/A</td>
</tr>
<tr>
<td>(Back)</td>
<td>CC 8-6</td>
<td>RNDZ-2b/125/O/A</td>
</tr>
<tr>
<td>HST RBAR APPROACH (Front)</td>
<td>CC 8-7</td>
<td>RNDZ-3a/125/O/C</td>
</tr>
<tr>
<td>(Back)</td>
<td>CC 8-8</td>
<td>RNDZ-3b/125/O/B</td>
</tr>
<tr>
<td>HST CONTINGENCY INRTL APPROACH (Front)</td>
<td>CC 8-9</td>
<td>RNDZ-4a/125/O/C</td>
</tr>
<tr>
<td>(Back)</td>
<td>CC 8-10</td>
<td>RNDZ-4b/125/O/B</td>
</tr>
<tr>
<td>HST BREAKOUT FLOWCHART (Front)</td>
<td>CC 8-11</td>
<td>RNDZ-5a/125/O/B</td>
</tr>
<tr>
<td>TOOL CHASING (Back)</td>
<td>CC 8-12</td>
<td>RNDZ-5b/125/O/A</td>
</tr>
<tr>
<td>NOMINAL RADAR ANGLES AND CAMERA ANGLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RANGING CHART (Front)</td>
<td>CC 8-13</td>
<td>RNDZ-6a/125/O/A</td>
</tr>
<tr>
<td>(Back)</td>
<td>CC 8-14</td>
<td>RNDZ-6b/125/O/A</td>
</tr>
<tr>
<td>GPC/MDM FAILURE RESPONSE DURING RNDZ</td>
<td>CC 8-15</td>
<td>RNDZ-7a/125/O/B</td>
</tr>
<tr>
<td>(Front)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RNDZ REF DATA (Back)</td>
<td>CC 8-16</td>
<td>RNDZ-7b/125/O/A</td>
</tr>
<tr>
<td>C/L CAMERA CORRIDOR AND ALIGNMENT</td>
<td>CC 8-17</td>
<td>RNDZ-8a/125/O/A</td>
</tr>
<tr>
<td>A31P PGSC DISPLAY OF C/L CAMERA CORRIDOR AND ALIGNMENT</td>
<td>CC 8-18</td>
<td>RNDZ-9a/125/O/A</td>
</tr>
<tr>
<td>SUB ANG RULER</td>
<td>CC 8-19</td>
<td>RNDZ-10a/125/O/A</td>
</tr>
<tr>
<td>STS-400 RBAR APPROACH (Front)</td>
<td>CC 2-29</td>
<td>RNDZ-11a/400/O/A</td>
</tr>
<tr>
<td>(Back)</td>
<td>CC 2-30</td>
<td>RNDZ-11b/400/O/A</td>
</tr>
</tbody>
</table>
## CONTENTS

<table>
<thead>
<tr>
<th>Flights Rules Summary &amp; Flight Profile</th>
<th>1-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flight Rules Summary</td>
<td>1-2</td>
</tr>
<tr>
<td>Rndz/Prox Ops Breakout Procedures Overview</td>
<td>1-2</td>
</tr>
<tr>
<td>Rndz Burn Solution Selection Guidelines</td>
<td>1-3</td>
</tr>
<tr>
<td>Engine Selection Guidelines</td>
<td>1-3</td>
</tr>
<tr>
<td>Failure/Response Summary</td>
<td>1-4</td>
</tr>
<tr>
<td>Orbt Rendezvous Profile</td>
<td>1-5</td>
</tr>
<tr>
<td>Post Ti Profile</td>
<td>1-6</td>
</tr>
<tr>
<td>STS-125 Terminal Phase, RBAR Approach, And Inertial Grapple</td>
<td>1-7</td>
</tr>
<tr>
<td>STS-400 Procedures</td>
<td>2-1</td>
</tr>
<tr>
<td>Maneuver Pads</td>
<td>3-1</td>
</tr>
<tr>
<td>STS-125 Rendezvous Timeline</td>
<td>4-1</td>
</tr>
<tr>
<td>Contingency Inertial Approach Timeline</td>
<td>4-23</td>
</tr>
<tr>
<td>Contingency Ops</td>
<td>5-1</td>
</tr>
<tr>
<td>Rndz Oms Burn</td>
<td>5-3</td>
</tr>
<tr>
<td>Sensor Fail</td>
<td>5-7</td>
</tr>
<tr>
<td>Trk Nav – High Initial Resid</td>
<td>5-8</td>
</tr>
<tr>
<td>Fltr Minus Prop</td>
<td>5-9</td>
</tr>
<tr>
<td>Coas Navigation</td>
<td>5-10</td>
</tr>
<tr>
<td>Backout/Breakouts</td>
<td>5-11</td>
</tr>
<tr>
<td>Proximity Ops Backoff</td>
<td>5-12</td>
</tr>
<tr>
<td>Hst RBAR Breakout</td>
<td>5-13</td>
</tr>
<tr>
<td>Flyaround/Loss of LO Z Breakout</td>
<td>5-14</td>
</tr>
<tr>
<td>Rndz Breakout</td>
<td>5-16</td>
</tr>
<tr>
<td>Ti Delay Burn</td>
<td>5-17</td>
</tr>
<tr>
<td>Rndz Nav Recovery</td>
<td>5-19</td>
</tr>
<tr>
<td>Tgt Iter</td>
<td>5-20</td>
</tr>
<tr>
<td>Loss of Comm</td>
<td>5-21</td>
</tr>
<tr>
<td>Degraded Control</td>
<td>5-23</td>
</tr>
<tr>
<td>Loss of VrCs</td>
<td>5-25</td>
</tr>
<tr>
<td>LO Z Braking</td>
<td>5-26</td>
</tr>
<tr>
<td>Reference Data</td>
<td>6-1</td>
</tr>
<tr>
<td>STS-125 Hst Rndz Ops Dap Configurations</td>
<td>6-2</td>
</tr>
<tr>
<td>Targeting Data</td>
<td>6-3</td>
</tr>
<tr>
<td>Post NC</td>
<td>6-5</td>
</tr>
<tr>
<td>Ti</td>
<td>6-6</td>
</tr>
<tr>
<td>Mc3</td>
<td>6-7</td>
</tr>
<tr>
<td>Coas Subtended Angles (Deg) Vs Range (Ft)</td>
<td>6-8</td>
</tr>
<tr>
<td>Rendezvous Tools</td>
<td>7-1</td>
</tr>
<tr>
<td>Cctv Config For Docking/Undocking</td>
<td>7-2</td>
</tr>
<tr>
<td>Rndz Tools Checkout</td>
<td>7-4</td>
</tr>
<tr>
<td>Troubleshooting</td>
<td>7-5</td>
</tr>
<tr>
<td>Tcs Cads Not Receiving Tcs Data</td>
<td>7-6</td>
</tr>
<tr>
<td>Rpop Not Receiving PcmMu Data</td>
<td>7-7</td>
</tr>
<tr>
<td>Hhl Data</td>
<td>7-8</td>
</tr>
<tr>
<td>Tcs Data (Cads Rcv Data On Same Pgsc)</td>
<td>7-9</td>
</tr>
<tr>
<td>Pgsc Reboot</td>
<td>7-9</td>
</tr>
<tr>
<td>Tools Configuration Status</td>
<td>7-10</td>
</tr>
</tbody>
</table>
FLIGHT RULES SUMMARY & FLIGHT PROFILE

FLIGHT RULES SUMMARY ............................................................................................ 1-2
RNDZ/PROX OPS BREAKOUT PROCEDURES OVERVIEW ....................................... 1-2
   BURN SOLUTION SELECTION GUIDELINES ...................................................... 1-3
   ENGINE SELECTION GUIDELINES ..................................................................... 1-3
 FAILURE/RESPONSE SUMMARY ............................................................................ 1-4
 ORBT RENDEZVOUS PROFILE .................................................................................. 1-5
   POST TI PROFILE ................................................................................................ 1-6
 STS-125 TERMINAL PHASE, RBAR APPROACH, AND INERTIAL GRAPPLE ............ 1-7
## FLIGHT RULES SUMMARY

### RNDZ/PROX OPS BREAKOUT PROCEDURES OVERVIEW

<table>
<thead>
<tr>
<th>RANGE BREAKOUT REQD</th>
<th>BREAKOUT PROCEDURE AND SUMMARY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior to Ti</td>
<td>Discontinue RNDZ burns; specific breakout only on MCC call</td>
</tr>
<tr>
<td>Between Ti and stable at 500 ft on the +RBAR</td>
<td>3 fps retrograde see RNDZ BREAKOUT (Contingency Operations), 5-16</td>
</tr>
<tr>
<td>In PROX OPS: If between 500 ft and INERTIAL ALIGNMENT FLYAROUND</td>
<td>3 fps posigrade or retrograde (MCC call). See HST RBAR BREAKOUT (CONTINGENCY OPERATIONS), 5-13</td>
</tr>
<tr>
<td>If between INERTIAL ALIGNMENT FLYAROUND and 30 ft</td>
<td>1.7 fps -X burn, manual pitch, 2 fps out-of-plane, 3.5 fps posigrade or retrograde (MCC call). See HST FLYAROUND/LOSS OF LO Z BREAKOUT (CONTINGENCY OPERATIONS), 5-14</td>
</tr>
<tr>
<td>If inside 30 ft</td>
<td>Maintain LO Z backout to &gt; 30 ft then 1.7 fps -X burn, manual pitch, 2 fps out-of-plane, 3.5 fps posigrade or retrograde (MCC call). See HST FLY AROUND/LOSS of LO Z BREAKOUT (CONTINGENCY OPERATIONS), 5-14</td>
</tr>
</tbody>
</table>
RNDZ BURN SOLUTION SELECTION GUIDELINES

<table>
<thead>
<tr>
<th>BURN</th>
<th>SOLUTION PRIORITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>All burns prior to, but not including, NCC</td>
<td>1) Ground solution</td>
</tr>
<tr>
<td>NCC &amp; Ti</td>
<td>1) Onboard FLTR solution if STRK or RR NAV converged* (for COAS, use step 2 below)</td>
</tr>
<tr>
<td></td>
<td>2) Onboard FLTR solution if it agrees with ground solution**</td>
</tr>
<tr>
<td></td>
<td>3) Onboard PROP solution if it agrees with ground solution</td>
</tr>
<tr>
<td></td>
<td>4) Ground solution</td>
</tr>
<tr>
<td>Post-Ti midcourse corrections</td>
<td>1) Onboard solution</td>
</tr>
</tbody>
</table>

*For the purpose of burn solution selection NAV is converged if, for the present sensor in acquisition (RR or STRK), at least 40 marks have been accepted with state vector position update of less than 0.5 Kft for at least the last 4 marks; or if state vector updates are small and stable. This criteria does not apply to COAS NAV

** Burn solutions are considered to be in agreement if delta Vs differ by no more than the ‘final-ground’ limits for each axis

RNDZ BURN ENGINE SELECTION GUIDELINES

<table>
<thead>
<tr>
<th>DELTA V</th>
<th>ENGINE</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 4 fps</td>
<td>RCS – Primary technique is multi-axis</td>
</tr>
<tr>
<td>4 to 6 fps</td>
<td>RCS – Primary technique is +X</td>
</tr>
<tr>
<td>&gt; 6 fps</td>
<td>OMS – Single engine</td>
</tr>
</tbody>
</table>
## RNDZ Failure/Response Summary

<table>
<thead>
<tr>
<th>Failure</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>No sensor data (RR, STRK, or COAS) during RNDZ, and no visual acquisition</td>
<td>Breakout by MC2 + 20 min</td>
</tr>
<tr>
<td>Good sensor data (RR, STRK, or COAS) during RNDZ, and no visual acquisition</td>
<td>Breakout by MC2 + 24 min</td>
</tr>
<tr>
<td>Target &gt; 30 deg from COAS horizontal at start of radar fail correction</td>
<td>Breakout ASAP; use RNDZ BREAKOUT (CONTINGENCY OPERATIONS), 5-16, until RBAR arrival</td>
</tr>
<tr>
<td>Prop quantities violate bingo numbers on RNDZ PRPLT PAD Cue Card or Orbiter systems malfunctions require breakout</td>
<td>Breakout per overview on previous page</td>
</tr>
<tr>
<td><strong>SYSTEMS:</strong></td>
<td></td>
</tr>
<tr>
<td>DPS: &lt; 2 GNC GPCs</td>
<td>2 GNC GPCs reqd for Ti and PROX OPS within 250 ft. Loss of GNC GPC inside 250 ft requires backout to 250 ft and stationkeep until reconfiguration to a 2 GNC redundant set is complete</td>
</tr>
<tr>
<td>GNC: Loss of redundant +Z Trans or PRCS TRANS, any axis ↓ or PRCS ROT, any axis ↓ or AFT THC (-Z sense), &gt; 1 TX contact ↓, all TY contacts ↓, all TZ contacts ↓ or AFT RHC, all channels, any axis ↓ or &lt; 2 IMUs</td>
<td>PROX OPS within 250 ft not permitted</td>
</tr>
<tr>
<td>Degraded LO Z: (loss of 2 -X jets):</td>
<td>Approach attempt allowable</td>
</tr>
<tr>
<td>Loss of LO Z Braking:</td>
<td>Breakout per HST FLYAROUND/LOSS OF LO Z BREAKOUT (CONTINGENCY OPERATIONS), 5-14</td>
</tr>
<tr>
<td>MECH: 1 KU ANTENNA STOW MOTOR</td>
<td>Normal ops</td>
</tr>
</tbody>
</table>
HST AT CENTER OF ROTATING LVLH REFERENCE FRAME

ORBIT RENDEZVOUS PROFILE

PET EVENT
-3:00 START RNDZ T/L (not shown)
-2:22 NH BURN (not shown)
-1:32 NC BURN
-1:28 S TRK NAVIGATION
-0:58 NCC BURN
-0:44 RADAR NAVIGATION
-0:00 Ti BURN
STS-125 TERMINAL PHASE, RBAR APPROACH, AND INERTIAL GRAPPLE

<table>
<thead>
<tr>
<th>APPROX PET</th>
<th>(min)</th>
<th>ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>MANUAL PHASE TAKEOVER (POST-MC4) 2000 FT RANGE RATE GATE (RDOT = -3.0 FPS)</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>1700 FT RANGE RATE GATE (RDOT = -2.6 FPS)</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>1500 FT RANGE RATE GATE (RDOT = -2.3 FPS) TRANSITION TO LOWZ</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>1000 FT RANGE RATE GATE (RDOT = -1.5 FPS)</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>600 FT (RDOT = -0.8 FPS) ALLOW RDOT TO FALL TO -R/1000 FPS</td>
</tr>
<tr>
<td>5</td>
<td>31</td>
<td>200 FT (MAINTAIN RDOT = -0.2 FPS)</td>
</tr>
<tr>
<td>5</td>
<td>38</td>
<td>120 FT (ALLOW RDOT TO FALL TO -0.1 FPS)</td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>INRTL WHEN HST V1 AXIS ALIGNED WITH ORBITER -Z AXIS</td>
</tr>
<tr>
<td>7</td>
<td>51</td>
<td>35 FT GRAPPLE POSITION (FINAL LOWZ BRAKING)</td>
</tr>
<tr>
<td>7</td>
<td>53</td>
<td>STABILIZE AND GRAPPLE</td>
</tr>
</tbody>
</table>

EARTH
HST-Centered LVLH Frame

HST ATTITUDE AT GRAPPLE AS VIEWED FROM ORBITER

- HBAR
  (Y-LVLH)

GRAPPLE FIXTURE

1-7 RNDZ/125/FIN
STS-400 PROCEDURES

FLIGHT PROFILE ............................................................................................................. 2-3
TERMINAL PHASE AND +RBAR APPROACH ............................................................. 2-4
UNGRAPPLE AND -VBAR SEPARATION ................................................................... 2-5
RENDEZVOUS OPS ...................................................................................................... 2-7
SSOR ACTIVATION ...................................................................................................... 2-9
RENDZVOUS TIMELINE ............................................................................................ 2-10
STS-400 RBAR APPROACH .................................................................................. CC 2-29
RELEASE OPS ............................................................................................................ 2-31
STS-125 RELEASE PREP .......................................................................................... 2-33
STS-125 RELEASE ..................................................................................................... 2-35
RELEASE T/L .............................................................................................................. 2-41
FLIGHT PROFILE

TERMINAL PHASE AND +RBAR APPROACH

<table>
<thead>
<tr>
<th>APPROX. PET (min)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 0</td>
<td>MANUAL PHASE TAKEOVER (POST-MC4) 2000 FT RANGE RATE GATE (RDOT = -3.0 FPS)</td>
</tr>
<tr>
<td>2 1700 FT RANGE RATE GATE (RDOT = -2.6 FPS)</td>
<td></td>
</tr>
<tr>
<td>3 3 1500 FT RANGE RATE GATE (RDOT = -2.3 FPS)</td>
<td></td>
</tr>
<tr>
<td>3 8 1000 FT RANGE RATE GATE (RDOT = -1.5 FPS)  TRANSITION TO LOWZ</td>
<td></td>
</tr>
<tr>
<td>4 13 600 FT RANGE RATE GATE (RDOT = -0.8 FPS) ALLOW RDOT TO FALL TO -R/1000 FPS</td>
<td></td>
</tr>
<tr>
<td>5 31 200 FT RANGE RATE GATE (MAINTAIN RDOT = -0.2 FPS)</td>
<td></td>
</tr>
<tr>
<td>5 38 120 FT RANGE RATE GATE (ALLOW RDOT TO FALL TO -0.1 FPS)</td>
<td></td>
</tr>
<tr>
<td>6 51 35 FT GRAPPLE POSITION (FINAL LOWZ BRAKING)</td>
<td></td>
</tr>
<tr>
<td>7 53 GRAPPLE WITH BOTH VEHICLES IN FREE DRIFT</td>
<td></td>
</tr>
</tbody>
</table>

EARTH
Atlantis-Centered LVLH Frame
UNGRAPPLE AND -VBAR SEPARATION

**EVENTS**

<table>
<thead>
<tr>
<th>PHASE ET (min)</th>
<th>EVENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td><strong>UNGRAPPLE</strong>: AT SUNRISE + 2 MIN; ATLANTIS IN AUTO/PRI TAIL ONLY WITH LARGE DEADBANDS AND RESCUE ORBITER IN FREE DRIFT</td>
</tr>
<tr>
<td>1 0</td>
<td><strong>SEP1</strong>: DAP A9/LVLH/VERN; 0.2 FPS +Z NORMZ RETROGRADE BURN</td>
</tr>
<tr>
<td>2 5</td>
<td><strong>SEP2</strong>: 3.0 FPS +Z NORMZ RETROGRADE BURN</td>
</tr>
<tr>
<td>6</td>
<td>SELECT INRTL</td>
</tr>
</tbody>
</table>
This Page Intentionally Blank
SSOR ACTIVATION

R14:C  1. √cb MNA UHF EVA – cl
       √MNC UHF EVA – cl

O6   2. √UHF SPLX/EVA PWR AMP – OFF
       √SPLX/EVA XMIT FREQ: 259.7/414.2
       √EVA STRING: 1
       MODE – EVA

A1R  3. AUD CTR UHF A/G 1 (2) – T/R

4. Perform voice checks as required after SSORs are within communicating range (less than 30,000 feet)

   SM 76 COMMUNICATIONS

   √SSOR FRM SYNC 1 – YES

5. MCC uplinks PCMMU/PDI/OIU configurations as required
AFT FLT STATION CONFIG FOR RNDZ

O14.16E

A6U

ADI ATT - LVLH
ERR - MED
RATE - MED
SENSE - minus Z

R13

\KU ANT - GND

A1U

\PWR - ON
sel - MAN SLEW
MODE - RDR PASSIVE
RADAR OUTPUT - HI
CNTL - PNL
SIG STRENGTH sel - KU
SLEW RATE - as reqd

A2

DIGI-DIS sel - R/RDOT
X-PNTR SCALE - X1

SM ANTENNA

CRT

SELF TEST - ITEM 7 EXEC (+)

NOTE

SELF TEST runs about 3 min

A1U

\KU SCAN WARN tb - gray
\TRACK tb - gray
\SEARCH tb - gray

A2

\RANGE - 888.8
DIGI-DIS sel - EL/AZ

CRT

SELF TEST - ITEM 7 EXEC (no +)

A1U

KU MODE - COMM
sel - GPC
CNTL - CMD

Install:
-Z COAS
RCS BURN
KU OPS
APPROACH

Cue Card
Cue Card
Cue Card

RENDZVOUS TIMELINE
RENDEZVOUS TIMELINE

**PET**

- **03:00**
  - CDR: AFT FLT STATION CONFIG FOR RNDZ
  - PLT: RNDZ OPS INITIALIZATION

- **02:55**
  - MS (125 and 400)
  - Perform SSOR ACTIVATION, steps 1 and 2, 2-9

- **02:50**
  - If NH reqd:
    - If –X RCS, Perform –X RCS NH Burn
    - If +X RCS burn, Perform RCS BURN, steps 1-5 (Cue Card)
    - If OMS BURN, Perform RNDZ OMS BURN, steps 1-4 (CONTINGENCY OPS), 5-4
  - Postburn DAP: A/LVLH/VERN(ALT)

- **02:45**
  - MCC UPDATE
    - Final NH Burn Pad, 3-3 (if reqd)

- **02:40**
  - MCC UPLINK
    - ORB SV
    - TGT SV
    - Drag K-factor

- **02:35**
  - RNDZ OPS INITIALIZATION
    - √ DPS Config for Rndz Ops - String 1233
    - SM 2 TIME
      - Set SM TIMER counting to Ti TIG per burn Pad, 3-6
      - Config DAP A,B to A7,B7
      - Record nominal TIGs in burn solution blocks per Execute Package:
        - MCC TIG pg 2-17
        - MC1 TIG pg 2-23
        - MC2 TIG pg 2-24
    - GNC 55 GPS STATUS
      - DES RCVR, ITEM 27 - (+)
      - INH GPS to G&C, ITEM 33 - (+)
      - NAV, ITEM 36 - (+)

- **02:30**
  - PERFORM -X RCS NH BURN
    - GNC UNIV PTG
      - CRT TGT ID +2
      - BODY VECT +5
      - Ref Values for NH
        - P +100
        - Y +0
        - OM +0
      - C3 TRK - ITEM 19 EXEC (CUR - +)
        - DAP: A/AUTO/ALT (BALT as reqd)
        - When in burn attitude, Perform RCS BURN, steps 1 thru 5 (Cue Card)
RENDEZVOUS TIMELINE

02:30
A7(B7)

TIG-5 MIN

02:25

If reqd, NH TIG
Postburn DAP: A/LVLH/VERN(ALT)

02:20

02:15
PLT
ENABLE RENDEZVOUS NAV [13A]

MS
\PGSCs setup per PGSC Usage Chart (if available) or UTILITY OUTLET PLUG-IN
PLAN ORBIT CONFIGURATION (REF DATA FS, UTIL_PWR)

PLT
On RPOP PGSCs:
MS
Perform RPOP INITIALIZATION (RNDZ TOOLS), 7-15, then
Perform RPOP OPS (RNDZ TOOLS), 7-16, then
Perform TCS ACTIVATION, step 1 (RNDZ TOOLS), 7-14

02:10

MS
Perform HHL CHECKOUT (RNDZ TOOLS), 7-14

02:05

02:00

MCC UPDATE
Final NC Burn Pad, 3-5

ENABLE RENDEZVOUS NAV [13A]

1. GNC-33 REL NAV
CRT
RNDZ NAV ENA - ITEM 1 EXEC (+)
< S TRK, ITEM 12 - (+)

2. GNC-34 ORBIT TGT
TGT NO - ITEM 1 +1 EXEC
Set BASE TIME to Ti TIG, (Ti Burn Pad, 3-6)
LOAD - ITEM 26 EXEC
MNVR TO BIASED +YLV +ZVV

Config DAP A,B to TBD, TBD

GNC UNIV PTG

CRT TGT ID +2
BODY VECT +5
P +90
Y +70
OM +270

DAP: B/AUTO/ALT
TRK - ITEM 19 EXEC

When MNVR cmplt:
DAP: A/AUTO/VERN(ALT)
2-00 RNDZ/400/FIN

**RENDEZVOUS TIMELINE**

**02:00**
- **CDR LOAD TARGET TRACK [15A]**
- **NOTE**
  - If NH performed, delay mnvr to NC burn attitude
  - until NC TIG - 5 min to minimize attitude mnvr

- **CDR**
  - If -X RCS, Perform -X RCS NC Burn [15B]
  - Perform RCS BURN steps 1-5 (Cue Card)

- **If OMS BURN**, Perform RNDZ OMS BURN steps 1-4 (CONTINGENCY OPS), 5-4

**01:55**
- **125 CDR** If prop available, perform MNVR TO BIASED, +YLV, +ZVV [14A]

**01:50**
- **TIG-5 MIN**

**01:45**
- **CDR INITIATE TARGET TRACK [15C]**

**01:40**
- **TIG-5 MIN**

**01:35**
- **CDR INITIATE TARGET TRACK [15C]**

**01:30**
- **PLT TARGET NCC BURN [17A]** (Preliminary), 2-17

**01:40**
- **PLT STAR TRACKER NAV [16A]**

**01:40**
- **PLT**
  - **STAR TRACKER NAV [16A]**

**01:40**
- **MC UPDATE**
  - **STAR TRK NAV IMU DES** [16A], 2-16

**01:40**
- **PERFORM -X RCS NC BURN [15B]**

**01:40**
- **CDR LOAD TARGET TRACK [15A]**

**01:40**
- **LOAD TARGET TRACK [15A]**
  - <DAP: A/LVLH/VERN(ALT)>
  - GNC UNIV PTG
  - MNVR TO BIASED, +YLV, +ZVV [14A]

**01:40**
- **CRT**
  - **TGT ID** +1
  - **Z AXIS** -Y STRK
  - **BODY VECT** +4 (-Z) +4
  - **P** +90 +90
  - **Y** +0 +280.57
  - **OM** +0 +90

**01:40**
- **Do not INITIATE TARGET TRACK [15C] until post NC**

**01:40**
- **PERFORM -X RCS NC BURN [15B]**

**01:40**
- **CDR LOAD TARGET TRACK [15A]**

**01:40**
- **LOAD TARGET TRACK [15A]**
  - <DAP: A/LVLH/VERN(ALT)>
  - GNC UNIV PTG
  - **MNVR TO BIASED, +YLV, +ZVV [14A]**

**01:40**
- **CRT**
  - **TGT ID** +2
  - **BODY VECT** +5
  - **Per PAD**
  - **Ref Values for NC**
    - **P** +100
    - **Y** +0
    - **OM** +0

**01:40**
- **C3 TRK - ITEM 19 EXEC (CUR - *)**
  - **DAP: A/AUTO/ALT (B/ALT as reqd)**

**01:40**
- **When in burn attitude,**
  - Perform RCS BURN steps 1 thru 5 (Cue Card)

**01:40**
- **INITIATE TARGET TRACK [15C]**

**01:40**
- **INITIATE TARGET TRACK [15C]**
  - **GNC UNIV PTG**
  - **MNVR TO BIASED, +YLV, +ZVV [14A]**

**01:40**
- **PERFORM -X RCS NC BURN [15B]**

**01:40**
- **CDR LOAD TARGET TRACK [15A]**

**01:40**
- **LOAD TARGET TRACK [15A]**
  - <DAP: A/LVLH/VERN(ALT)>
  - GNC UNIV PTG
  - **MNVR TO BIASED, +YLV, +ZVV [14A]**

**01:40**
- **CRT**
  - **TGT ID** +1
  - **Z AXIS** -Y STRK
  - **BODY VECT** +4 (-Z) +4
  - **P** +90 +90
  - **Y** +0 +280.57
  - **OM** +0 +90

**01:40**
- **Do not INITIATE TARGET TRACK [15C] until post NC**

**01:40**
- **PERFORM -X RCS NC BURN [15B]**

**01:40**
- **CDR LOAD TARGET TRACK [15A]**

**01:40**
- **LOAD TARGET TRACK [15A]**
  - <DAP: A/LVLH/VERN(ALT)>
  - GNC UNIV PTG
  - **MNVR TO BIASED, +YLV, +ZVV [14A]**

**01:40**
- **CRT**
  - **TGT ID** +2
  - **BODY VECT** +5
  - **Per PAD**
  - **Ref Values for NC**
    - **P** +100
    - **Y** +0
    - **OM** +0

**01:40**
- **C3 TRK - ITEM 19 EXEC (CUR - *)**
  - **DAP: A/AUTO/ALT (B/ALT as reqd)**

**01:40**
- **When in burn attitude,**
  - Perform RCS BURN steps 1 thru 5 (Cue Card)

**01:40**
- **INITIATE TARGET TRACK [15C]**

**01:40**
- **INITIATE TARGET TRACK [15C]**
  - **GNC UNIV PTG**
  - **MNVR TO BIASED, +YLV, +ZVV [14A]**

**01:40**
- **PERFORM -X RCS NC BURN [15B]**

**01:40**
- **CDR LOAD TARGET TRACK [15A]**

**01:40**
- **LOAD TARGET TRACK [15A]**
  - <DAP: A/LVLH/VERN(ALT)>
  - GNC UNIV PTG
  - **MNVR TO BIASED, +YLV, +ZVV [14A]**

**01:40**
- **CRT**
  - **TGT ID** +1
  - **Z AXIS** -Y STRK
  - **BODY VECT** +4 (-Z) +4
  - **P** +90 +90
  - **Y** +0 +280.57
  - **OM** +0 +90

**01:40**
- **Do not INITIATE TARGET TRACK [15C] until post NC**

**01:40**
- **PERFORM -X RCS NC BURN [15B]**

**01:40**
- **CDR LOAD TARGET TRACK [15A]**

**01:40**
- **LOAD TARGET TRACK [15A]**
  - <DAP: A/LVLH/VERN(ALT)>
  - GNC UNIV PTG
  - **MNVR TO BIASED, +YLV, +ZVV [14A]**

**01:40**
- **CRT**
  - **TGT ID** +2
  - **BODY VECT** +5
  - **Per PAD**
  - **Ref Values for NC**
    - **P** +100
    - **Y** +0
    - **OM** +0

**01:40**
- **C3 TRK - ITEM 19 EXEC (CUR - *)**
  - **DAP: A/AUTO/ALT (B/ALT as reqd)**

**01:40**
- **When in burn attitude,**
  - Perform RCS BURN steps 1 thru 5 (Cue Card)
**RENDZVOUS TIMELINE**

1. **CONFIG FOR STRK NAV**
   - DAP: A/AUTO/VERN(ALT)
   - Turn down cabin lights to optimize target viewing through -Z COAS/overhead window
   - IMU for Deselct _____ (If no comm, use IMU 1 for deselct)

   **GNC 21 IMU ALIGN**

   **CRT IMU DES** - ITEM 7(8,9) EXEC (+)

   **GNC 33 REL NAV**
   - If first NAV pass, SV SEL, ITEM 4 - PROP
   - If previous NAV, SV SEL, ITEM 4 - FLTR
   - INH Angles, ITEM 24 (+)
   - S TRK, ITEM 12 (+)

   **GNC 22 S TRK/COAS_CNTL**
   - Z(-Y) TGT TRK - ITEM 6(5) EXEC (+)
   - STATUS - blank
   - SHUTTER - op

2. **INITIAL MEASUREMENT EVALUATION**

   **GNC 22 S TRK/COAS_CNTL**
   - When S PRES - (+), continue

   **GNC 33 REL NAV**
   - Monitor RESID V and H each NAV cycle for at least four consecutive cycles (~30 sec)

   Record init RESID V = _______ _______ _______ _______ 
   H = _______ _______ _______ _______

   If RESID V or H changes by > 0.05 each cycle:
   - **GNC 22 S TRK/COAS_CNTL**
     - Z(-Y) BREAK TRK - ITEM 8(7) EXEC
     - Repeat Step 2
   - If RESID V or H > 0.6:
     - **GNC 22 S TRK/COAS_CNTL**
       - Z(-Y) BREAK TRK - ITEM 8(7) EXEC

3. **INCORPORATE DATA INTO NAV**
   - If SV SEL = PROP:
     - AUTO Angles - ITEM 23 EXEC (+)
       - Record 1st SV UPDATE POS = _______ _______ _______ _______

       When SV UPDATE POS < 1.0 and Angle ACPT > 9:
         - SV SEL - ITEM 4 EXEC (FLTR) >>

   - If SV = FLTR:
     - FLTR TO PROP - ITEM 8 EXEC
     - AUTO Angles - ITEM 23 EXEC (+)
       - Record 1st SV UPDATE POS = _______ _______ _______ _______

   * If FLTR MINUS PROP changes by more than 8 kft within a S TRK pass: *
   * Perform S TRK NAV - HIGH FLTR MINUS PROP *
   * (CONTINGENCY OPS), 5-9 *

**END S TRK NAV**

- **GNC 33 REL NAV**
  - INH Angles - ITEM 24 EXEC (+)

- **GNC 21 IMU ALIGN**
  - IMU DES - ITEM 7(8,9) EXEC (no +)
TARGET NCC BURN [17A]

MCC UPDATE
Nav Selected IMU

MCC UPDATE
Ground NCC Burn Solution

When NAV converged (SV UPDATES small and stable):

CDR  TARGET NCC BURN [17A] (Intermediate)

- TIG-17 MIN

- TIG-10 MIN  γMCC for burn type  * If no comm
  * If ΔVT > 6 fps:
    * END S TRK NAV [168]
    * TARGET NCC BURN [17A] (Final)
    * Perform RNDZ OMS BURN (CONTINGENCY OPS), 5-4
  * If ΔVT > 4 fps:
    * END S TRK NAV [168]
    * TARGET NCC BURN [17A] (Final)
    * Perform  +X Burn, RCS BURN (Cue Card)

- TIG-5 MIN

- PLT TARGET NCC BURN [17A] (Final)

- PLT  Perform RCS BURN (Cue Card)

- CDR  Perform RCS BURN (Cue Card)

- NCC TIG

FINAL SOLUTION
OPS 202 FPO
GNC ORBIT MNVR EXEC
√ Eng Sel CORRECT

CRT  √ SV SEL correct
GNC 34 ORBIT TGT
TGT NO - ITEM 1 +2 EXEC
√ TGT Set data:
T1 TIG = NCC BURN SOLUTION TIG
EL  +0.0
ΔT  +60.1
ΔX  -48.6
ΔY  +0.0
AZ  +1.2
COMPUTE T1 - ITEM 28 EXEC
Record solution in PAD

FINAL SOLUTION
If > 40 marks in current sensor pass and
SV UPDATE POS < 0.5 for the last 4 marks:
| Burn FLTR soln |
If FLTR within ground solution limits:
| Burn FLTR soln |
If PROP within ground solution limits:
| Burn PROP soln |
If none of the above:
Burn ground soln EXT ΔV

NCC BURN SOLUTION

TIG

PRELIMINARY

INTERMEDIATE

FINAL

GROUND

FINAL - GROUND LIMITS

ΔVX  

ΔVY  

ΔVZ  

ΔVT  

(0.6)

(1.5)

(2.5)

RENEZVOUS TIMELINE

2-17
**RENDEZVOUS TIMELINE**

**PET**

- **00:00**
  - PLT TARGET TI BURN [19A] (Preliminary)
  - MCC UPDATE RNDZ PRPLT PAD

- **00:05**
  - **RR NAVIGATION [19B]**
    - CRT RR - ITEM 13 EXEC (+)
    - Elev, Az approx 0
    - Record Initial RESID RANGE = _____ RDOT = _____

- **00:15**
  - If no lock-on by 10 minutes after initial search:
    - MS KU OPS, step 2 (Cue Card)

- **00:40**
  - PLT Perform RR NAVIGATION [19B]

- **00:45**
  - When RR RNG < 135 KFT:
    - MS KU OPS, step 1 (Cue Card)

**PLT**

- **00:35**
  - When NAV converged (SV UPDATES small and stable):
    - TARGET TI BURN [19A] (Intermediate)

- **00:55**
  - **TARGET TI BURN [19A]**
    - CRT √SV SEL correct
    - GNC 34 ORBIT TGT
    - TGT NO - ITEM 1 +1 0 EXEC
    - √TGT Set data:
      - T1 TIG = BASE TIME
      - EL +0
      - AT +80.1
      - AX -0.9
      - AY +0
      - AZ +1.8
    - COMPUTE T1 - ITEM 28 EXEC
    - Record solution in PAD

**MCC UPDATE**

- RNDZ PRPLT PAD
<table>
<thead>
<tr>
<th>PREL FLTR</th>
<th>INTER FLTR</th>
<th>FINAL FLTR</th>
<th>GND</th>
<th>PROP (If Req'd)</th>
<th>FINAL - GROUND LIMITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VX (0.9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VY (1.3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>VZ (1.2)</td>
</tr>
</tbody>
</table>

FINAL Ti Burn Pad, 3-7
RENDEZVOUS TIMELINE

- **00:00**
  - Ti TIG

- **00:05**
  - TIG-5
  - If Ti is multi-axis burn:
    - CDR: Perform RCS BURN (Cue Card)

- **00:10**
  - CDR: Perform Ti DELAY BURN (CONTINGENCY OPS), 5-17

- **00:15**
  - PLT
  - TARGET Ti BURN [21A] (Final)
  - If Ti is multi-axis burn, delay final targeting until TIG-5

- **00:20**
  - CDR: Perform Ti DELAY BURN (CONTINGENCY OPS), 5-17
  - If GO for Ti not received by TIG-5 or RNDZ DELAY called by MCC
  - If Ti is +X RCS burn:
    - CDR: Perform RCS BURN (Cue Card)
  - If Ti is OMS BURN:
    - Perform RNDZ OMS BURN (CONTINGENCY OPERATIONS), 5-4

- **00:25**
  - Ti DELAY Soln, MCC UPDATE

- **00:30**
  - A7(B7)

- **MCC UPDATE**
  - MCC for burn type. If no comm:
    - If \( \Delta V_T > 6 \), at TIG-17:
      - Perform RNDZ OMS BURN (CONTINGENCY OPERATIONS), 5-4
    - If \( 4 \leq \Delta V_T \leq 6 \), at TIG-17:
      - Perform +X RCS burn, RCS BURN (Cue Card)
    - If \( \Delta V_T < 4 \), at TIG-5:
      - Perform multi-axis RCS burn, RCS BURN (Cue Card)

- **00:40**
  - MCC UPDATE
  - GO for Ti

- **PET**
  - 00:30
  - A7(B7)

- **TARGET Ti BURN** [21A] (Final)

- **CRT**
  - OPS 202 PRO
  - GNC ORBIT MNRV EXEC
  - Load Eng Sel. TVR, WT and Trims for Ti per Final Ti Burn Pad
  - LOAD - ITEM 22 EXEC
  - GNC 33 REL NAV
  - SV SEL correct
  - GNC 34 ORBIT TGT
  - TGT NO - ITEM 1 +1 0 EXEC
  - TGT Set data:
    - Ti TIG = BASE TIME
    - EL +0
    - \( \Delta T \) +80.1
    - \( \Delta X \) -0.9
    - \( \Delta Y \) +0
    - \( \Delta Z \) +1.8
  - COMPUTE Ti - ITEM 28 EXEC

- **FINAL SOLUTION**
  - Record solution in PAD
  - If > 40 marks in current sensor pass and
    - SV UPDATE POS < 0.5 for the last 4 marks:
      - Burn FLTR soln
    - FLTR within ground solution limits:
      - Burn FLTR soln
    - PROP within ground solution limits:
      - Burn PROP soln
    - none of the above:
      - Burn ground soln EXT \( \Delta V_s \)
RENDEZVOUS TIMELINE

POST Ti NAV

A6U: √DAP: A/AUTO/VERN(ALT)
A1U: √KU sel - GPC

<table>
<thead>
<tr>
<th>GNC 33 REL NAV</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF SV SEL = FLTR:</td>
</tr>
<tr>
<td>FLTR TO PROP - ITEM 8 EXEC (*)</td>
</tr>
<tr>
<td>√AUTO Angles - ITEM 23 EXEC (*)</td>
</tr>
</tbody>
</table>

| If RR NOT Tracking TGT: |
| √Inhibit Data |
| Perform KU OPS, steps 2 and 3 (Cue Card) |
| If still no RR ACQ, assume RR Fail |

| GNC 22 S TRK/COAS_CNTL |
| Z TGT TRK - ITEM 6 EXEC (*) |

| CRT |
| Z TGT TRK ATT - ITEM 8 EXEC (*) |

IF RR FAIL

| √-Z Star Tracker: |
| √-Z TGT TRK ATT, then: |
| Perform STAR TRACKER NAV [16A] |

| √COAS NAV: |
| √-Z TGT TRK ATT, then: |
| Perform COAS NAVIGATION (CONTINGENCY OPS), 5-10 |

| √-Y Star Tracker: |
| (GNC UNIV PtG) |
| TGT ID +1 |
| BODY VECT +4 |
| P √0 |
| Y √+280.57 |
| OM +90 |
| DAP: B/AUTO/ALT |
| TRK - ITEM 19 EXEC |
| When MNVR cmplt: |
| √DAP: A/AUTO/VERN(ALT) |
| Perform STAR TRACKER NAV [16A] |
**RENTOYVOS TIMELINE**

**PET**

**PLIT**
00:00
TARGET MC1 BURN 23A (Preliminary)

**CDR**
00:05
When MNVR to att omnip:
POST T1 NAV 22A

**MS1**
00:10
POISED FOR CAPTURE POSITION (PDRS, NOMINAL STS 125 OPS)

When NAV converged, (SV UPDATES small and stable):
TARGET MC1 BURN 23A (Intermediate)

√Time of OOP null

00:15

TIG-3 MIN

**PLIT**
00:20
TARGET MC1 BURN 23A (Final)
Perform RCS BURN ( Cue Card)

**MC 1 TIG**

**PLIT**
00:25
When Y = 0:
MANUAL OUT-OF-PLANE NULL 25A

126 CDR
If power available, turn on payload bay lights

**A6L**
LTS TRUSS AFT, FWD (two) - ON
VEST PORT, STBD (two) - ON

**TARGET MC1 BURN 23A**

**CRT**
√SV SEL correct

**GNC 34 ORBIT TGT**

**TGT NO - ITEM 1 +1 1 EXEC**

**TGT Set data:**

T1 TIG = MC1 BURN SOLUTION TIG

EL 0
ΔT +60.1
ΔX -0.9
ΔY +0
ΔZ -1.8

**COMPUTE T1 - ITEM 28 EXEC**

Record solution in PAD

**TARGET MC1 BURN SOLUTION**

**TIG**

**PRELIMINARY**

ΔVX ( )
ΔVY ( )
ΔVZ ( )
ΔVT ( )

**INTERMEDIATE**

ΔVX ( )
ΔVY ( )
ΔVZ ( )
ΔVT ( )

**FINAL**

ΔVX ( )
ΔVY ( )
ΔVZ ( )
ΔVT ( )

**MEAN ± (3σ VARIATION)**

0.0 ± (0.5)
0.1 ± (0.5)
0.0 ± (1.2)

**TARGET MC2 23B** (Preliminary)

**CRT**
√SV SEL correct

**GNC 34 ORBIT TGT**

**TGT NO - ITEM 1 +2 2 EXEC**

**TGT Set data:**

T1 TIG = MC2 BURN SOLUTION TIG

EL +30.25
ΔT +27.0
ΔX -0.9
ΔY +0
ΔZ -1.8

**COMPUTE T1 - ITEM 28 EXEC**

**NOTE**

If TGT EL ANG Alarm,
ΔV still valid for current TIG,
TIG slip limits still apply

Record solution in PAD
TARGET MC 2 BURN (Intermediate)

CFT  $\sqrt{SV}$ SEL correct

GNC 34 ORBIT TGT
TGT NO - ITEM 1 +1 2 EXEC
COMPUTE T1 - ITEM 26 EXEC
Record solution in PAD

TARGET MC 2 BURN (Final)

CFT  $\sqrt{SV}$ SEL correct

GNC 34 ORBIT TGT
TGT NO - ITEM 1 +1 2 EXEC
COMPUTE T1 - ITEM 26 EXEC
$\sqrt{TIG}$ change

IF TIG CHANGE < 3 OR > +7 MIN
Set BASE TIME to (Nominal MC 2 TIG -3 or +7 min as appropriate)
LOAD - ITEM 26 EXEC
TGT NO - ITEM 1 +1 2 EXEC
$\sqrt{TIG}$ Set data:
T1 TIG = BASE TIME
EL = +0
$\Delta T = +27.0$
$\Delta X = -0.9$
$\Delta Y = +0$
$\Delta Z = +1.8$
COMPUTE T1 - ITEM 26 EXEC

Set EVENT TIMER counting to MC 2 TIG
Record solution in PAD

GNC 33 REL NAV

CFT FLTR TO PROP - ITEM 8 EXEC

-2 AXIS TARGET TRACK (24C)

CFT  GNC UNIV PTC
$\sqrt{TGT}$ ID +1
BODY VECT +3 (-2)
OM +0
CS DAP: B/AUTO/ALT
CFT TRK - ITEM 19 EXEC (CUR + *)
When MNVR cmplt, DAP: A/AUTO/VERNL(ALT)

CCTV CONFIG (24D)

A7U VID OUT - MON 1
IN - A
OUT - MON 2
IN - B
Aim A at B and B at A at full zoom in
PANTILT - RESET
For both camrs:
PAN = 0.0 deg
TILT = 90.0 deg
Repeat for Camrs C & D

RENEZVOS TIMELINE
**Rendezvous Timeline**

**MC 3 BURN SOLUTION**

- **TIG**: [ ] / [ ]

- **PRELIMINARY**
  - \( \Delta V_x \) ( ) [ ] [ ] [ ] [ ]
  - \( \Delta V_y \) ( ) [ ] [ ] [ ] [ ]
  - \( \Delta V_z \) ( ) [ ] [ ] [ ] [ ]
  - \( \Delta V_T \) ( ) [ ] [ ] [ ] [ ]

- **FINAL**
  - [ ] [ ] [ ] [ ]
  - [ ] [ ] [ ] [ ]
  - [ ] [ ] [ ] [ ]
  - [ ] [ ] [ ] [ ]

- **MEAN \pm 3\sigma**
  - \( \Delta V_x \): 0.0 \pm 0.5
  - \( \Delta V_y \): 0.1 \pm 0.5
  - \( \Delta V_z \): 0.0 \pm 1.2

---

**MC2 ET**

- 100:10
  - MS: Perform TCS ACTIVATION, steps 2-4 (FIND0 TOOL), 7-18 (Set AUTO AGG to 10,000 ft)
  - SSP2: DSGN NEY PWR - ON (to - gray)

- 00:05
  - TIG: 5 MINT
  - PLT: TARGET MC 2 BURN [25A] (Final)
  - Perform RCS BURN (Cue Card)

---

**MC 2 TIG**

- 00:05
  - PLT: TARGET MC 2 BURN [25A] (Preliminary)

- 00:55
  - PLT: TARGET MC 3 BURN [25B] (Preliminary)

---

**PLT**

- 00:35
  - When NAV converged (SV UPDATES small and stable):
    - TARGET MC 2 BURN [24A] (Intermediate)

- 00:40
  - END STAR TRACKER NAV [24E]

---

**PET**

- 00:30
  - IF S TRK NAV,
    - At Sunset
  - PLT: END STAR TRACKER NAV [24E]

- 00:45
  - MS (125 and 400): Perform SSOR ACTIVATION, steps 3 and 4, 2-9

---

**TARGET MC 3**

- 00:00
  - PLT: TARGET MC 3 BURN [25B] (Preliminary)

- 00:55
  - IF - Y STRK TRACK
    - Z AXIS TARGET TRACK [24C]

---

**MC 3 BURN SOLUTION**

**PRELIMINARY**

- \( \Delta V_x \)
- \( \Delta V_y \)
- \( \Delta V_z \)
- \( \Delta V_T \)

**FINAL**

- \( \Delta V_x \)
- \( \Delta V_y \)
- \( \Delta V_z \)
- \( \Delta V_T \)

**MEAN \pm 3\sigma**

- \( \Delta V_x \): 0.0 \pm 0.5
- \( \Delta V_y \): 0.1 \pm 0.5
- \( \Delta V_z \): 0.0 \pm 1.2
RADAR FAIL PROCEDURE 26A

Note: At sunrise, report TGT Tally-Ho to MCC MS if TGT outside COAS reticle, config CCTV as reqd to measure vertical position

1. AT MC2 TIG+14:00 (MC3 TIG-3:00):
   PLT TARGET MC3 [268] (final)
   CDR Perform RCS BURN, steps 1 thru 5 (Cue Card), then:
   AT MC2+18 IF NO VISUAL ACQUISITION OR
   TARGET > 30 DEG FROM COAS HORIZONTAL
   CDR Go to RNDZ BREAKOUT (CONTINGENCY OPS), 5-16 >>
   AGU FLT CNTLR PWR - ON
   VSENSE - Z
   DAP: A/AVLH/PRI
   \COAS for TGT vertical position
   THC: \+X or -X per COAS LOGIC:
   If TGT N deg high in COAS, perform 2N +X (up) pulses
   if TGT N deg low in COAS, perform 1N -X (down) pulses
   DAP: A/AVLH/VERN(PRI)
   Inform MCC of TGT vertical position in COAS and number of pulses performed
   Following radar fail X correction,
   THC: As reqd to control out-of-plane motion and manage ROOT
   Perform CONFIG FOR RBAR [276]

2. AT MC2 TIG + 19:00:
   CRT TRK - ITEM 19 EXEC (CUR - )
   AGU DAP: A/AUTOVERN (PRI)
   THC: As reqd to stabilize and maintain TGT between 0 deg and 10 deg
   high in COAS
   AT 2000 ft:
   Perform STS 400 RBAR APPROACH (Cue Card)

LATE RADAR NAV 268

GNC 33 REL NAV
CRT FLTR TO PROP - ITEM 8 EXEC
\SV SEL, ITEM 4 - PROP
\VR - ITEM 13 EXEC (+)
AUTO RING - ITEM 17 EXEC (+)
DROT - ITEM 20 EXEC (+)
Angles - ITEM 23 EXEC (+)
Go to RADAR FAIL PROCEDURE 20A

MC 4 BURN SOLUTION

<table>
<thead>
<tr>
<th>PRELIMINARY</th>
<th>FINAL</th>
<th>MEAN ± 3σ VARIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔVX</td>
<td>( )</td>
<td>*</td>
</tr>
<tr>
<td>ΔVY</td>
<td>( )</td>
<td>*</td>
</tr>
<tr>
<td>ΔVZ</td>
<td>( )</td>
<td>*</td>
</tr>
<tr>
<td>ΔVT</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

RENEZVOUS TIMELINE

2-26
RENDEZVOUS TIMELINE

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>01:00</td>
<td>PET</td>
</tr>
<tr>
<td>01:05</td>
<td>IF NO RR INTO NAV</td>
</tr>
<tr>
<td>01:10</td>
<td>CDR Go to RADAR FAIL PROCEDURES</td>
</tr>
<tr>
<td>01:15</td>
<td>PLT TIG-3 MIN</td>
</tr>
<tr>
<td>01:20</td>
<td>CDR CONFIG FOR RBAR</td>
</tr>
<tr>
<td>01:25</td>
<td>MS Perform HHL OPS (RNDZ TOOLS), 7-14</td>
</tr>
<tr>
<td>01:30</td>
<td>CDR ESTABLISH RBAR Go to STS-400 RBAR APPROACH</td>
</tr>
<tr>
<td>01:35</td>
<td>MANUAL TRAJECTORY CONTROL</td>
</tr>
<tr>
<td>01:40</td>
<td>PLT TARGET MC 4 BURN (Final)</td>
</tr>
<tr>
<td>01:45</td>
<td>CDR ESTABLISH RBAR (Cue Card)</td>
</tr>
</tbody>
</table>

TARGET MC 4 BURN

CRT

<table>
<thead>
<tr>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>√SV SEL correct</td>
</tr>
<tr>
<td>TGT NO - ITEM 1 +1 4 EXEC</td>
</tr>
</tbody>
</table>

TGT Set data:
- T1 TIG = BASE TIME + 0:00:27.00
- EL = +13.0
- ΔX = +0
- ΔY = +0
- ΔZ = +0.6

COMPUTE T1 - ITEM 28 EXEC
Record solution in PAD

CONFIG FOR RBAR

CRT

<table>
<thead>
<tr>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERR TOT - ITEM 23 EXEC (*)</td>
</tr>
</tbody>
</table>

When ERR <2 deg each axis
- Config DAP A,B to A8,B8

ER TOT - ITEM 23 EXEC (*)

When ERR <2 deg each axis
- Config DAP A,B to A8,B8

Do not initiate Target Track until ESTABLISH RBAR

ESTABLISH RBAR

CRT

<table>
<thead>
<tr>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRK - ITEM 19 EXEC (CUR - *)</td>
</tr>
</tbody>
</table>

DAP: A/AUTO/VERN(PRI)

THC: as reqd to control TGT motion in COAS

MNVR 125 ORBITER TO GRAPPLE ATTITUDE

CRT

<table>
<thead>
<tr>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>Config DAP A,B to A8,B8</td>
</tr>
</tbody>
</table>

Y = +0
DAP: B/AUTO/ALT
TRK - ITEM 19 EXEC

When MNVR comp:
DAP: A/AUTO/VERN(ALT), LO Z
## STS-400 RBAR APPROACH

<table>
<thead>
<tr>
<th>CG to CG RNG (ft)</th>
<th>RDOT (ft/s)</th>
<th>MC2 ET h:mm:ss</th>
<th>DAP</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>-3.0</td>
<td>0:27:00</td>
<td>A6/B8 AUTO/VERN (PRI)</td>
<td>If RDOT falls below value for next gate, THC: -Z (in) as reqd to maintain RDOT</td>
</tr>
<tr>
<td>1700</td>
<td>-2.6</td>
<td>0:29:00</td>
<td></td>
<td>1990 HHL Report</td>
</tr>
<tr>
<td>1600</td>
<td>-2.3</td>
<td>0:30:00</td>
<td></td>
<td>1690 HHL Report</td>
</tr>
<tr>
<td>1000</td>
<td>-1.5</td>
<td>0:34:30</td>
<td>LO Z</td>
<td>990 HHL Report</td>
</tr>
<tr>
<td>800</td>
<td>-0.8</td>
<td>0:40:30</td>
<td>A9,B9</td>
<td>790 HHL Report</td>
</tr>
<tr>
<td>500</td>
<td>-0.5</td>
<td>0:41:30</td>
<td></td>
<td>490 HHL Report</td>
</tr>
<tr>
<td>400</td>
<td>-0.4</td>
<td>0:44:30</td>
<td></td>
<td>390 HHL Report</td>
</tr>
<tr>
<td>300</td>
<td>-0.3</td>
<td></td>
<td></td>
<td>290 HHL Report</td>
</tr>
<tr>
<td>300 (EE-GF:269)</td>
<td>-0.3</td>
<td>0:51:30</td>
<td></td>
<td>HHL RNG (to Airlock) 282</td>
</tr>
<tr>
<td>200</td>
<td>-0.2</td>
<td>0:58:00</td>
<td>C/L Camera Full Zoom</td>
<td>223 HHL Report</td>
</tr>
<tr>
<td>150</td>
<td>-0.2</td>
<td>1:02:00</td>
<td>Configure Camera B/C with EE at bottom</td>
<td>173</td>
</tr>
<tr>
<td>120</td>
<td>-0.20</td>
<td>1:05:00</td>
<td>Perform CONFIGURE KU FOR COMM ( Cue Card, KU OPS)</td>
<td>143</td>
</tr>
<tr>
<td>100</td>
<td>-0.1</td>
<td>1:07:00</td>
<td>Configure Camera B/C centered on the RMS EE</td>
<td>123 HHL Report</td>
</tr>
<tr>
<td>50</td>
<td>-0.1</td>
<td>1:18:00</td>
<td>When Airlock fills full zoom C/L camera: THC: as required to null motion</td>
<td>73 HHL Report</td>
</tr>
<tr>
<td>-5</td>
<td>0.0</td>
<td>1:19:00</td>
<td>When Airlock fills full zoom C/L camera: THC: as required to null motion</td>
<td>28 Ready to grapple</td>
</tr>
</tbody>
</table>

### BRAKING GATES

- **CG to CG RNG (ft)**
- **RDOT (ft/s)**
- **MC2 ET h:mm:ss**
- **DAP**
- **COMMENTS**

### TERMINATE RNDZ OPS

- **CDR A6U**
  - **FLT CNTRL PWR – OFF**

- **MS**
  - Perform HHL STOW (RNDZ TOOLS), 7-14
  - EXIT RPOP – [SHIFT][F10]
  - Perform TCS DEACTIVATION (RNDZ TOOLS), 7-20
  - Z COAS – OFF

- **SSP2**
  - DRGNEYE PWR – OFF (tb-bp)

### PLT

- **GNC 33 REL NAV**
  - RNDZ NAV ENA – ITEM 1 EXEC (no *)

- **GNC 55 GPS STATUS**
  - DES RCVR – ITEM 27 (no *)

- **GNC 22 S TRK/COAS CNTRL**
  - Z(Y) STAR TRK – ITEM 4(3) EXEC (*)

- **GNC 23 RCS**
  - RCS F – ITEM 1 EXEC (*)
  - F1U – ITEM 17 EXEC (*)
  - F3U – ITEM 19 EXEC (*)
  - F2U – ITEM 21 EXEC (*)

- **DAP: A15/ALT**
- **DAP: LV/LH**
This Page Intentionally Blank
NOTE
To be completed before leaving STS-125 Vehicle

1. POWERUPS
As reqd, perform
PRIORITY PWRUP GRP C (OPCL, PRIORITY PWRDN)

2. CONFIGURE FREE DRIFT DAP
   √DAP: FREE
   GNC 20 DAP CONFIG
   ITEM 2 + 8 EXEC
   ITEM 31 + 4 0 EXEC
   ITEM 38 + 5 EXEC
   ITEM 42 + 1 0 EXEC
   DAP: B/AUTO/PRI

3. CONFIGURE OMS ENGINES FOR DISPOSAL
   L,R OMS HE PRESS/VAP ISOL (two) A – OP
   (two) B – GPC
   OMS ENG (two) – ARM/PRESS

4. UPDATE ORBITER WEIGHT
   √MCC: Predicted Orbiter Weight at Release
   GNC OPS 202 PRO
   GNC ORBIT MNVR EXEC
   Update Orbiter weight
   √PEG 7 not all zero and TIG in future
   ITEM 22 – LOAD
   OPS 201 PRO

5. CONFIGURE GPS FOR RELEASE
   Perform GPS PWRUP (ORBIT OPS, GNC)

6. CONFIGURE IDPs FOR COMMANDING
   C2
   √IDP/CRT 1,2 (two) PWR – ON, major function to GNC
   R11
   IDP/CRT 4 PWR – ON, major function to GNC

   1: GNC UNIV PTG 2: GNC 20 DAP CONFIG

7. MCC CHECK COMMANDING CONFIG
   √1: GNC UNIV PTG (DSM 20102 to the GNC if reqd)
   √2: GNC 20 DAP CONFIG (DSM 20103 to the GNC if reqd)
   4: GNC 23 RCS (DSM 20130 to the GNC)
MCC
Verify STS125 Ready for Release and Separation

Install -Z COAS

1. CAMR SETUP
A7
√ PL BAY FLOODS FWD, MID, AFT (six) – as reqd

P/TV03 RELEASE (PHOTO/TV FS, SCENES) perform SETUP

2. ADI SETUP
A6U
ADJ ATT — LVLH
ERR — MED
RATE — LO
SENSE: -Z

O14:E, √ cb DDU (six) – cl
O15:E,
O16:E

3. KU RDR SETUP
A1U
√ KU CNTL — CMD
√ PWR — OFF
MODE — RDR PASSIVE
RADAR OUTPUT — LO
sel — GPC
√ SIG STRENGTH sel — KU
SLEW RATE — as reqd

A2
DIGI-DIS sel — R/RDOT
√ X-PNTR SCALE — X1
SM ANTENNA
√ RDR RNG AUTO (ITEM 16) — (*)

4. UPDATE ORBITER WEIGHT
GNC, OPS 202 PRO

GNC ORBIT MNVR EXEC
Load WT — ITEM 9 + ________ EXEC
√ PEG 7 not all zero and TIG in future
LOAD – ITEM 22 EXEC
GNC, OPS 201 PRO
5. **RMS SETUP**

**ATTITUDE HOLD/EVA posn**

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
<th>Z</th>
<th>PITCH</th>
<th>YAW</th>
<th>ROLL</th>
<th>PL ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>-878</td>
<td>0</td>
<td>-964</td>
<td>0</td>
<td>0</td>
<td>180</td>
<td>3</td>
</tr>
</tbody>
</table>

\[\sqrt{\phantom{0}}\]

<table>
<thead>
<tr>
<th>SY</th>
<th>SP</th>
<th>EP</th>
<th>WP</th>
<th>WY</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>-63.8</td>
<td>+58.6</td>
<td>-29.9</td>
<td>+33.9</td>
<td>-12.8</td>
<td>-47.4</td>
</tr>
</tbody>
</table>

\[\sqrt{\phantom{0}}\]

**SAFING** tb – gray

6. **ENABLE RNDZ NAV**

<table>
<thead>
<tr>
<th>GNC 33 REL NAV</th>
</tr>
</thead>
<tbody>
<tr>
<td>ORB TO TGT – ITEM 10 EXEC</td>
</tr>
<tr>
<td>RNDZ NAV ENA – ITEM 1 EXEC (*)</td>
</tr>
</tbody>
</table>

\[\sqrt{\phantom{0}}\]

**SV SEL** (ITEM 4) – PROP

\[\sqrt{\phantom{0}}\]

**INH RNG** (ITEM 18) – (*)

\[\sqrt{\phantom{0}}\]

**RDOT** (ITEM 21) – (*)

\[\sqrt{\phantom{0}}\]

**Angles** (ITEM 24) – (*)

\[\sqrt{\phantom{0}}\]

**RR** – ITEM 13 EXEC (*)

7. **MNVR TO RELEASE ATTITUDE**

<table>
<thead>
<tr>
<th>GNC UNIV PTG</th>
</tr>
</thead>
</table>

\[\sqrt{\phantom{0}}\]

**TGT ID** +2

\[\sqrt{\phantom{0}}\]

**BODY VECTOR** +2

\[\sqrt{\phantom{0}}\]

**OM** +180

\[\sqrt{\phantom{0}}\]

**DAP:** A/AUTO/ALT

**TRK** – ITEM 19 EXEC (CUR - *)

When in Attitude:

**DAP:** VERN
<table>
<thead>
<tr>
<th><strong>RMS</strong></th>
<th><strong>STS-400 Orbiter</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RELEASE</strong></td>
<td><strong>RELEASE</strong></td>
</tr>
</tbody>
</table>
| M 1a. RELEASE PREPS  
On MCC GO for Release:  
\checkmark VTR Recording | M 1b. RELEASE PREPS  
\checkmark ATT ERR < 5 deg  
\checkmark RATES:  
ROLL, YAW ≤ 0.070 deg/sec  
PITCH: -0.004 ≤ RATE ≤ +0.136 deg/sec  
AFT FLT CNTRL PWR – ON  
SSP2 DRGNEYE PWR – ON (tb-gray) |

-03:00 |
### RMS

<table>
<thead>
<tr>
<th>M 2a. RELEASE</th>
</tr>
</thead>
</table>
| * If Single Joint, execute starred block Manual Release below, *
| * SEP 1 will maneuver RMS clear *

- RHC/A8U
  - RATE – VERN (RATE MIN tb-ON)
  - BRAKES – OFF (tb-OFF)
  - A8U
    - MODE – END EFF, ENTER

#### CAUTION
Monitor EE tb timing to prevent EE motor burnout

- If manual release reqd:
  - EE MODE – MAN
  - EE MAN CONTR – DERIGID (hold until DERIGID tb-gray, 5 sec max)
  - RELEASE sw – depress (hold until OPEN tb-gray, 3 sec max)
  - Mnvr arm 5 ft (minimum) clear
  - EE MAN CONTR – DERIGID (hold until EXTEND tb-gray, 20 sec max)
  - EE MODE – OFF

### STS-400 Orbiter

<table>
<thead>
<tr>
<th>M 2b. RELEASE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GNC 33 REL NAV</strong></td>
</tr>
<tr>
<td>ORB TO TGT – ITEM 10 EXEC</td>
</tr>
</tbody>
</table>
| If VRCS, *
| DAP: FREE |
| If ALT, *
| DAP: FREE |
| -:01:00 |
| -:00:30 |

- If Single Joint, after Manual Release, *
- execute SEP 1 in FREE DRIFT to maneuver RMS clear

#### GNC 20 DAP CONFIG
Change DAP A,B to A9,B9
DAP: A(FREE/VERN(PRI))
DAP TRANS: PULSE/PULSE/PULSE, No LO Z

- SM 169 PDRS STATUS
<table>
<thead>
<tr>
<th>RMS</th>
<th>STS-400 Orbiter</th>
</tr>
</thead>
<tbody>
<tr>
<td>:00:00 RHC</td>
<td>-:00:00</td>
</tr>
</tbody>
</table>

EE MODE – AUTO
RELEASE sw – depress (mom)

When OPEN tb – gray, mnvr arm 5 ft (minimum) clear of grapple pin

A8U CRITICAL TIMES (28-sec total):
- DERIGID tb – gray, 5-sec max, then OPEN tb – gray, 3-sec max, then EXTEND tb – gray, 20-sec max

When clear of GF pin:
EE MODE – OFF
BRAKES – ON (tb-ON)

If STS-125 Not Released
- BRAKES – OFF (tb-OFF)
Perform BACKUP RELEASE
(PDRS, MISCELLANEOUS PROCEDURES)

Non-time critical:
- SM 94 PDRS CONTROL
  PL ID – ITEM 3 + 0 EXEC
  INIT ID – ITEM 24 + 0 EXEC

ASAP

3. SEP 1 BURN
When RMS motion has stopped:
DAP: A/LVLH/VERN(PRI)

- If Single Joint,
- DAP: FREE

AFT THC: +Z(out) 4 pulses (0.2 fps)
Record MET: ___/___:___:___ (burn init)
Report TIG to MCC

DAP: A/LVLH/VERN(PRI)

4. SEP 2 BURN
At SEP 1 TIG +5 min:
DAP TRANS: PULSE/PULSE/NORM
AFT THC: +Z(out) 8 sec (3.0 fps)
Record MET: ___/___:___:___ (burn init)

AFT FLT CNTRL PWR – OFF
Report TIG to MCC
DAP TRANS: PULSE/PULSE/PULSE
DAP: A/INRTL/VERN(ALT)
## RMS

### ACTIONS COMPLETE

- **5. RADAR ACQUISITION**
  - √ Range ≥ 100 ft
  - GNC 33 REL NAV
  - KU ANT ENA – ITEM 2 EXEC (*)
  - GNC I/O RESET

  **A1U**
  - √ KU RADAR OUTPUT – LO
  - sel – GPC
  - MODE – RDR PASSIVE
  - CNTL – PNL (wait 3 sec)
  - PWR – ON

  **A2**
  - √ DIGI-DIS SEL – R/RDOT

  **A1U**
  - * If no lock within 2 min:
  - * KU sel – AUTO TRACK
  - * SLEW ELEV – as seen in COAS
  - * AZ – as seen in COAS
  - * √ EL, AZ angles < 30 deg
  - * KU SEARCH – SEARCH (tb-gray)
  - * Repeat slew and search as reqd
  - * If acquisition not successful, √ MCC

- **6. RR NAVIGATION**
  - √ KU TRACK tb – gray
  - GNC 33 REL NAV
  - RR (ITEM 13) – (*)

  **A1U**
  - * If RATIO > 1.0,
  - * √ MCC

  AUTO RNG – ITEM 17 EXEC (*)
  RDOT – ITEM 20 EXEC (*)
  Angles – ITEM 23 EXEC (*)

When SV UPDATE POS < 0.03 and MARK ACPT > 9, SV SEL – ITEM 4 EXEC (FLTR)

When R > 600 ft,

**A1U**
- KU RDR OUTPUT – HI
<table>
<thead>
<tr>
<th><strong>RMS</strong></th>
<th><strong>STS-400 Orbiter</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>When R &gt; 1000 ft,</td>
<td></td>
</tr>
</tbody>
</table>
| 7. **-Z TARGET TRACK** | GNC UNIV PTG
TGT ID + 1
BODY VECTOR + 3
OM + 180
TRK – ITEM 19 EXEC (CUR - *)
DAP: A/AUTO/VERN(ALT) |
| 8. **P/TV DEACTIVATION** | Go to P/TV03 HST RELEASE, DEACTIVATION (PHOTO/TV FS, SCENES) |
| 9. **CONFIG KU FOR COMM** | When RANGE > 5000 FT:
GNC 33 REL NAV
INH RNG – ITEM 18 EXEC (*)
RDOT – ITEM 21 EXEC (*)
Angles – ITEM 24 EXEC (*)
KU ANT ENA – ITEM 2 EXEC (no *) |
| A1U | KU MODE – COMM
\`SEL – GPC
CNTL – CMD |
| A2 | DIGI-DIS SEL – EL/AZ |
| SSP2 | DRGNEYE PWR – OFF (tb-bp) |

Actions Complete

Return to Timeline
NOTE:
This is the timeline for the STS-400 Release, Separation and Disposal of the STS-125 vehicle.
**MCC UPDATE**

**Release Time**

**Set Release Timer**

**Nominal:**

**Backup:**

Set SM and GNC timers counting down to release time

**Configure STS-125 RCS Jets for Release**

**MCC Uplink:**

Jet reselects

- **RCS F – Item 1 EXEC** (DSM 20131 to the GNC, IDP 4)
- **F1U – Item 17 (no *)** (DSM 20132 to the GNC, IDP 4)
- **F3U – Item 19 (no *)** (DSM 20133 to the GNC, IDP 4)
- **F2U – Item 21 (no *)** (DSM 20134 to the GNC, IDP 4)
- **RCS L – Item 2 EXEC** (DSM 20135 to the GNC, IDP 4)
- **L4U – Item 17 (no *)** (DSM 20136 to the GNC, IDP 4)
- **L2U – Item 19 (no *)** (DSM 20137 to the GNC, IDP 4)
- **L1U – Item 21 (no *)** (DSM 20138 to the GNC, IDP 4)
- **RCS R – Item 3 EXEC** (DSM 20139 to the GNC, IDP 4)
- **R4U – Item 17 (no *)** (DSM 20140 to the GNC, IDP 4)
- **R2U – Item 19 (no *)** (DSM 20141 to the GNC, IDP 4)
- **R1U – Item 21 (no *)** (DSM 20142 to the GNC, IDP 4)
- **RESUME** (DSM 20102 to the GNC, IDP 4)
**STS-125/STS-400 RELEASE TIMELINE**

**PET**

- **01:00**
  - **00:55**
    - **00:50**
      - **00:45**
        - **00:40**
          - **00:35**
            - **00:30**

**MCC UPDATE**

- **ORB SV**
  - **TGT SV**
- **MCC UPLINK**
  - Configure TFL for TCS operations

**CONFIGURE RCS JETS FOR RELEASE**

- **45A**
  - **RCS F – ITEM 1 EXEC (+)**
  - **F1U - ITEM 17 (no *)
  - **F3U - ITEM 19 (no *)
  - **F2U - ITEM 21 (no *)**

**CONFIGURE GPS FOR RELEASE**

- **45B**
  - Perform GPS PWRUP (ORBIT OPS, GNC)
    - **GNC 55 GPS STATUS**
      - **DES RCVR - ITEM 27 EXEC (no +)**
      - **INH GPS to G&C - ITEM 33 EXEC (+)**
      - **NAV - ITEM 36 EXEC (+)**

**CONFIGURE TCS FOR SEPARATION**

- **45C**
  - √ PGSCs setup per PGSC Usage Chart (if available) or UTILITY OUTLET PLUG-IN PLAN ORBIT CONFIGURATION (REF DATA FS, UTIL PWR)
    - **NOTE:** power PGSCs via source not on MAIN B (example: A15 connector)
  - On RPOP PGSCs:
    - Perform RPOP INITIALIZATION (RENDZVOUS, RNDZ TOOLS), 7-15 then:
      - Perform RPOP OPS (RENDZVOUS, RNDZ TOOLS), 7-16, then:
        - In RPOP, set POR - ORB DP to TGT DP, then:
          - set TGT attitude to LVLH TO TGT BODY 90,0,0 PYR, then:
            - Perform TCS ACTIVATION, steps 1 thru 3 (RENDZVOUS, RNDZ TOOLS), 7-16, then:
              - Perform TCS MANUAL ACQUISITION (RENDZVOUS, RNDZ TOOLS), 7-19
                - set RANGE = 4 ft, AZIMUTH = 0, ELEVATION = 0
  - **SIM-188**

If reflector installed on STS-125

**CONFIGURE TCS FOR SEPARATION**

- **45C**

**MCC: Verify STS-125 Ready for Release and Separation**

**Perform RELEASE PREP, 2-33**
2-48

UNGRAPPLE AND -VBAR SEPARATION

<table>
<thead>
<tr>
<th>PHASE ET (min)</th>
<th>EVENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>UNGRAPPLE: AT SUNRISE + 2 MIN; ATLANTIS IN AUTO/PRI TAIL ONLY WITH LARGE DEADBANDS AND RESCUE ORBITER IN FREE DRIFT</td>
</tr>
<tr>
<td>1</td>
<td>SEP1: DAP A9/LVLH/VERN; 0.2 FPS +Z NORMZ RETROGRADE BURN</td>
</tr>
<tr>
<td>2</td>
<td>SEP2: 3.0 FPS +Z NORMZ RETROGRADE BURN</td>
</tr>
<tr>
<td>6</td>
<td>SELECT INRTL</td>
</tr>
</tbody>
</table>

EARTH
Atlantis-Centered LVLH Frame
STS-125/STS-400 RELEASE TIMELINE

- **MCC UPDATE**
  - STS-125 Orbiter vent (DSM 42601)

- **STS-400 Separation Complete**
  - STS-400 crew and MCC team Return to Flight Plan>>
  - STS-125 MCC Team continue with Release/Disposal Timeline
ST-125/STS-400 RELEASE TIMELINE

01:00
PET

D/O BURN

-00:30
MCC: MANEUVER TO DISPOSAL BURN ATTITUDE

01:05
-00:25

01:10
-00:20

01:15
-00:15

01:20
-00:10

01:25
-00:05

01:30
00:00
DISPOSAL BURN

MCC UPDATE
Orbiter SV (DSM 40101)

MANEUVER TO DISPOSAL BURN ATTITUDE

MCC uplink: OPS 202 PRO (DSM 20121 to the GNC, IDP1)
MCC uplink: disposal burn/deorbit targets
MCC uplink: load target and maneuver to burn attitude:

MNVR EXEC

EXECUTE DISPOSAL BURN

EXEC (DSM 20124 to the GNC, IDP1)

NOTE: Disposal burn may be performed later to optimize trajectory
2-55

STS-125/STS-400 RELEASE TIMELINE

PET  D/O BURN
02:00
01:30
01:35
01:40
01:45
01:50
01:55
02:00

MCC: When Disposal burn complete, if reqd. MANEUVER STS-125 TO POST BURN ATTITUDE [55A]

00:40
00:35
00:30
00:25
00:20
00:15
00:10
00:05
00:00

MANEUVER STS-125 TO POST BURN ATTITUDE [55A]

If maneuver required after disposal burn:
MCC: OPS 201 PRO (DSM 20125 to the GNC, IDP1)

Configure disposal attitude (-XLV -ZVV):
GNC UNIV PTG
ITEM 8 + 2 EXEC (DSM 20126 to the GNC, IDP1)
ITEM 14 + 2 EXEC (DSM 20127 to the GNC, IDP1)
ITEM 17 + 1 EXEC (DSM 20128 to the GNC, IDP1)
ITEM 19 EXEC (DSM 20119 to the GNC, IDP1)
MANEUVER PADS
### FINAL ORBIT MANEUVER PAD FOR NH

#### BURN ATT
- R: 24
- P: 25
- Y: 26

#### TRIM LOAD
- P: 6
- LY: 7
- RY: 8

#### TV ROLL
- WT: 9
- TIG: 10

#### RCS SEL
- 4

#### NOTES
- 3-3

#### OMS BOTH
- 1

#### L
- 2

#### R
- 3

#### RCS SEL
- 4

#### TV ROLL
- 5

#### TRIM LOAD
- P: 6
- LY: 7
- RY: 8

#### WT
- 9

#### TIG
- 10

#### TGT PEG 7
- ΔVX: 19
- ΔVY: 20
- ΔVZ: 21

#### OMS GMBL CK:
- PRE
- POST-BURN

#### RCS I’CNCT:
- L PRI
- L SEC
- R PRI
- R SEC
- NONE

#### DOWN MODE OPTIONS:
- 2 OMS → 1 OMS
- 1 OMS → RCS
- NONE

#### ORBIT BURN MONITOR
- GPC FILL-INS
- CRIT BURN
- NON-CRIT BURN

#### MAX TIG SLIP
- MIN

---

**NOTES**

---

**3-3**

**RNDZ/125/FIN**
# Preliminary Orbit Maneuver Pad for NC

## Notes

### Trim Load
- **P**: 6
- **LY**: 7
- **RY**: 8

### RCS Selection
- **RCS SEL**: 4

### TV Roll
- **TV ROLL**: 5

### TRIM Load
- **TRIM LOAD**: P 6, LY 7, RY 8

### WT
- **WT**: 9

### TIG
- **TIG**: 10

### TGT Peg
- **TGT PEG**: 7
  - **ΔVX**: 19
  - **ΔVY**: 20
  - **ΔVZ**: 21

## Burn Attitude

### Burn Attitude
- **R**: 24
- **P**: 25
- **Y**: 26

### ΔVTOT

### TGO

### OMS GMBL CK:
- **L PRI**: Pre-Postburn
- **L SEC**: Pre-Postburn
- **R PRI**: Pre-Postburn
- **R SEC**: Pre-Postburn
- **NONE**: Pre-Postburn

### RCS I'CNCT:
- **L OMS → RCS**
- **R OMS → RCS**
- **NONE**

### Down Mode Options:
- **2 OMS → 1 OMS**
- **1 OMS → RCS**
- **NONE**

### Orbit Burn Monitor
- **GPC FILL-INS**
- **CRIT BURN**
- **NON-CRIT BURN**

### Notes
- **MAX TIG SLIP**
- **DO NOT UPDATE TIG**
- **UPDATE TIG AFTER**

---

**NOTES**
**FINAL ORBIT MANEUVER PAD FOR NC**

<table>
<thead>
<tr>
<th>OMS BOTH</th>
<th>L</th>
<th>2</th>
<th>R</th>
<th>3</th>
<th>RCS SEL</th>
<th>4</th>
<th>TV ROLL</th>
<th>5</th>
<th>TRIM LOAD</th>
<th>P</th>
<th>6</th>
<th>LY</th>
<th>7</th>
<th>RY</th>
<th>8</th>
<th>WT</th>
<th>9</th>
<th>TIG</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>+X</th>
<th>-X</th>
<th>MULTI-AXIS</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>BURN ATT</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
</tr>
<tr>
<td>P</td>
</tr>
<tr>
<td>Y</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ΔVTOT</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGO</td>
</tr>
</tbody>
</table>

| VGO X |
|       |
| ( )   |

| VGO Y |
|       |
| ( )   |

| VGO Z |
|       |
| ( )   |

<table>
<thead>
<tr>
<th>HA</th>
</tr>
</thead>
<tbody>
<tr>
<td>HP</td>
</tr>
</tbody>
</table>

| TGT |
|     |
| ( ) |

<table>
<thead>
<tr>
<th>OMS GMBL CK:</th>
</tr>
</thead>
<tbody>
<tr>
<td>L PRI</td>
</tr>
<tr>
<td>L SEC</td>
</tr>
<tr>
<td>R PRI</td>
</tr>
<tr>
<td>R SEC</td>
</tr>
<tr>
<td>NONE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RCS I’CNCT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>L OMS → RCS</td>
</tr>
<tr>
<td>R OMS → RCS</td>
</tr>
<tr>
<td>NONE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DOWN MODE OPTIONS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 OMS → 1 OMS</td>
</tr>
<tr>
<td>1 OMS → RCS</td>
</tr>
<tr>
<td>NONE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ORBIT BURN MONITOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPC FILL-INS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OMS HE REG TEST:</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>-X RCS BURNS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>BURN ATT</td>
</tr>
<tr>
<td>LVLH ATT</td>
</tr>
<tr>
<td>P</td>
</tr>
<tr>
<td>Y</td>
</tr>
<tr>
<td>OM 17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NOTE:</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX TIG SLIP</td>
</tr>
<tr>
<td>DO NOT UPDATE TIG</td>
</tr>
<tr>
<td>UPDATE TIG AFTER</td>
</tr>
</tbody>
</table>

3-5

RNDZ/125/FIN
### Preliminary Orbit Maneuver Pad for Ti

#### Burn Attitude
- **BURN ATT**
  - **R** 24
  - **P** 25
  - **Y** 26

#### ΔVTOT
- **TGO**
  - ___.

#### VGO
- **X** (___) ___.
- **Y** (___) ___.
- **Z** (___) ___.

#### OMS GMBL CK:
- **L PRI**
- **L SEC**
- **R PRI**
- **R SEC**

#### Notes
- **ΔVTOT**
- **TGO**
- **RCS I’CNCT:**
  - **L OMS → RCS**
  - **R OMS → RCS**
  - **NONE**

#### Down Mode Options:
- **2 OMS → 1 OMS**
- **1 OMS → RCS**

#### Orbit Burn Monitor
- **GPC FILL-INS** __ (___)
- **CRIT BURN**
- **NON-CRIT BURN**

#### ORBIT BURN MONITOR
- **GPC FILL-INS** __ (___)
- **CRIT BURN**
- **NON-CRIT BURN**

#### Burn Delay
- **τ**
- **ΔVTOT**
- **TGO**

#### Burn Timer
- **TGT**
  - (___)

#### Trim Load
- **P** 6
- **LY** 7
- **RY** 8

#### Trim Load
- **WT** 9

#### Turn Roll
- **TIG** 10

#### TGT Peg
- **ΔX** 19
- **ΔY** 20
- **ΔZ** 21

#### TGT Peg
- **ΔX** 19
- **ΔY** 20
- **ΔZ** 21

#### New Ti (Basetime)
- **ΔX** 19
- **ΔY** 20
- **ΔZ** 21

#### New Ti (Basetime)
- **ΔX** 19
- **ΔY** 20
- **ΔZ** 21

#### Notes
- **TIG SLIP:**
  - If Ti not started by nominal TIG + ___ min, go to Ti DELAY, 5-17
  - Max Ti DELAY TIG slip ___ min

- **DO NOT UPDATE TIG:**
- **UPDATE TIG AFTER ___ MIN**
| ORBIT MANEUVER PAD FOR ____________ |

<table>
<thead>
<tr>
<th>OMS BOTH</th>
<th>L 2</th>
<th>RCS SEL</th>
<th>R 3</th>
<th>TV ROLL</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>MULTI-AXIS</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TRIM LOAD</th>
<th>P 6</th>
<th>LY 7</th>
<th>RY 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(   )</td>
<td>(   )</td>
<td>(   )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WT 9</th>
<th>TIG 10</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TGT PEG 7</th>
<th>ΔVX 19</th>
<th>ΔVY 20</th>
<th>ΔVZ 21</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(   )</td>
<td>(   )</td>
<td>(   )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BURN ATT</th>
</tr>
</thead>
<tbody>
<tr>
<td>R 24</td>
</tr>
<tr>
<td>P 25</td>
</tr>
<tr>
<td>Y 26</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ΔVTOT</th>
<th>TGO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VGO X</th>
<th>VGO Y</th>
<th>VGO Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>(     )</td>
<td>(     )</td>
<td>(     )</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HA</th>
<th>HP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OMS GMBL CK:</th>
</tr>
</thead>
<tbody>
<tr>
<td>L PRI</td>
</tr>
<tr>
<td>L SEC</td>
</tr>
<tr>
<td>R PRI</td>
</tr>
<tr>
<td>R SEC</td>
</tr>
<tr>
<td>NONE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RCS I’CNCT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>L OMS → RCS</td>
</tr>
<tr>
<td>R OMS → RCS</td>
</tr>
<tr>
<td>NONE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DOWN MODE OPTIONS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 OMS → 1 OMS</td>
</tr>
<tr>
<td>1 OMS → RCS</td>
</tr>
<tr>
<td>NONE</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ORBIT BURN MONITOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPC FILL-INS __ (   )</td>
</tr>
<tr>
<td>CRIT BURN</td>
</tr>
<tr>
<td>NON-CRIT BURN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MAX TIG SLIP ___ MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO NOT UPDATE TIG</td>
</tr>
<tr>
<td>UPDATE TIG AFTER ___ MIN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ORBIT BURN MONITOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPC FILL-INS __ (   )</td>
</tr>
<tr>
<td>CRIT BURN</td>
</tr>
<tr>
<td>NON-CRIT BURN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MAX TIG SLIP ___ MIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO NOT UPDATE TIG</td>
</tr>
<tr>
<td>UPDATE TIG AFTER ___ MIN</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOP CL</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOP CL</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OMS HE REG TEST:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
<tr>
<td>B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>-X RCS BURNS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>BURN ATT</td>
</tr>
<tr>
<td>LVLH ATT</td>
</tr>
<tr>
<td>P 15</td>
</tr>
<tr>
<td>Y 16</td>
</tr>
<tr>
<td>OM 17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>L</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOP CL</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>OMS BOTH</td>
</tr>
<tr>
<td>L</td>
</tr>
<tr>
<td>R</td>
</tr>
<tr>
<td>RCS SEL</td>
</tr>
<tr>
<td>TV ROLL</td>
</tr>
</tbody>
</table>

| TRIM LOAD |   |   |   |   |
| P          | 6 | ( ) | . |   |
| LY         | 7 | ( ) | . |   |
| RY         | 8 | ( ) | . |   |
| WT         | 9 |   |   |   |
| TIG        | 10 | / | : | : | . |

| TGT PEG 7 |   |   |   |   |
| ΔVX 19    | ( ) |   | . |   |
| ΔVY 20    | ( ) |   | . |   |
| ΔVZ 21    | ( ) |   | . |   |

**ORBIT MANEUVER PAD FOR _________**

**BURN ATT**
- R 24
- P 25
- Y 26

**AVTOT**

**TGO**

**VGO X ( ) .**

**VGO Y ( ) .**

**VGO Z ( ) .**

**OBS GMBL CK:**
- L PRI
- L SEC
- R PRI
- R SEC
- NONE

**RCS I’CNCT:**
- L OMS → RCS
- R OMS → RCS
- NONE

**DOWN MODE OPTIONS:**
- 2 OMS → 1 OMS
- 1 OMS → RCS
- NONE

**GPC FILL-INS**

**CRIT BURN**

**NON-CRIT BURN**

**ORBIT BURN MONITOR**

**MAX TIG SLIP ___ MIN**

**DO NOT UPDATE TIG**

**UPDATE TIG AFTER ___ MIN**
### ORBIT MANEUVER PAD FOR

<table>
<thead>
<tr>
<th>Control</th>
<th>Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMS BOTH</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>RCS SEL</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>TV ROLL</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>TRIM LOAD</td>
<td>P</td>
<td>6</td>
</tr>
<tr>
<td>LY</td>
<td>7</td>
<td>( ) .</td>
</tr>
<tr>
<td>RY</td>
<td>8</td>
<td>( ) .</td>
</tr>
<tr>
<td>WT</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>TGT PEG</td>
<td>7</td>
<td>ΔVX</td>
</tr>
<tr>
<td>ΔVY</td>
<td>20</td>
<td>( ) .</td>
</tr>
<tr>
<td>ΔVZ</td>
<td>21</td>
<td>( ) .</td>
</tr>
</tbody>
</table>

### BURN ATT

<table>
<thead>
<tr>
<th>Axis</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>R</td>
<td>24</td>
</tr>
<tr>
<td>P</td>
<td>25</td>
</tr>
<tr>
<td>Y</td>
<td>26</td>
</tr>
</tbody>
</table>

### ΔVTOT

<table>
<thead>
<tr>
<th>Target</th>
<th>Status</th>
</tr>
</thead>
</table>

### TGO

<table>
<thead>
<tr>
<th>Target</th>
<th>Status</th>
</tr>
</thead>
</table>

### OMS GMBL CK:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>L PRI</td>
<td></td>
</tr>
<tr>
<td>L SEC</td>
<td></td>
</tr>
<tr>
<td>R PRI</td>
<td></td>
</tr>
<tr>
<td>R SEC</td>
<td></td>
</tr>
<tr>
<td>NONE</td>
<td></td>
</tr>
</tbody>
</table>

### RCS I’CNCT:

- L OMS → RCS
- R OMS → RCS
- NONE

### DOWN MODE OPTIONS:

- 2 OMS → 1 OMS
- 1 OMS → RCS
- NONE

### ORBIT BURN MONITOR

- GPC FILL-INS __ ( __ )
- CRIT BURN
- NON-CRIT BURN

### ORBIT HE REG TEST:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Status</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>L OP CL</td>
<td></td>
<td>NONE</td>
</tr>
<tr>
<td>R OP CL</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### MAX TIG SLIP __ MIN

- DO NOT UPDATE TIG
- UPDATE TIG AFTER __ MIN
### ORBIT MANEUVER PAD FOR ___________

<table>
<thead>
<tr>
<th>OMS BOTH</th>
<th>L 2</th>
<th>R 3</th>
<th>RCS SEL 4</th>
<th>TV ROLL 5</th>
<th>TRIM LOAD</th>
<th>P 6</th>
<th>LY 7</th>
<th>RY 8</th>
<th>WT 9</th>
<th>TIG 10</th>
<th>TGT PEG 7</th>
<th>ΔVX 19</th>
<th>ΔVY 20</th>
<th>ΔVZ 21</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>+X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>MULTI-AXIS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### BURN ATT

- R 24
- P 25
- Y 26

#### VGO

- X ( )
- Y ( )
- Z ( )

#### ΔVTOT

- TGO :  

#### OMS GMBL CK:

- PRE
- POST-BURN

#### RCS I’CNCT:

- L OMS → RCS
- R OMS → RCS
- NONE

#### DOWN MODE OPTIONS:

- 2 OMS → 1 OMS
- 1 OMS → RCS
- NONE

#### ORBIT BURN MONITOR

- CRIT BURN
- NON-CRIT BURN

#### NOTES

- MAX TIG SLIP ___ MIN
- DO NOT UPDATE TIG
- UPDATE TIG AFTER ___ MIN
ORBIT MANEUVER PAD FOR __________

OMS BOTH 1
L  2
R  3
RCS SEL 4
TV ROLL 5

TRIM LOAD  P 6
LY 7
RY 8
WT 9
TIG 10

TGT PEG 7
ΔVX 19
ΔVY 20
ΔVZ 21

Burn Att
R 24
P 25
Y 26

ΔVTOT
TGO

BURN ATT

VGO X ( )
VGO Y ( )
VGO Z ( )

DO NOT UPDATE TIG
UPDATE TIG AFTER ___ MIN

OMS GMBL CK:
L PRI
L SEC
R PRI
R SEC
NONE

RCS I'CNCT:
L OMS → RCS
R OMS → RCS
NONE

DOWN MODE OPTIONS:
2 OMS → 1 OMS
1 OMS → RCS
NONE

GPC FILL-INS  __ ( __ )

CRIT BURN
NON-CRIT BURN

ORBIT BURN MONITOR

MAX TIG SLIP ___ MIN

NONE

-X RCS BURNS:

BURN ATT

LVLH ATT

GPC FILL-INS  __ ( __ )

LOCK LOAD

NOTES
STS-125 RENDEZVOUS TIMELINE
This Page Intentionally Blank
AFT FLT STATION CONFIG FOR RNDZ

O14,16:E  \(\text{\textmd{cb MNA,C DDU AFT (two)}}\) - cl

A6U  ADI ATT - LVLH
     ERR - MED
     RATE - MED
     SENSE - minus Z

R13  \(\text{\textmd{\textbackslash KU ANT}}\) - GND
A1U  \(\text{\textmd{\textbackslash PWR}}\) - ON
     sel - MAN SLEW
     MODE - RDR PASSIVE
     RADAR OUTPUT - HI
     CNTL - PNL
     SIG STRENGTH sel - KU
     SLEW RATE - as reqd

A2  DIGI-DIS sel - R/RDOT
     X-PNTR SCALE - X1

SM ANTENNA

CRT  SELF TEST - ITEM 7 EXEC (+)

NOTE
SELF TEST runs about 3 min

A1U  \(\text{\textmd{\textbackslash KU SCAN WARN tb}}\) - gray
     \(\text{\textmd{\textbackslash TRACK tb}}\) - gray
     \(\text{\textmd{\textbackslash SEARCH tb}}\) - gray
A2  \(\text{\textmd{\textbackslash RANGE}}\) - 888.8
     DIGI-DIS sel - EL/AZ

CRT  SELF TEST - ITEM 7 EXEC (no +)

A1U  KU MODE - COMM
     sel - GPC
     CNTL - CMD

Install:
-Z COAS
RCS BURN  Cue Card
KU OPS  Cue Card
APPROACH  Cue Card

NOTE
SELF TEST runs about 3 min

A1U  \(\text{\textmd{\textbackslash KU SCAN WARN tb}}\) - gray
     \(\text{\textmd{\textbackslash TRACK tb}}\) - gray
     \(\text{\textmd{\textbackslash SEARCH tb}}\) - gray
A2  \(\text{\textmd{\textbackslash RANGE}}\) - 888.8
     DIGI-DIS sel - EL/AZ

CRT  SELF TEST - ITEM 7 EXEC (no +)

A1U  KU MODE - COMM
     sel - GPC
     CNTL - CMD

Install:
-Z COAS
RCS BURN  Cue Card
KU OPS  Cue Card
APPROACH  Cue Card

NOTE
SELF TEST runs about 3 min

A1U  \(\text{\textmd{\textbackslash KU SCAN WARN tb}}\) - gray
     \(\text{\textmd{\textbackslash TRACK tb}}\) - gray
     \(\text{\textmd{\textbackslash SEARCH tb}}\) - gray
A2  \(\text{\textmd{\textbackslash RANGE}}\) - 888.8
     DIGI-DIS sel - EL/AZ

CRT  SELF TEST - ITEM 7 EXEC (no +)

A1U  KU MODE - COMM
     sel - GPC
     CNTL - CMD

Install:
-Z COAS
RCS BURN  Cue Card
KU OPS  Cue Card
APPROACH  Cue Card

NOTE
SELF TEST runs about 3 min

A1U  \(\text{\textmd{\textbackslash KU SCAN WARN tb}}\) - gray
     \(\text{\textmd{\textbackslash TRACK tb}}\) - gray
     \(\text{\textmd{\textbackslash SEARCH tb}}\) - gray
A2  \(\text{\textmd{\textbackslash RANGE}}\) - 888.8
     DIGI-DIS sel - EL/AZ

CRT  SELF TEST - ITEM 7 EXEC (no +)

A1U  KU MODE - COMM
     sel - GPC
     CNTL - CMD

Install:
-Z COAS
RCS BURN  Cue Card
KU OPS  Cue Card
APPROACH  Cue Card
**RENNDEZVOUS TIMELINE**

**02:30**
- CDR AFT FLT STATION CONFIG FOR RNDZ
- PLT RNDZ OPS INITIALIZATION

**02:40**
- MCC UPDATE
  - Final NH Burn Pad, 3-3 (if reqd)

**02:55**
- MCC UPLINK
  - ORB SV
  - TGT SV
  - Drag K-factor

**03:00**
- CDR AFT FLT STATION CONFIG FOR RNDZ
- PLT RNDZ OPS INITIALIZATION

---

**RNDZ OPS INITIALIZATION**

**5A**
- √ DPS Config for Rndz Ops - String 1233
- [SM 2 TIME]
  - Set SM TIMER counting to Ti TIG per burn Pad, 3-6
  - Config DAP A,B to A7,B7
- Record nominal TIGs in burn solution blocks per Execute Package:
  - NCC TIG: pg 4-11
  - MC1 TIG: pg 4-17
  - MC2 TIG: pg 4-18

**GNC 55 GPS STATUS**
- DES RCVR, ITEM 27 - (∗)
- √ INH GPS to G&C, ITEM 33 - (∗)
- NAV, ITEM 36 - (∗)

**PERFORM -X RCS NH BURN**

**5B**
- CRT TGT ID +2
- BODY VECT +5
- Ref Values for NH
  - P: +100
  - Y: +0
  - OM: +0

**C3**
- TRK - ITEM 19 EXEC (CUR - ∗)
  - DAP: A/AUTO/ALT (B/ALT as reqd)

When in burn attitude,
- Perform RCS BURN, steps 1 thru 5 (Cue Card)
RENDEZVOUS TIMELINE

**PET**

- **02:30** A7(B7)
  - TIG-5 MIN

- **02:25**
  - If reqd, NH TIG
  - Postburn DAP: A/LVLH/VERN(ALT)

- **02:20**

- **02:15** PLT
  - ENABLE RENDEZVOUS NAV [7A]
    - MS: PGSCs setup per PGSC Usage Chart (if available) or UTILITY OUTLET PLUG-IN
      - PLAN ORBIT CONFIGURATION (REF DATA FS, UTIL PWR)
    - PLT:
      - On RPOP PGSCs:
        - MS: Perform RPOP INITIALIZATION (RNDZ TOOLS), 7-15, then
        - Perform RPOP OPS (RNDZ TOOLS), 7-16, then
      - MS: Perform HHL CHECKOUT (RNDZ TOOLS), 7-14

- **02:10**

- **02:05**

- **02:00**

**ENABLE RENDEZVOUS NAV [7A]**

1. **GNC_33 REL NAV**
   - CRT: RNDZ NAV ENA - ITEM 1 EXEC (*)
   - < S TRK, ITEM 12 - (*)

2. **GNC_34 ORBIT TGT**
   - TGT NO - ITEM 1 +1 EXEC
   - Set BASE TIME to Ti TIG, (Ti Burn Pad, 3-6)
   - LOAD - ITEM 26 EXEC

**MCC UPDATE**

- Final NC Burn Pad, 3-5
PET

02:00
A7(87)

CDR LOAD TARGET TRACK 9A

NOTE
If NH performed, delay mnvr to NC burn attitude
until NC TIG - 5 min to minimize attitude mnvr

CDR If -X RCS, Perform -X RCS NC Burn 9B
If +X RCS burn, Perform RCS BURN, steps 1-5 (Cue Card)
If OMS BURN, Perform RNDZ OMS BURN, steps 1-4 (CONTINGENCY OPS), 5-4

01:55

MS Perform PI CONFIG, steps 1-4 only (PL OPS, RETRIEVAL OPS)

01:50

01:45

01:40

TIG-5 MIN

01:35

CDR INITIATE TARGET TRACK 9G

PLT TARGET NCC BURN 11A (Preliminary), 4-11

PLT STAR TRACKER NAV 10A

01:30

RENDZVOUS TIMELINE

LOAD TARGET TRACK 9A

\( \text{\textlangle DAP: A/LVLH/VERN(ALT) \rangle} \)

GNC UNIV PTG

CRT CNCL - ITEM 21 EXEC
TGT ID +1
\( \text{\textlangle Z AXIS \textlangle Y STRK \rangle} \)

BODY VECT +3 (-Z) +4
P +90 +0
Y +0 +280.57
OM +0 +90

Do not INITIATE TARGET TRACK 9B until post NC

PERFORM -X RCS NC BURN 9B

\( \text{\textlangle DAP: A/AUTO/VERN(ALT) \rangle} \)

GNC UNIV PTG

CRT TGT ID +2
BODY VECT +5
Per PAD Ref Values for NC
P ___ +100
Y ___ +0
OM ___ +0

C3 TRK - ITEM 19 EXEC (CUR - *)
DAP: A/AUTO/ALT (B/ALT as reqd)

When in burn attitude,
Perform RCS BURN, steps 1 thru 5 (Cue Card)

\( \text{\textlangle DAP: A/AUTO/VERN(ALT) \rangle} \)

GNC UNIV PTG

CRT TGT ID +1
\( \text{\textlangle Z AXIS \textlangle Y STRK \rangle} \)

BODY VECT +3 (-Z) +4
P +90 +0
Y +0 +280.57
OM +0 +90

INITIATE TARGET TRACK 9G

\( \text{\textlangle DAP: A/AUTO/VERN(ALT) \rangle} \)

GNC UNIV PTG

TRK - ITEM 19 EXEC (CUR - *)
DAP: B/AUTO/ALT

When MNVR cmplt,
DAP: A/AUTO/VERN(ALT)
1. **CONFIG FOR STRK NAV**
   - DAP: A/AUTO/VERN(ALT)
   - Turn down cabin lights to optimize target viewing through -Z COAS/overhead window
   - IMU for Deselect _____ (If no comm, use IMU 1 for deselect)
   - **GNC 21 IMU ALIGN**
   - **GNC 33 REL NAV**
   - If first NAV pass,
     - SV SEL, ITEM 4 - PROP
   - If previous NAV,
     - SV SEL, ITEM 4 - FLTR
   - INH Angles, ITEM 24 - (+)
   - S TRK, ITEM 12 - (+)
   - **GNC 22 S TRK/COAS_CNTL**
     - -Z (-Y) TGT TRK - ITEM 6(5) EXEC (+)
     - STATUS - blank
     - SHUTTER - op
   - **END S TRK NAV**

2. **INITIAL MEASUREMENT EVALUATION**
   - **GNC 22 S TRK/COAS_CNTL**
     - When S PRES - (†), continue
   - **GNC 33 REL NAV**
     - Monitor RESID V and H each NAV cycle for at least four consecutive cycles (~30 sec)
     - Record init RESID V = _______ _______ _______ _______
     - H = _______ _______ _______ _______
     - If RESID V or H changes by > 0.05 each cycle:
       - **GNC 22 S TRK/COAS_CNTL**
         - -Z (-Y) BREAK TRK - ITEM 8(7) EXEC
       - Repeat Step 2
     - If RESID V or H > 0.6:
       - **GNC 22 S TRK/COAS_CNTL**
         - -Z (-Y) BREAK TRK - ITEM 8(7) EXEC
     - When S PRES - (†), if RESID V or H still > 0.6 and stable:
       - Perform S TRK NAV - HIGH INITIAL RESID (CONTINGENCY OPS), 5-8

3. **INCORPORATE DATA INTO NAV**
   - **GNC 22 S TRK/COAS_CNTL**
     - When S PRES - (†), continue
   - **GNC 33 REL NAV**
     - Inh Angles - ITEM 24 EXEC (+)
     - **GNC 21 IMU ALIGN**
     - IMU DES - ITEM 7(8,9) EXEC (no +)

---

**RENNEDVOUS TIMELINE**

---
When NAV converged (SV UPDATES small and stable):

Target NCC Burn Solution (Intermediate)

**TARGET NCC BURN [11A]**

**FINAL SOLUTION**

- OPS 202 PRO
- GNC ORBIT MNVR EXEC
- Eng Sel CORRECT

**MCC UPDATE**

- Nav Selected IMU
- MCC UPDATE
- Ground NCC Burn Solution

**PRELIMINARY**

ΔX: [ ] [ ] [ ] [ ]
ΔY: [ ] [ ] [ ] [ ]
ΔZ: [ ] [ ] [ ] [ ]
ΔVT: [ ] [ ] [ ] [ ]

**INTERMEDIATE**

- Target NCC Burn [11A] (Final)
- Perform RNDZ OMS Burn (CONTINGENCY OPS), 5-4
- If ΔVT > 4 fps:
  - Target NCC Burn [11A] (Final)
  - Perform +X Burn, RCS BURN (Cue Card)

**FINAL**

ΔX: [ ] [ ] [ ] [ ]
ΔY: [ ] [ ] [ ] [ ]
ΔZ: [ ] [ ] [ ] [ ]
ΔVT: [ ] [ ] [ ] [ ]

**GROUND LIMITS**

- Final - Ground Limits
  - ΔX: (0.6)
  - ΔY: (1.5)
  - ΔZ: (2.5)
  - ΔVT:

**END S TRK NAV**

- Target NCC Burn Solution [10B]
- End S TRK NAV
- Target NCC Burn Solution [10B]
- Perform RCS BURN (Cue Card)

CDR

- Perform RCS BURN (Cue Card)

**TIG-10 MIN**

- MCC for burn type
  - If no comm
    - If ΔVT > 6 fps:
      - Target NCC Burn Solution [10B]
      - Target NCC Burn Solution [10B]
      - Perform RCS BURN (Cue Card)

**TIG-17 MIN**

**TIG-5 MIN**

- Target NCC Burn Solution [11A] (Final)
- Perform +X Burn, RCS BURN (Cue Card)

**TIG-0 MIN**

- MCC for burn type
  - If no comm
    - If ΔVT > 6 fps:
      - Target NCC Burn Solution [10B]
      - End S TRK NAV
      - Target NCC Burn Solution [10B]
      - Perform RCS BURN (Cue Card)

**TIG-0 MIN**

- MCC for burn type
  - If no comm
    - If ΔVT > 6 fps:
      - Target NCC Burn Solution [10B]
      - Target NCC Burn Solution [10B]
      - End S TRK NAV
      - Target NCC Burn Solution [10B]
      - Perform +X Burn, RCS BURN (Cue Card)
When NAV converged (SV UPDATES small and stable):

- **TARGET TI BURN** (Intermediate)

- **- Z AXIS TARGET TRACK**

**TARGET TI BURN**

- **(Preliminary)**
- **√SV SEL correct**
- **GNC 34 ORBIT TGT**
- **TGT NO - ITEM 1 +1 0 EXEC**
- **√TGT Set data:**
  - **T1 TIG = BASE TIME**
  - **EL = +0**
  - **ΔT = +80.1**
  - **ΔX = -0.9**
  - **ΔY = +0**
  - **ΔZ = +1.8**
- **COMPUTE T1 - ITEM 28 EXEC**
- **Record solution in PAD**

**MCC UPDATE RNDZ PRPLT PAD**

**RR NAVIGATION**

- **(GNC 33 REL NAV)**
- **CRT RR - ITEM 13 EXEC (+)**
- **√Elev, Az approx 0**
- **Record Initial RESID RANGE = ______ RDOT = ______**

- **IF RESID RANGE > 5.0 or RDOT > 3.0**
  - **SV SEL - ITEM 4 EXEC (PROP)**
  - **Proceed with taking data and contact MCC as soon as practical**

- **FLTR TO PROP - ITEM 8 EXEC**
- **AUTO RNG - ITEM 17 EXEC (+)**
- **RDOT - ITEM 20 EXEC (+)**
- **Angles - ITEM 23 EXEC (+)**
- **Record 1st SV UPDATE POS = ______**

- **IF SV SEL = PROP**
  - **When SV UPDATE POS < 0.3 and MARK ACPT > 9:**
    - **SV SEL - ITEM 4 EXEC (FLTR)**

**- Z AXIS TARGET TRACK**

- **(GNC UNIV PTG)**
- **CRT √TGT ID +1**
- **BODY VECT +3 (-Z)**
- **OM +0**
- **C3 DAP: B/AUTO/ALT**
- **CRT TRK - ITEM 19 EXEC (CUR - +)**

When MNVR cmplt,
- **DAP: A/AUTO/VERN(ALT)**

**When no lock-on by 10 minutes after initial search:**

- **MS KU OPS, step 2 (Cue Card)**

**When RR RNG < 135 KFT:**

- **PLT Perform RR NAVIGATION 13B**

**When NAV RNG < 150 KFT:**

- **MS KU OPS, step 1 (Cue Card)**

**When RR RNG < 135 KFT:**

- **PLT TARGET Ti BURN 13A**

**When RR RNG < 135 KFT:**

- **PLT TARGET Ti BURN** (Preliminary)

**IF Y S TRK TRACK**

- **CDR - Z AXIS TARGET TRACK 13C**

**RENNDEZVOUS TIMELINE**
### Rendezvous Timeline

#### Final - Ground

- $\Delta V_x$: (0.9)
- $\Delta V_y$: (1.3)
- $\Delta V_z$: (1.2)

#### Ti Burn Solutions

<table>
<thead>
<tr>
<th></th>
<th>Prel Fltr</th>
<th>Inter Fltr</th>
<th>Final Fltr</th>
<th>Gnd</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>
</tbody>
</table>

**Final Ti Burn Pad, 3-7**

**Prop (If Reqd)**
4-15 RNDZ/125/FIN

RENDEZVOUS TIMELINE

PET

A7(B7)

TARGET Ti BURN [15A] (Final)

CRT

OPER 202 PRO

GNC ORBIT MNVR EXEC

Load Eng Sel, TVR, WT and Trims for Ti per Final Ti Burn Pad
LOAD - ITEM 22 EXEC

GNC 33 REL NAV

√SV SEL correct

GNC 34 ORBIT TGT

TGT NO - ITEM 1 +1 0 EXEC
√TGT Set data:
T1 TIG = BASE TIME
EL +0
ΔT +80.1
ΔX -0.9
ΔY +0
ΔZ +1.8

COMPUTE T1 - ITEM 28 EXEC

Record solution in PAD

FINAL SOLUTION

If > 40 marks in current sensor pass and
SV UPDATE POS < 0.5 for the last 4 marks:
Burn FLTR soln
If FLTR within ground solution limits:
Burn FLTR soln
If PROP within ground solution limits:
Burn PROP soln
If none of the above:
Burn ground soln EXT ΔVs

If Ti is multi-axis burn:
Perform RCS BURN (Cue Card)

MCC UPDATE

Ti Final Ground Soln,
Ti DELAY Soln, 3-7

MCC UPDATE

GO for Ti

CDR

Perform Ti DELAY BURN (CONTINGENCY OPS), 5-17

TIG-17

If Ti is multi-axis burn, delay final targeting until TIG-5

PLT

TARGET Ti BURN [15A] (Final)

If Ti is +X RCS burn:
Perform RCS BURN (Cue Card)

If Ti is OMS BURN:
Perform RNDZ OMS BURN (CONTINGENCY OPERATIONS), 5-4

MCC UPDATE

If Ti is multi-axis burn, delay final targeting until TIG-5

CDR

Perform RCS BURN (Cue Card)

If Ti is +X RCS burn:
Perform RCS BURN (Cue Card)

If Ti is OMS BURN:
Perform RNDZ OMS BURN (CONTINGENCY OPERATIONS), 5-4

CDR

CONTINGENCY INERTIAL APPROACH TIMELINE, 4-25

If HST Door Open, go to
CDR

CONTINGENCY INERTIAL APPROACH TIMELINE, 4-25

If Ti is multi-axis burn:
Perform RCS BURN (Cue Card)

TIG-5

If Ti is multi-axis burn:
Perform RCS BURN (Cue Card)

MCC UPDATE

If Ti is multi-axis burn, delay final targeting until TIG-5

CDR

Perform RCS BURN (Cue Card)

If Ti is +X RCS burn:
Perform RCS BURN (Cue Card)

If Ti is OMS BURN:
Perform RNDZ OMS BURN (CONTINGENCY OPERATIONS), 5-4

MCC UPDATE

If Ti is multi-axis burn, delay final targeting until TIG-5

CDR

Perform RCS BURN (Cue Card)

If Ti is +X RCS burn:
Perform RCS BURN (Cue Card)

If Ti is OMS BURN:
Perform RNDZ OMS BURN (CONTINGENCY OPERATIONS), 5-4

MCC UPDATE

If Ti is multi-axis burn, delay final targeting until TIG-5

CDR

Perform RCS BURN (Cue Card)

If Ti is +X RCS burn:
Perform RCS BURN (Cue Card)

If Ti is OMS BURN:
Perform RNDZ OMS BURN (CONTINGENCY OPERATIONS), 5-4

MCC UPDATE

If Ti is multi-axis burn, delay final targeting until TIG-5

CDR

Perform RCS BURN (Cue Card)

If Ti is +X RCS burn:
Perform RCS BURN (Cue Card)

If Ti is OMS BURN:
Perform RNDZ OMS BURN (CONTINGENCY OPERATIONS), 5-4
**POST Ti NAV**

**A6U**

\DAP:  A/AUTO/VERN(ALT)

**A1U**

\KU sel - GPC

**GNC 33 REL NAV**

IF SV SEL = FLTR:

- FLTR TO PROP - ITEM 8 EXEC (*)
- AUTO Angles - ITEM 23 EXEC (*)

IF RR NOT Tracking TGT:

- Inhibit Data

Perform KU OPS, steps 2 and 3 (Cue Card)

If still no RR ACQ, assume RR Fail

**GNC 22 S TRK/COAS_CNTL**

\TGT TRK - ITEM 6 EXEC (*)

**CRT**

\+Z TGT TRK - ITEM 6 EXEC (*)

**IF RR FAIL**

- If -Z Star Tracker:
  - \+Z TGT TRK ATT, then:
    - Perform STAR TRACKER NAV [10A]
  - If COAS NAV:
    - \+Z TGT TRK ATT, then:
      - Perform COAS NAVIGATION (CONTINGENCY OPS), 5-10
- If -Y Star Tracker:
  - \GNC UNIV PTG:
    - TGT ID = 1
    - BODY VECT = 4
    - P = +0
    - Y = +280.57
    - OM = +90
  - DAP:  B/AUTO/ALT
  - TRK - ITEM 19 EXEC

When MNVR cmplt:

- DAP:  A/AUTO/VERN(ALT)

Perform STAR TRACKER NAV [10A]
**RENDZVOUS TIMELINE**

**PET**

- **00:00**
  - PLT TARGET MC 1 BURN (Preliminary)
  - When MNVR to att cmplt:
    - COR POST Ti NAV
  - MS POISE FOR CAPTURE (PDRS OPS, NOMINAL HST RETRIEVAL)

- **00:05**
  - PLT TARGET MC 1 BURN (Preliminary)
  - MS POISE FOR CAPTURE (PDRS OPS, NOMINAL HST RETRIEVAL)

- **00:10**
  - When NAV converged, (SV UPDATES small and stable):
    - COR POST Ti NAV
    - MCC UPDATE Prox Ops Cov Matrix
  - PLT TARGET MC 1 BURN (Intermediate)
  - MS √ Time of OOP null

- **00:15**
  - PLT TARGET MC 1 BURN (Final)
  - MCC UPDATE Prox Ops Cov Matrix
  - MC 1 BURN SOLUTION
    - ΔVX
    - ΔVY
    - ΔVZ
    - ΔVT
  - MS POISE FOR CAPTURE (PDRS OPS, NOMINAL HST RETRIEVAL)

- **00:20**
  - PLT TARGET MC 1 BURN (Final)
  - MCC UPDATE Prox Ops Cov Matrix
  - MCC ESTABLISH PI COMM

- **00:25**
  - When Y = 0:
    - PLT MANUAL OUT-OF-PLANE NULL (Preliminary)

- **00:30**
  - PLT TARGET MC 2 BURN (Intermediate)
  - MCC UPDATE Prox Ops Cov Matrix

**TARGET MC 1 BURN**

- **00:05**
  - COR POST Ti NAV
  - MCC UPDATE Prox Ops Cov Matrix
  - MS POISE FOR CAPTURE (PDRS OPS, NOMINAL HST RETRIEVAL)

- **00:10**
  - When NAV converged, (SV UPDATES small and stable):
    - PLT TARGET MC 1 BURN (Intermediate)
    - MCC UPDATE Prox Ops Cov Matrix
  - MS √ Time of OOP null

- **00:15**
  - PLT TARGET MC 1 BURN (Final)
  - MCC UPDATE Prox Ops Cov Matrix
  - MC 1 BURN SOLUTION
    - ΔVX
    - ΔVY
    - ΔVZ
    - ΔVT
  - MS POISE FOR CAPTURE (PDRS OPS, NOMINAL HST RETRIEVAL)

- **00:20**
  - PLT TARGET MC 1 BURN (Final)
  - MCC UPDATE Prox Ops Cov Matrix
  - MCC ESTABLISH PI COMM

- **00:25**
  - When Y = 0:
    - PLT MANUAL OUT-OF-PLANE NULL (Preliminary)

- **00:30**
  - PLT TARGET MC 2 BURN (Final)
  - MCC UPDATE Prox Ops Cov Matrix

**TARGET MC 2**

- **00:10**
  - When NAV converged, (SV UPDATES small and stable):
    - PLT TARGET MC 2 BURN (Intermediate)
    - MCC UPDATE Prox Ops Cov Matrix
  - MS POISE FOR CAPTURE (PDRS OPS, NOMINAL HST RETRIEVAL)

- **00:15**
  - PLT TARGET MC 2 BURN (Final)
  - MCC UPDATE Prox Ops Cov Matrix
  - MCC ESTABLISH PI COMM

- **00:20**
  - PLT TARGET MC 2 BURN (Final)
  - MCC UPDATE Prox Ops Cov Matrix
  - MCC ESTABLISH PI COMM

- **00:25**
  - When Y = 0:
    - PLT MANUAL OUT-OF-PLANE NULL (Final)

- **00:30**
  - PLT TARGET MC 2 BURN (Final)
  - MCC UPDATE Prox Ops Cov Matrix

**NOTE**

- If TGT EL ANG Alarm,
- ΔV still valid for current TIG,
- TIG slip limits still apply

Record solution in PAD
TARGET MC 2 BURN (Intermediate)

CRT
SV SEL correct
(GNC 34 ORBIT TGT)
TGT NO - ITEM 1 +1 2 EXEC
COMPUTE T1 - ITEM 28 EXEC
Record solution in PAD

TARGET MC 2 BURN (Final)

CRT
SV SEL correct
(GNC 34 ORBIT TGT)
TGT NO - ITEM 1 +1 2 EXEC
COMPUTE T1 - ITEM 28 EXEC
√
TIG change

IF TIG CHANGE < -3 OR > +7 MIN
Set BASE TIME to (Nominal MC 2 TIG -3 or +7 min as appropriate)
TGT NO - ITEM 1 +1 2 EXEC
√
TGT Set data:
T1 TIG = BASE TIME
EL +0
ΔT +27.0
ΔX -0.9
ΔY +0
ΔZ +1.8
COMPUTE T1 - ITEM 28 EXEC

Set EVENT TIMER counting to MC 2 TIG
Record solution in PAD
GNC 33 REL NAV
CRT
FLTR TO PROP - ITEM 8 EXEC

- Z AXIS TARGET TRACK

GNC UNIV PTG
CRT
√
TGT ID +1
BODY VECT +3 (-Z)
CM +0
C3
DAP: B/AUTO/ALT
CRT
TRK - ITEM 19 EXEC (CUR - *)

When MNVR cmplt,
DAP: A/AUTO/VERN(ALT)

MC 2 BURN SOLUTION

PRELIMINARY

INTERMEDIATE

FINAL

MEAN ± (3σ VARIATION)

TIG

TIG SLIP (COMPUTED-NOM)

PREL

INTER

FINAL

NOMINAL

CCTV CONFIG

A7U
VID OUT – MON 1
IN – A
OUT – MON 2
IN – B
Aim A at B and B at A at full zoom in PAN/ TILT - RESET
For both cams:
PAN – 0.0 deg
TILT – 90.0 deg
Repeat for Camr C & D

END S TRK NAV

GNC 33 REL NAV
CRT
INH Angles - ITEM 24 EXEC (*)
GNC 21 IMU ALIGN
IMU DES - ITEM 7 (8,9) EXEC (no +)

RENNZ/125/FIN

4-18
RENDEZVOUS TIMELINE

PET

00:30

A7(B7)

00:35

00:40

MC2 ET

-00:10

00:45

-00:05

00:50

00:00

MC 2 TIG

00:55

00:05

IF INITIAL RR ACQ POST-MC2

CDR Perform LATE RR NAV 19B

01:00

CDR Go to RADAR FAIL PROCEDURES 20A

IF NO RR INTO NAV

MCC LGA SWITCH AFT TO FWD

MANUAL OUT-OF-PLANE NULL 19A

GNC 33 REL NAV

CRT When Y = 0:

F7 FLT CNTRL PWR - ON
DAP: A/AUTO/PRI
DAP TRANS: as reqd
THC: Null YDOT

If -Z AXIS TRACK,

+YDOT = FWD THC left
AFT THC right

If -Y S TRK TRACK,

+YDOT = FWD THC down
AFT THC out

F7 FLT CNTRL PWR - OFF
DAP: A/AUTO/ALT
When rates nulled:
DAP: VERN(ALT)

TARGET MC 3 19B

CRT √SV SEL correct

GNC 34 ORBIT TGT
TGT NO - ITEM 1 +13 EXEC
√TGT Sel data:
T1 TIG = BASE TIME + 0:00:17:00
EL +0
ΔT +10.0
ΔX -0.9
ΔY +0
ΔZ +1.8
COMPUTE T1 - ITEM 28 EXEC
Record solution in PAD

TARGET MC 2 BURN (Final)
Perform RCS BURN (Cue Card)

TARGET MC 3 BURN SOLUTION

PRELIMINARY

FINAL

MEAN ± (3σ VARIATION)

ΔVX ( ) ( )
ΔVY ( ) ( )
ΔVZ ( ) ( )
ΔVT ( ) ( )

0.0 ± (0.5)
0.1 ± (0.5)
0.0 ± (1.2)

PLT When NAV converged (SV UPDATES small and stable):
TARGET MC 2 BURN 18A (Intermediate)

PLT When NAV converged (SV UPDATES small and stable):
TARGET MC 2 BURN 18A (Intermediate)

PLT When NAV converged (SV UPDATES small and stable):
TARGET MC 2 BURN 18A (Intermediate)

PLT When NAV converged (SV UPDATES small and stable):
TARGET MC 2 BURN 18A (Intermediate)

PLT When NAV converged (SV UPDATES small and stable):
TARGET MC 2 BURN 18A (Intermediate)

PLT When NAV converged (SV UPDATES small and stable):
TARGET MC 2 BURN 18A (Intermediate)

PLT When NAV converged (SV UPDATES small and stable):
TARGET MC 2 BURN 18A (Intermediate)

PLT When NAV converged (SV UPDATES small and stable):
TARGET MC 2 BURN 18A (Intermediate)

PLT When NAV converged (SV UPDATES small and stable):
TARGET MC 2 BURN 18A (Intermediate)

PLT When NAV converged (SV UPDATES small and stable):
TARGET MC 2 BURN 18A (Intermediate)
**MC 4 BURN SOLUTION**

<table>
<thead>
<tr>
<th>TIG</th>
<th>PRELIMINARY</th>
<th>FINAL</th>
<th>MEAN ± 3σ VARIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔVX</td>
<td>( )</td>
<td>*</td>
<td>( )</td>
</tr>
<tr>
<td>ΔVY</td>
<td>( )</td>
<td>*</td>
<td>( )</td>
</tr>
<tr>
<td>ΔVZ</td>
<td>( )</td>
<td>*</td>
<td>( )</td>
</tr>
<tr>
<td>ΔVT</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

**MC 4 BURN SOLUTION**

<table>
<thead>
<tr>
<th>TIG</th>
<th>PRELIMINARY</th>
<th>FINAL</th>
<th>MEAN ± 3σ VARIATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔVX</td>
<td>( )</td>
<td>*</td>
<td>( )</td>
</tr>
<tr>
<td>ΔVY</td>
<td>( )</td>
<td>*</td>
<td>( )</td>
</tr>
<tr>
<td>ΔVZ</td>
<td>( )</td>
<td>*</td>
<td>( )</td>
</tr>
<tr>
<td>ΔVT</td>
<td>*</td>
<td>*</td>
<td>*</td>
</tr>
</tbody>
</table>

**RENNZVOUS TIMELINE**

1. **At MC2 TIG+14:00 (MC3 TIG-3:00):**
   - **PLT** TARGET MC3 [19B] (final)
   - **CDR** Perform RCS BURN, steps 1 thru 5 (Cue Card), then:
     - **AT MC2+18 IF NO VISUAL ACQUISITION OR TARGET > 30 DEG FROM COAS HORIZONTAL:**
       - **CDR** Go to RNDZ BREAKOUT (CONTINGENCY OPS). 5-16 >>
   - **A6U** FLTR CTRL PWR - ON
     - SENSE - Z
     - DAP: A/LVLH/PRI
     - ACOAS for TGT vertical position
   - THC: +X (or -X) per COAS LOGIC:
     - If TGT = N deg high in COAS, perform 2N +X (up) pulses
     - If TGT = N deg low in COAS, perform 1N -X (down) pulses
   - DAP: A/LVLH/VERN(PRI)
     - Inform MCC of TGT vertical position in COAS and number of pulses performed
   - Following radar fail X correction,
     - THC: As reqd to control out-of-plane motion and manage RDOT
     - Perform CONFIG FOR RBAR [21B]

2. **At MC2 TIG + 19:00:**
   - **A6U** FLTR CTRL PWR - ON
     - SENSE - Z
     - DAP: A/LVLH/PRI
   - ACOAS for TGT vertical position
   - THC: +X (or -X) per COAS LOGIC:
     - If TGT = N deg high in COAS, perform 2N +X (up) pulses
     - If TGT = N deg low in COAS, perform 1N -X (down) pulses
   - DAP: A/LVLH/VERN(PRI)
     - Inform MCC of TGT vertical position in COAS and number of pulses performed
   - Following radar fail X correction,
     - THC: As reqd to control out-of-plane motion and manage RDOT
     - Perform CONFIG FOR RBAR [21B]

3. **At MC2 TIG + 24:00 or 2000 ft, whichever comes first:**
   - **GNC UNIV PTG**
     - **CRT** TRK - ITEM 19 EXEC (CUR - ∗)
     - **A6U** DAP: A/AUTO/VERN (PRI)
     - THC: as reqd to stabilize and maintain TGT between 0 deg and 10 deg high in COAS

   At 2000 ft:
   - Perform HST RBAR APPROACH (Cue Card)

   **LATE RADAR NAV [20B]**

   - **GNC 33 REL NAV**
     - **CRT** FLTR TO PROP - ITEM 8 EXEC
     - S/V SEL, ITEM 4 - PROP
     - V/R - ITEM 13 EXEC (∗)
     - AUTO RNG - ITEM 17 EXEC (∗)
     - RDOT - ITEM 20 EXEC (∗)
     - Angles - ITEM 23 EXEC (∗)
   - Go to RADAR FAIL PROCEDURE [20A]
RENDZVOUS TIMELINE

PET 01:00
- A7(B7)

MC2 ET
- 01:05
- A8(B8) 01:10

CDR Go to RADAR FAIL PROCEDURES 20A

01:15
- CDR Go to RADAR FAIL PROCEDURES 20A

01:20
- CDR ESTABLISH RBAR 21C

01:25
- CDR ESTABLISH RBAR 21C

01:30
- CDR ESTABLISH RBAR 21C

01:35
- MANUAL TRAJECTORY CONTROL

TARGET MC 4 BURN 21A

CRT
- SV SEL correct

TGT NO - ITEM 1 +1 F EXEC

TGT Set data:
- T1 TIG = BASE TIME + 0:00:27:00
- EL +0
- ΔT +13.0
- ΔX +0
- ΔY +0
- ΔZ +0.6

COMPUTE T1 - ITEM 28 EXEC

Record solution in PAD

CONFIG FOR RBAR 21B

- GNC UNIV PTG
  - ERR TGT - ITEM 23 EXEC (*)
  
  When ERR <2 deg each axis
  
  Config DAP A,B to A8,B8

- GNC UNIV PTG
  - TGT ID +2
  - BODY VECT +5
  - P +270
  - Y +0
  - OM +0

Do not initiate Target Track until ESTABLISH RBAR 21C

ESTABLISH RBAR 21C

- A6U FLT CNTLR PWR - ON

- GNC UNIV PTG

CRT
- TRK - ITEM 19 EXEC (CUR - *)

DAP: A/AUTO/VERN(PRI)

THC: as reqd to control TGT motion in COAS
CONTINGENCY INERTIAL APPROACH TIMELINE
NOTE:
Perform nominal rendezvous timeline activities though PET 00:00.
For NCC targeting, use TGT NO - ITEM 1 +29 EXEC
For Ti targeting, use TGT NO - ITEM 1 +30 EXEC
For Ti and NCC targeting blocks, √TGT Set data per TARGETING DATA, 310 Inertial (REFERENCE DATA), 6-4.
CONTINGENCY INERTIAL APPROACH TIMELINE

TARGET MC 1 INERTIAL [26A]

CRT
√ SV SEL correct
 GNC 33 ORBIT TGT
 TGT NO - ITEM 1 + 3 EXEC
 √ TGT Set data:
  T1 TIG = MC1 BURN SOLUTION TIG
  EL +0
  ΔT +59.1
  ΔX +0
  ΔY +0
  ΔZ +0
 COMPUTE T1 - ITEM 28 EXEC

Note solution in PAD

TARGET MC 2 INERTIAL [26C] (Preliminary)

CRT
√ SV SEL correct
 GNC 34 ORBIT TGT
 TGT NO - ITEM 1 + 3 EXEC
 √ TGT Set data:
  T1 TIG = MC2 BURN SOLUTION TIG
  EL +29.49
  ΔT +32.7
  ΔX +0
  ΔY +0
  ΔZ +0
 COMPUTE T1 - ITEM 28 EXEC

NOTE
If TGT EL ANG Alarm,
ΔV still valid for current TIG,
TIG slip limits still apply

Note solution in PAD

POST Ti NAV [26B]

A6U √ (DAP: A/AUTO/VERN(ALT))
A1U √ (KU sel - GPC)

GNC 33 REL NAV
IF SV SEL = FLTR:
  FLTR TO PROP - ITEM 8 EXEC (∗)
  √ AUTO Angles - ITEM 23 EXEC (∗)
IF RR NOT Tracking TGT:
  √ Inhibit Data
  Perform KU OPS, steps 2 and 3 (Cue Card)
  If still no RR ACQ, assume RR Fail

GNC 22 S TRK/COAS_CNTL
CRT
√ Z TGT TRK - ITEM 6 EXEC (∗)
 √ Z THOLD - ITEM 14 + 2 EXEC

IF RR FAIL
If -Z Star Tracker:
  √ Z TGT TRK ATT, then:
  Perform STAR TRACKER NAV [10A]
If COAS NAV:
  √ Z TGT TRK ATT, then:
  Perform COAS NAVIGATION [CONTINGENCY OPS], 5-10
If -Y Star Tracker:
  GNC 22 S TRK/COAS_CNTL
  √ Y THOLD - ITEM 13 +0 EXEC
  GNC 34 UNIV PTG
  TGT ID +1
  BODY VECT +4
  P √ +0
  Y +280.57
  OM +90
  DAP: B/AUTO/ALT
  TRK - ITEM 19 EXEC
  When MNVR compl: DAP: A/AUTO/VERN(ALT)
  Perform STAR TRACKER NAV [10A]
**CONTINGENCY INERTIAL APPROACH TIMELINE**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>00:00</td>
<td>CDR TARGET MC 1 INERTIAL (Preliminary)</td>
</tr>
<tr>
<td>00:05</td>
<td>MS1 POISE FOR CAPTURE (PDNS OPS, NOMINAL HST RETRIEVAL)</td>
</tr>
<tr>
<td>00:10</td>
<td>CDR When NAV converged, (SV UPDATES small and stable) TARGET MC 1 INERTIAL (Intermediate)</td>
</tr>
<tr>
<td>00:15</td>
<td>√/FOR TIME OF OOP NULL</td>
</tr>
<tr>
<td>00:20</td>
<td>TIG -03:00</td>
</tr>
<tr>
<td>00:25</td>
<td>CDR TARGET MC 1 INERTIAL (Final)</td>
</tr>
<tr>
<td>00:30</td>
<td>CDR TARGET MC 2 INERTIAL (Preliminary)</td>
</tr>
</tbody>
</table>

**MC 1 BURN SOLUTION**

<table>
<thead>
<tr>
<th>TIG</th>
<th>PRELIMINARY</th>
<th>INTERMEDIATE</th>
<th>FINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΔVX</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>ΔVY</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>ΔVZ</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
<tr>
<td>ΔVT</td>
<td>( )</td>
<td>( )</td>
<td>( )</td>
</tr>
</tbody>
</table>

**MANUAL OUT-OF-PLANE NULL**

<table>
<thead>
<tr>
<th>GNC 33 REL NAV</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT When Y = 0:</td>
</tr>
<tr>
<td>F7 FLT CNTLR PWR ON</td>
</tr>
<tr>
<td>DAP: A/AUTO/PRI</td>
</tr>
<tr>
<td>DAP TRANS: as reqd</td>
</tr>
<tr>
<td>THC: Null YDOT</td>
</tr>
<tr>
<td>If -Z AXIS TRACK, +YDOT = FWD THC left</td>
</tr>
<tr>
<td>AFT THC right</td>
</tr>
<tr>
<td>If -Y S TRK TRACK, +YDOT = FWD THC down</td>
</tr>
<tr>
<td>AFT THC out</td>
</tr>
<tr>
<td>F7 FLT CNTLR PWR OFF</td>
</tr>
<tr>
<td>DAP: A/AUTO/ALT</td>
</tr>
<tr>
<td>When rates nulled:</td>
</tr>
<tr>
<td>DAP: VERN(ALT)</td>
</tr>
</tbody>
</table>
CONTINGENCY INERTIAL APPROACH TIMELINE

TARGET MC 2 INERTIAL

- Z AXIS TARGET TRACK

END S TRK NAV

MC2 BURN SOLUTION

PRELIMINARY

INTERMEDIATE

FINAL

TIG

TIG SLIP (COMPUTED-NOM)

PREL

INTER

FINAL

NOMINAL

CRT

GNC_34__ORBIT_TGT

TGT NO - ITEM 1 +3 2 EXEC

COMPUTE T1 - ITEM 28 EXEC

Note solution in PAD

CRT

GNC UNIV PTG

√TGT ID

BODY VECT +3 (-Z)

OM +0

CRT

TRK - ITEM 19 EXEC (CUR - *)

When MNVR cmplt,

DAP: A/AUTO/VERN(ALT)

CRT

GNC_33__REL_NAV

INH Angles - ITEM 24 EXEC (+)

GNC 21 IMU ALIGN

IMU DES - ITEM 7(8,9) EXEC (no *)

CRT

DAP: B/AUTO/ALT

CRT TRK - ITEM 19 EXEC (CUR - *)

When MNVR cmplt,

DAP: A/AUTO/VERN(ALT)

CRT TGT NO - ITEM 1 +3

EXEC

COMPUTE T1 - ITEM 28 EXEC

Note solution in PAD

CRT

TGT NO - ITEM 1 +3

EXEC

COMPUTE T1 - ITEM 28 EXEC

Note solution in PAD

CRT

√TGT ID

BODY VECT +3 (-Z)

OM +0

CRT

TRK - ITEM 19 EXEC (CUR - *)

When MNVR cmplt,

DAP: A/AUTO/VERN(ALT)

CRT

GNC UNIV PTG

√TGT ID

BODY VECT +3 (-Z)

OM +0

CRT

TRK - ITEM 19 EXEC (CUR - *)

When MNVR cmplt,

DAP: A/AUTO/VERN(ALT)

CRT

GNC UNIV PTG

√TGT ID

BODY VECT +3 (-Z)

OM +0

CRT

TRK - ITEM 19 EXEC (CUR - *)

When MNVR cmplt,

DAP: A/AUTO/VERN(ALT)

CRT

GNC UNIV PTG

√TGT ID

BODY VECT +3 (-Z)

OM +0

CRT

TRK - ITEM 19 EXEC (CUR - *)

When MNVR cmplt,

DAP: A/AUTO/VERN(ALT)

CRT

GNC UNIV PTG

√TGT ID

BODY VECT +3 (-Z)

OM +0

CRT

TRK - ITEM 19 EXEC (CUR - *)

When MNVR cmplt,

DAP: A/AUTO/VERN(ALT)

CRT

GNC UNIV PTG

√TGT ID

BODY VECT +3 (-Z)

OM +0

CRT

TRK - ITEM 19 EXEC (CUR - *)

When MNVR cmplt,

DAP: A/AUTO/VERN(ALT)
Contingency Inertial Approach Timeline

PET

00:30
A7(B7)

00:35

00:40

00:45

00:50

00:00 ➔ MC 2 TIG

CDR

TARGET MC 2 INERTIAL [29A] (Final)

TIG -05:00
CDR

TARGET MC 2 INERTIAL [29A] (Final)

Perform RCS BURN (cue card)

Target MC 2 Inertial

User

TARGET MC 2 INERTIAL [29A] (Intermediate)

CDR

When NAV converged, (SV UPDATE small and stable)

TARGET MC 2 INERTIAL

If NAV converged, (SV UPDATE small and stable)

TARGET MC 3 INERTIAL

Perform RCS BURN (cue card)

MC2 ET

-00.05

TIG -05.00
CDR

TARGET MC 2 INERTIAL [29A] (Final)

Set EVENT TIMER counting to MC 2 TIG

Note solution in PAD

TARGET MC 3 INERTIAL [29B] (Final)

If TIG CHANGE < -3 OR > +7 MIN

Set BASE TIME to (Nominal MC 2 TIG -3 or +7 min as appropriate)

LOAD - ITEM 26 EXEC

TGT NO - ITEM 1 +3 2 EXEC

√TIG change

√TGT Set data:

T1 TIG = BASE TIME
EL +0
ΔT +32.7
ΔX +0
ΔY +0
ΔZ +0

MC 3 BURN SOLUTION

Compute T1 - ITEM 28 EXEC

Note solution in PAD

MC 3 BURN SOLUTION

TIG

IF No POST-TI SENSOR DATA AND NO VISUAL (OR RR) ACQ BY MC2+20 MIN, OR

IF POST-TI SENSOR DATA AVAILABLE, BUT NO VISUAL (OR RR) ACQ BY MC2+25 MIN:

Go to RENDEZVOUS BREAKOUT (CONTINGENCY OPERATIONS), 5-16

TGT

ΔX

ΔY

ΔZ

ΔV

TGT NO - ITEM 1 +3 EXEC

FLTR TO PROP - ITEM 8 EXEC

TARGET MC 3 INERTIAL [29B] (Final)

CDR

TARGET MC 3 INERTIAL [29B] (Preliminary)

TGT

ΔX

ΔY

ΔZ

ΔV

Preliminary

Final

Note solution in PAD

At sunset,

If RR NAV

[TGC 22 STRK/COAS CNTL]

-2 STAR TRK - ITEM 4 EXEC (+)

If S TRK NAV,

END S TRK NAV [28C]

If no sensor data (RR, STRK, COAS) at any time during the RNDZ,

Go to RNDZ BREAKOUT (CONTINGENCY OPERATIONS), 5-16

MC 3 BURN SOLUTION

Note solution in PAD

Target MC 3 Inertial

User

Target MC 3 Inertial

User
MC 4 BURN SOLUTION

<table>
<thead>
<tr>
<th>TIG</th>
<th>PRELIMINARY</th>
<th>FINAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\Delta V_X)</td>
<td>( )</td>
<td>.</td>
</tr>
<tr>
<td>(\Delta V_Y)</td>
<td>( )</td>
<td>.</td>
</tr>
<tr>
<td>(\Delta V_Z)</td>
<td>( )</td>
<td>.</td>
</tr>
<tr>
<td>(\Delta V_T)</td>
<td>( )</td>
<td>.</td>
</tr>
</tbody>
</table>

CCTV CONFIG [30A]
A7U VID OUT – MON 1
IN – A
OUT – MON 2
IN – B
Aim A at B and B at A at full zoom
PAN/TILT - RESET
for both camrs
| PAN – 0.0 deg |
| TILT – 90.0 deg |
Repeat for Camr C & D

TARGET MC 3 INERTIAL [30B]

CRT ✓SV SEL correct
GNC 34 ORBIT TGT
TGT NO - ITEM 1 \(+3.3\) EXEC
TGT Set data:
| T1 TIG = BASE TIME + 0:00:10:00 |
| EL +0 |
| \(\Delta T\) +22.7 |
| \(\Delta X\) +0 |
| \(\Delta Y\) +0 |
| \(\Delta Z\) +0 |
COMPUTE T1 - ITEM 28 EXEC
Note solution in PAD
TARGET MC 4 INERTIAL [31A]

CRT  √ SV SEL correct

GNC 34 ORBIT TGT

TGT NO - ITEM 1 +3 4 EXEC
√ TGT Set data:
T1 TIG = BASE TIME + 0:00:20:00
EL +0
ΔT +12.7
ΔX +0
ΔY +0
ΔZ +0

COMPUTE T1 - ITEM 28 EXEC
Note solution in PAD

MANUAL TRAJECTORY CONTROL
CONTINGENCY OPS

RNDZ OMS BURN........................................................................................................... 5-3
SENSOR FAIL .................................................................................................................. 5-7
S TRK NAV – HIGH INITIAL RESID ............................................................................... 5-8
FLTR MINUS PROP ........................................................................................................... 5-9
COAS NAVIGATION ....................................................................................................... 5-10
BACKOUT/BREAKOUTS ................................................................................................. 5-11
PROXIMITY OPS BACKOFF .......................................................................................... 5-12
HST RBAR BREAKOUT .................................................................................................... 5-13
HST FLYAROUND/LOSS OF LO Z BREAKOUT ............................................................. 5-14
RNDZ BREAKOUT .......................................................................................................... 5-16
Ti DELAY BURN ............................................................................................................... 5-17
RNDZ NAV RECOVERY .................................................................................................. 5-19
TGT ITER .......................................................................................................................... 5-20
LOSS OF COMM .............................................................................................................. 5-21
DEGRADED CONTROL ................................................................................................. 5-23
LOSS OF VRCS .............................................................................................................. 5-25
LO Z BRAKING ............................................................................................................... 5-26
This Page Intentionally Blank
RNDZ OMS BURN
RNDZ OMS BURN

1. OMS BURN PREP
   C2 Install OMS2/ORBIT OMS BURNS (Cue Cards) (two) and
   Wedge ORBIT BURN MONITOR (Cue Cards) (two) (F6,F8)
   CRT1 GNC 20 DAP CONFIG
   1: GNC 20 DAP CONFIG
   1: GNC ORBIT MNVR EXEC
   2: GNC SYS SUMM 2

2. LOAD TGT DATA
   If onboard-computed burn:
   \[\text{Eng sel, TV ROLL, TRIM LOAD, and WT per Burn Pad}\]
   \[\text{TIG and TGT PEG 7 \DeltaVs per Final ORBIT TGT solution}\]
   \[\text{Guidance option is LAMBERT}\]
   If ground-computed burn:
   \[\text{TGT data per Burn Pad (reload WT as reqd)}\]
   LOAD – ITEM 22 EXEC
   TIMER – ITEM 23 EXEC
   CRT1 MNVR – ITEM 27 EXEC (*)

3. PERFORM RNDZ OMS BURN
   TIG-3 F6,F8 ADI RATE (two) – MED (1 deg/sec)
   Perform OMS2/ORBIT OMS BURNS (Cue Card)
   FLT CNTLR PWR (two) – ON

4. OMS POST BURN RECONFIGURATION
   F6,F8 FLT CNTLR PWR (two) – OFF
   O8 L,R OMS He PRESS/VAP ISOL (four) – CL
   C3 DAP: B/INRTL/ALT
   CRT1 RCS SEL – ITEM 4 EXEC (*)
   Perform OMS TVC GMBL CK per Burn Pad
   * If down arrow(s) or M(s), *
   * select good GMBL *

GNC, OPS 201 PRO

Cont next page
5. MNVR TO POST BURN ATTITUDE

1. GNC UNIV PTG

Desired UNIV PTG load active

C3 DAP:  

If RR ops, when ATT ERR < 30 deg:

A1U

KU sel – GPC

KU TRACK tb – gray

1. GNC 33 REL NAV

CRT1

AUTO Angles – ITEM 23 EXEC (*)

1. GNC UNIV PTG

When in attitude and rates nulled:

C3 DAP:  

A/AUTO/VERN(ALT)
SENSOR FAIL
S TRK NAV – HIGH INITIAL RESID

1. NAV SAFING

   1: GNC 33 REL NAV

   CRT1 \[\sqrt{\text{INH Angles}} – \text{ITEM 24 EXEC (*)}\]

   On MCC GO (if no comm, continue):

2. CHECK FOR S TRK FALSE LOCK

   2: GNC 22 S TRK/COAS CNTL

   If -Z S TRK, perform COAS visual check:

   \[\text{NOTE}\]
   GNC 33 REL NAV: COAS X (+up) and COAS Y (+left)
   provide approx TGT position in COAS based on -Z
   S TRK measurement

   \[\sqrt{\text{For debris near TGT position}}\]
   If no debris near TGT position or TGT not visible:
   | Go to step 3
   If debris near TGT position:

   CRT2 -Z BREAK TRK – ITEM 8 EXEC
   When S PRES – (*):
   CRT1 Monitor RESID V and H. Repeat BREAK TRK as reqd until
   stable lock-on
   Go to STAR TRACKER NAV, step 2[10A]

   If -Y S TRK, perform visual check through W1:

   \[\sqrt{\text{For debris near TGT line-of-sight}}\]
   If no debris near TGT line-of-sight or TGT not visible:
   | Go to step 3
   If debris near TGT line-of-sight:

   CRT2 -Y BREAK TRK – ITEM 7 EXEC
   When S PRES – (*):
   CRT1 Monitor RESID V and H. Repeat BREAK TRK as reqd until
   stable lock-on
   Go to STAR TRACKER NAV, step 2[10A]

3. CHECK IMU MISALIGNMENT

   2: GNC 21 IMU ALIGN

   CRT2 Nav sel IMU – des,sel (If Nav sel IMU unknown, pick one of two remaining IMUs)
   CRT1 Record RESID V _____ and H _____
   If RESID V and H < 0.6:
   Go to STAR TRACKER NAV, step 3[10A]

   CRT2 Other IMU – des,sel
   CRT1 Record RESID V _____ and H _____

4. RESUME PASS

   Continue with pass per STAR TRACKER NAV, step 3[10A], then:
   After S TRK pass, on MCC GO:

   \[\text{NOTE}\]
   SELF-TEST may fail. \[\sqrt{\text{MCC for S TRK status}}\]

   2: GNC 22 S TRK/COAS CNTL

   CRT2 -Z(-Y) SELF-TEST – ITEM 2(1) EXEC (*)
S TRK NAV – HIGH FLTR MINUS PROP

1. NAV SAFING
   1: GNC 33 REL NAV
   CRT1 INH Angles – ITEM 24 EXEC (*)

   On MCC GO (continue if no comm):

2. CHECK FOR S TRK FALSE LOCK
   2: GNC 22 S TRK/COAS CNTL
   If -Z S TRK, perform COAS visual check:

   NOTE
   GNC 33 REL NAV: COAS X (+up) and COAS Y (+left)
   provide approx TGT position in COAS based on -Z
   S TRK measurement

   √For debris near TGT position
   If no debris near TGT position or TGT not visible:
   Go to step 3
   If debris near TGT position:
   SV SEL – ITEM 4 EXEC (PROP)
   PROP TO FLTR – ITEM 9 EXEC
   CRT2 -Z BREAK TRK – ITEM 8 EXEC
   When S PRES – (*):
   CRT1 Monitor RESID V and H. Repeat BREAK TRK as reqd until stable
   lock-on
   Go to STAR TRACKER NAV, step 2 10A
   If -Y S TRK, perform visual check through W1:
   √For debris near TGT line-of-sight
   If no debris near TGT line-of-sight or TGT not visible:
   Go to step 3
   If debris near TGT line-of-sight:
   SV SEL – ITEM 4 EXEC (PROP)
   PROP TO FLTR – ITEM 9 EXEC
   CRT2 -Y BREAK TRK – ITEM 7 EXEC
   When S PRES – (*):
   CRT1 Monitor RESID V and H. Repeat BREAK TRK as reqd until stable
   lock-on
   Perform STAR TRACKER NAV, step 2 10A

3. RESUME PASS
   AUTO Angles – ITEM 23 EXEC (*)
   Continue -Z S TRK pass
   After S TRK pass, on MCC GO:

   NOTE
   SELF-TEST may false fail. √MCC for S TRK status

   2: GNC 22 S TRK/COAS CNTL
   CRT2 -Z(-Y) SELF-TEST – ITEM 2(1) EXEC (*)
COAS NAVIGATION

NOTE
Do not execute MC1 or Out-Of-Plane null.
Prior COAS cal reqd to perform COAS NAV.
VERNs reqd to perform COAS NAV.
COAS Nav must be started within ~10 min of Ti to guarantee
adequate geometry for nav convergence.
Breakout – If tgt not visible at MC2+18, refer to 1-4 for
breakout criteria

1. COAS NAV CONFIG

A6U
\[\sqrt{\text{SENSE: } -Z}\]
\[\sqrt{\text{DAP: } B7/\text{AUTO/VERN(ALT)}}\]

CRT
\[\text{COAS: SIGHT MODE – ITEM 22 EXEC (*)}\]
\[\text{REQD ID – ITEM 21 +1 EXEC}\]
\[\sqrt{\text{POS -Z: } \text{ITEM 27 (*)}}\]

\[\text{GNC 22 STRK/COAS CNTL}\]
\[\text{INH Angles – ITEM 24 EXEC (*)}\]
\[\sqrt{\text{SV SEL, ITEM 4 – FLTR}}\]
If TGT NOT in COAS FOV:
| \[\sqrt{\text{MCC}}\]
If TGT in COAS FOV:
\[\text{FLTR TO PROP – ITEM 8 EXEC}\]
\[\text{COAS – ITEM 14 EXEC (*)}\]

Upon MCC uplink of COVARIANCE MATRIX,
\text{COVAR REINIT – ITEM 16 EXEC}

2. COAS MARKS

A6U
\[\text{FLT CNTLR PWR – ON}\]
\[\text{DAP: B/FREE/PRI}\]
\[\text{RHC: As reqd to move TGT near COAS center and maintain BODY YAW}\]
\[\text{ERR < 10 deg}\]
\[\text{DAP: B/FREE/VERN}\]
\[\text{RHC: As reqd to maintain TGT at COAS center and maintain BODY YAW}\]
\[\text{ERR < 10 deg}\]

When TGT centered in COAS, ATT REF pb – push

\[\text{GNC 33 REL NAV}\]
\[\text{If X and Y RESID magnitudes } \geq 1.0:}\]
| \[\sqrt{\text{MCC}}\]
\[\text{If X and Y RESID magnitudes } < 1.0:\]
\[\text{FOR – ITEM 25 EXEC}\]
\[\text{SV UPDATE – non-zero (within 8 sec), then}\]
\[\text{0.0 (after 8 sec more)}\]

Repeat step 2 per schedule:
One mark every 10 to 20 sec until sunset Post-Ti

At sunset,
3. END COAS NAV

A6U
\[\text{DAP: A7/\text{AUTO/VERN(ALT)}}\]
\[\text{FLT CNTLR PWR – OFF}\]
\[\text{GNC 22 STRK/COAS CNTL}\]

CRT
\[\text{COAS: DES – ITEM 25 EXEC (*)}\]

Resume rendezvous timeline
BACKOUT/BREAKOUTS
PROXIMITY OPS BACKOFF

NOTE
Procedure assumes orbiter nose in target’s plane

A6U
√SENSE: -Z
√ADI ATT: - LVLH
√DAP: LO Z as reqd

1. If immediate backoff reqd,
   THC +Z (out) – init 0.2 fps opening rate

2. If on +RBAR:
   √DAP: A/AUTO/VERN(PRI)
   THC as reqd to maintain opening rate and target over PLB (-Z axis)
   Null opening rate at 250 ft
   THC: as reqd to stationkeep >>

3. If not on +RBAR, + or – VBAR:
   DAP: INRTL
   THC as reqd to maintain target over PLB (-Z axis)

4. When + or - VBar reached (Aft ADI pitch = 180 or 0):
   DAP: LVLH
   Config UNIV PTG with tail or nose to Earth track as appropriate

GNC UNIV PTG

TGT ID: +2
BODY VECT: +2 (tail to Earth: +VBar)
           +1 (nose to Earth: -VBar)
OM:        +0
TRACK – ITEM 19 EXEC (CUR – *)
DAP: AUTO
THC: as reqd to maintain target over PLB
     (-Z axis) – low in COAS

5. If opening rate not established (step 1 not performed),
   THC: +Z (out) – init 0.2 fps opening rate

6. Null opening rate when safe range reached (standard range = 250 ft,
   flight specific as reqd),
   THC: as reqd to stationkeep
HST RBAR BREAKOUT

CAUTION
Constraints for use:
Orbiter on +Rbar in + XVV attitude
Range < 500 ft cg to cg
Tgt stable on Orbiter -Z axis

1. AFT STATION CONFIG
   √SENSE: -Z
   √A/AUTO/VERN(PRI)
   √DAP: LO Z

   If RNG < 75 ft

2. INITIATE BACKOUT
   If RNG ≤ 75 ft:
      THC: +Z (out) as reqd to establish a +0.1 ft/sec opening rate
      Maintain lateral position within 8 deg of RBAR

   When RNG > 75 ft

3. PERFORM POSIGRADE/RETROGRADE BURN ON +RBAR
   Config DAP A,B to A7,B7
   √MCC for breakout direction

   NOTE
   Posigrade burn will be performed if second rendezvous attempt is desired

   DAP:  A/AUTO/PRI
   DAP TRANS:  NORM/PULSE/PULSE

   If Posigrad Sep:
      THC:  +X (up) for 12 sec (3.0 fps)
   If Retrograde Sep:
      THC:  -X (down) for 12 sec (3.0 fps)

   DAP TRANS:  PULSE/PULSE/PULSE
   FLT CNTLR PWR – OFF
   DAP:  A/INRTL/VERN(ALT)

   Inform MCC when SEP complete

   When RNG > 1500 ft:
      DAP:  NO LO Z
HST FLYAROUND/LOSS OF LO Z BREAKOUT

CAUTION
Constraints for use:
- HST near orbiter -Z axis
- RNG > 30 ft (EE to grapple fixture)
- RNG < 150 ft (nominal approach)
or
- Post +Vbar crossing (inertial approach)

1. AFT STATION CONFIG
   √ SENSE: -Z
   √ DAP: LO Z
   Verify RMS clearance to HST

2. 1st BURN
   DAP TRANS: NORM/PULSE/PULSE
   DAP: A/FREE/VERN(PRI)
   THC: -X (dn) for 7 sec (1.7 fps)
   
   * If single fwd firing jet  
   * THC: -X (dn) for 14 sec *

   At TIG + 01:00,
   DAP: A/INRTL/PRI
   DAP TRANS: PULSE/PULSE/PULSE

3. PLACE AND MAINTAIN HST IN OVHD WINDOW
   DAP: A/INTRL/VERN(PRI)
   Perform manual pitch rotation as reqd:
   DAP ROT: DISC/PULSE/DISC
   RHC: +/- PITCH as reqd to place and maintain HST in OVHD Window

4. 2nd BURN (Out-Of-Plane)
   When RNG > 1500 ft:
   DAP: no LO Z
   DAP ROT: DISC/DISC/DISC
   GNC, OPS 202 PRO
   [GNC ORBIT MNVR EXEC]
   √ RCS SEL – ITEM 4 EXEC (*)

   Set TIG to current time + 1 min
   TGT PEG 7 ΔVX – ITEM 19 +0 EXEC
   ΔVY – ITEM 20 +2 EXEC
   ΔVZ – ITEM 21 +0 EXEC

   LOAD – ITEM 22 EXEC
   TIMER – ITEM 23 EXEC

   √VGO Z ≥ 0; if VGO Z < 0 then:
   
   * TGT PEG 7 ΔVY – ITEM 20 -2 EXEC *
   * LOAD – ITEM 22 EXEC *
   * TIMER – ITEM 23 EXEC *
   *√VGO Z ≥ 0 *

Cont next page
Do not MNVR to BURN ATT

At TIG, deflect THC to null VGOs

Record 2nd Burn TIG ___/___:___:

5. 3rd BURN (Posigrade/Retrograde)

\( \sqrt{\text{MCC}} \) for breakout direction

If Posigrade Sep:

- If \( \Delta VY \) (step 3) +2:
  - TV ROLL – ITEM 5 +2 7 0 EXEC
- If \( \Delta VY \) (step 3) -2:
  - TV ROLL – ITEM 5 +9 0 EXEC

Set TIG to 3rd Burn + 22 min:

- TGT PEG 7 \( \Delta VX \) – ITEM 19 +3.5 EXEC
- \( \Delta VY \) – ITEM 20 +0 EXEC
- \( \Delta VZ \) – ITEM 21 +0 EXEC

If Retrograde Sep:

- If \( \Delta VY \) (step 3) +2:
  - TV ROLL – ITEM 5 +9 0 EXEC
- If \( \Delta VY \) (step 3) -2:
  - TV ROLL – ITEM 5 +2 7 0 EXEC

Set TIG to 3rd Burn + 22 min:

- TGT PEG 7 \( \Delta VX \) – ITEM 19 -3.5 EXEC
- \( \Delta VY \) – ITEM 20 +0 EXEC
- \( \Delta VZ \) – ITEM 21 +0 EXEC

LOA D – ITEM 22 EXEC

TIMER – ITEM 23 EXEC

MNVR – ITEM 27 EXEC

DAP: B/AUTO/PRI

At TIG-0:30

DAP: A/INTRL/PRI

At TIG, deflect THC to null VGOs

FLT CNTLR PWR – OFF

DAP: A/INTRL/VERN(ALT)

GNC, OPS 201 PRO
RNDZ BREAKOUT

NOTE
This procedure may be performed anytime between Ti and 500 ft. For the contingency inertial approach, this procedure may be performed anytime between Ti and the +V bar crossing.

1. BREAKOUT BURN PREP
   DAP: A/LVLH/PRI
   FLT CNTLR PWR – ON

2. 3 FPS OUT OF PLANE (CONTINGENCY INERTIAL APPROACH RNDZ ONLY)
   DAP TRANS: PULSE/NORM/PULSE, NO LO Z
   GNC 33 REL NAV

   CRT
   If Y > 0:
   FWD THC: +Y (right) 16 sec
   (AFT THC: left)
   If Y < 0:
   FWD THC: -Y (left) 16 sec
   (AFT THC: right)
   DAP TRANS: PULSE/PULSE/PULSE

3. 3 FPS RETROGRADE
   If RANGE < 1500 ft:
   Config DAP B to B7
   DAP: LO Z
   DAP: B/AUTO/PRI
   When in attitude:
   DAP: A/LVLH/PRI

   CRT
   OPS 202 PRO
   GNC ORBIT MNVR EXEC
   \[\text{RCS SEL – ITEM 4 (\textasteriskcentered)}\]
   Set TIG to current time + 1:00
   If Contingency Inertial Approach Rndz:
   Set TIG to current time + 15:00
   TGT PEG 7 ΔVX – ITEM 19 -3 EXEC
   ΔVY – ITEM 20 +0 EXEC
   ΔVZ – ITEM 21 +0 EXEC
   LOAD – ITEM 22 EXEC
   TIMER – ITEM 23 EXEC
   DO NOT MNVR TO BURN ATT
   At TIG, deflect THC to null VGOs
   FLT CNTLR PWR – OFF

   CRT
   OPS 201 PRO
   DAP: A/AUTO/VERN
**Ti DELAY BURN**

1. **OPS 202 PRO**
   - **GNC ORBIT MNVR EXEC**
   - Load Ti Delay Pad, 3-7

   If no Ti Delay targets available:
   - Add 3.0 fps to $\Delta V_x$ of last Ti burn solution
   - Burn $\Delta V_y$ and $\Delta V_z$ as computed in last Ti burn solution
   - Max TIG Slip is 4 minutes

   **NOTE**
   - Guidance will downmode to EXT $\Delta V$

   If RCS:
   - Perform **RCS BURN** (Cue Card)

   If OMS:
   - Perform **RNDZ OMS BURN** (CONTINGENCY OPS), 5-4

2. **Reload new BASETIME per final Ti PAD, 3-7**
   - **GNC 34 ORBIT TGT**
   - TGT NO – ITEM 1 +1 EXEC
   - Set BASETIME to new Ti TIG ___/___:___:
   - Load – ITEM 26 EXEC
   - Reset ET, SM timers to new Ti TIG

   If Ti Delay executed because no comm:
   - Add 0/01:36:00 to BASE TIME for subsequent delay rev

   **NOTE**
   - Ti Delay breakout is a 1.5 fps posigrade burn at the next Ti point

   Perform **RNDZ BREAKOUT** (CONTINGENCY OPS), 5-16, with the following deltas:
   - Set TIG to BASE TIME
   - TGT PEG 7 $\Delta V_x$ – ITEM 19 +1.5 EXEC
   - $\Delta V_y$ – ITEM 20 +0 EXEC
   - $\Delta V_z$ – ITEM 21 +0 EXEC

   Go to TERMINATE RNDZ OPS (Cue Card, HST RBAR APPROACH) >>

3. **Perform Post Ti Nav** [16A], 4-16, then

   Return to RENDEZVOUS TIMELINE at PET: -01:25, 4-11

   **NOTE**
   - Extra NCC Burn and Ti Onboard Solution pads, 5-18
## NCC BURN SOLUTION

**TIG**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### PRELIMINARY

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### INTERMEDIATE

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### FINAL

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### GROUND

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### FINAL-GROUND LIMITS

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

## Ti ONBOARD SOLUTIONS

### PREL FLTR

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### 1ST INTER FLTR

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### 2ND INTER FLTR (IF REQD)

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### FINAL FLTR

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### PROP (IF REQD)

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### FINAL-GROUND LIMITS

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

### FINAL Ti PAD (MNVR PADS)

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
</table>
RNDZ NAV RECOVERY

1. If Recovery from OPS MODE RECALL:
   (add/delete GPC to/from redundant set)
   
   GNC 33 REL NAV

   RNDZ NAV ENA – ITEM 1 EXEC (*)
   GNC UNIV PTG
   TRK – ITEM 19 (CUR-*)
   Go to step 3

2. If Recovery from OPS TRANSITION (G8/G3 to G2):
   
   GNC 34 ORBIT TGT
   TGT NO – ITEM 1 +1 EXEC
   Set BASE TIME to Ti TIG (Ti Burn Pad, 3-6)
   LOAD – ITEM 26 EXEC
   GNC 33 REL NAV
   Upon MCC uplink of TGT SV,
   RNDZ NAV ENA – ITEM 1 EXEC (*)

   NOTE
   If RNDZ NAV not enabled (no *),
   DO NOT PROCEED. √MCC

   Select appropriate target track attitude
   GNC UNIV PTG

<table>
<thead>
<tr>
<th>-Z</th>
<th>-Y (STRK)</th>
<th>+Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGT ID</td>
<td>+1</td>
<td>+1</td>
</tr>
<tr>
<td>BODY VECT</td>
<td>+3</td>
<td>+4</td>
</tr>
<tr>
<td>P</td>
<td>√+90</td>
<td>√+0</td>
</tr>
<tr>
<td>Y</td>
<td>√+0</td>
<td>√+280.6</td>
</tr>
<tr>
<td>OM</td>
<td>+0</td>
<td>+90</td>
</tr>
</tbody>
</table>

   TRK – ITEM 19 (CUR-*)

   C3

3. DAP: ALT
   DAP: A/AUTO
   DAP ROT: DISC/DISC/DISC
   When in attitude, DAP: VERN

   If NAV sensor data available:
   If STRK NAV:
   Go to STAR TRACKER NAV 10A , 4-10 >>
   If RR NAV:
   GNC 33 REL NAV

   CRT
   KU ANT ENA – ITEM 2 (*)
   GNC I/O RESET
   Go to RR NAVIGATION 13B , 4-13
TGT ITER

When in Lambert Targeting and TGT ITER occurs:

If PRED MATCH other than 999999 (all 9s):

√MCC and read down PRED MATCH from SPEC 34 (MCC has delta Vs)
On MCC GO or if no comm:
Recall TGT set and recompute
If TGT ITER recurs and PRED MATCH less than 400:
Contact MCC and read down PRED MATCH from SPEC 34
On MCC GO or if no comm:
Load current delta Vs and execute as Lambert burn >>
If TGT ITER recurs and PRED MATCH greater than 400:
Contact MCC and read down PRED MATCH from SPEC 34
On MCC GO or if no comm:
Load ground solution and execute as EXT DV burn
(If MC burn, uplink of ground solution reqd) >>
If ground solution not available: No burn >>

If PRED MATCH 999999 (all 9s):
On MCC GO or if no comm:
Load ground solution and execute as EXT DV burn
(If MC burn, uplink of ground solution reqd) >>
If ground solution not available: No burn >>
LOSS OF COMM

If comm with MCC is lost during rendezvous ops, attempt to establish comm by performing COMM LOST (ORB PKT, COMM). Do not maneuver out of target track attitude unless all other means of acquiring comm are expended.

Ground-Targeted Burns
1. If NH or NC PADs not available, do not perform burn
2. If a day of rendezvous NC or NH maneuver was not performed nominally, then discontinue rendezvous operations
3. If the day of rendezvous NC maneuver is performed using preliminary pads, a large NCC burn can be expected

Lambert-Targeted Burns
1. If "GO for Ti" not received from MCC by Ti TIG - 5 min, perform Ti DELAY BURN (CONTINGENCY OPS), 5-17. If comm is not recovered after two delay revs, perform modified RNDZ BREAKOUT per Ti DELAY BURN (CONTINGENCY OPS), 5-17
2. If radar nav was stopped in an attempt to get Ku comm during the delay, do not perform second or third NCC burn unless radar nav is re-enabled and sufficient radar marks are taken to provide a converged solution
3. If no comm for any midcourse correction (MC) burn, perform burn and continue to prox ops

Prox Ops
1. Continue on best effort basis
DEGRADED CONTROL
LOSS OF VRCS

NOTE
This procedure overrides LOSS OF VERNIERS (ORB OPS, RCS) during rendezvous ops

1. Utilize VERN fail downmodes (PRI/ALT) specified in parentheses and follow VERN fail starred blocks per timeline. If VERN fail downmode not specified, use PRI Nose and Tail control.

2. COAS NAV should not be performed if VERN fail.

3. Additional braking pulses (+Z) may be reqd due to LO Z PRI attitude control cross coupling.
# LOSS OF LO Z BRAKING

During Approach:

If 2 -X jets ↓ (Degraded LO Z braking):

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>LO Z +Z translation with a single -X jet will couple strongly into +X translation</td>
</tr>
</tbody>
</table>

Maintain DAP: LO Z  
Minimize LO Z +Z translations  
Continue approach and attempt grapple >>

If 3 -X jets ↓ (Loss of LO Z Braking and/or -X translation not available):

<table>
<thead>
<tr>
<th>If RNG &gt; 150 ft:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakout 3 fps posigrade or retrograde per MCC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If RNG &lt; 150 ft:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakout using ±Y translation or NORM Z braking as reqd to avoid collision</td>
</tr>
</tbody>
</table>

√MCC for subsequent maneuvers >

If 2 +X jets ↓ in same pod (Loss of LO Z Braking):

<table>
<thead>
<tr>
<th>If 150 &lt; RNG &lt; 1500 ft:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain Rbar within 10 deg (do not initiate flyaround)</td>
</tr>
<tr>
<td>Maintain DAP: LO Z</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>If LO Z not recoverable:</th>
</tr>
</thead>
<tbody>
<tr>
<td>If 500 &lt; RNG &lt; 1500</td>
</tr>
<tr>
<td>Perform RNDZ BREAKOUT, 5-16</td>
</tr>
<tr>
<td>If 150 &lt; RNG &lt; 500</td>
</tr>
<tr>
<td>Perform HST RBAR BREAKOUT, 5-13</td>
</tr>
</tbody>
</table>

If possibility of recovering LO Z:  
Establish station keeping at 120 ft ± 10 ft  
If RNG < 150 ft and range to grapple > 30 ft:  
Perform HST FLYAROUND/LOSS OF LO Z BREAKOUT (CONTINGENCY OPERATIONS), 5-14  
If Range to Grapple < 30 ft:  
Proceed with NORM Z braking and perform grapple  
Maintain DAP: LO Z when not braking
REFERENCE DATA

STS-125 HST RNDZ OPS DAP CONFIGURATIONS ..................................................... 6-2
TARGETING DATA ................................................................................................. 6-3
POST NC ............................................................................................................. 6-5
   Ti ..................................................................................................................... 6-6
   MC3 ............................................................................................................... 6-7
COAS SUBTENDED ANGLES (DEG) VS RANGE (FT) ............................................. 6-8
## STS-125 HST RNDZ OPS DAP CONFIGURATIONS

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>PRI</th>
<th>A7</th>
<th>B7</th>
<th>A8</th>
<th>B8</th>
<th>A9</th>
<th>B9</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RNDZ</td>
<td>TERMINAL PHASE</td>
<td>FLYAROUND</td>
<td>SPEC 20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ITEM #</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROT RATE</td>
<td>0.200</td>
<td>0.500</td>
<td>0.0500</td>
<td>0.0500</td>
<td><strong>0.200</strong></td>
<td><strong>0.200</strong></td>
<td>10</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>ATT DB</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>2.00</td>
<td>1.00</td>
<td>1.00</td>
<td>11</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>RATE DB</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.20</td>
<td>0.10</td>
<td>0.10</td>
<td>12</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>ROT PLS</td>
<td>0.10</td>
<td>0.04</td>
<td>0.10</td>
<td>0.04</td>
<td>0.10</td>
<td>0.04</td>
<td>13</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>COMP</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>14</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>P OPTION</td>
<td>ALL</td>
<td>ALL</td>
<td>ALL</td>
<td>ALL</td>
<td>TAIL</td>
<td>TAIL</td>
<td>15</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Y OPTION</td>
<td>ALL</td>
<td>ALL</td>
<td>ALL</td>
<td>ALL</td>
<td>TAIL</td>
<td>TAIL</td>
<td>16</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>TRAN PLS</td>
<td>0.10</td>
<td>0.05</td>
<td>0.10</td>
<td>0.05</td>
<td>0.05</td>
<td>.01</td>
<td>17</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>ALT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RATE DB</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>0.10</td>
<td>18</td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>JET OPT</td>
<td>ALL</td>
<td>ALL</td>
<td>ALL</td>
<td>ALL</td>
<td>TAIL</td>
<td>TAIL</td>
<td>19</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td># JETS</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>20</td>
<td>40</td>
<td></td>
</tr>
<tr>
<td>ON TIME</td>
<td>0.08</td>
<td>0.08</td>
<td>0.08</td>
<td>.08</td>
<td>0.08</td>
<td>0.08</td>
<td>21</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>DELAY</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>22</td>
<td>42</td>
<td></td>
</tr>
<tr>
<td>VERN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROT RATE</td>
<td>0.0160</td>
<td>0.2000</td>
<td>0.0500</td>
<td>0.0500</td>
<td>0.200</td>
<td>0.200</td>
<td>23</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>ATT DB</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>24</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>RATE DB</td>
<td>0.020</td>
<td>0.020</td>
<td>0.020</td>
<td>0.020</td>
<td>0.020</td>
<td>0.020</td>
<td>25</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>ROT PLS</td>
<td>0.010</td>
<td>0.002</td>
<td>0.050</td>
<td>0.020</td>
<td>0.050</td>
<td>0.020</td>
<td>26</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>COMP</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>.000</td>
<td>27</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>CNTL ACC</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>28</td>
<td>48</td>
<td></td>
</tr>
</tbody>
</table>
## TARGETING DATA

<table>
<thead>
<tr>
<th>SPEC 34 ITEM NO</th>
<th>TGT ALTITUDE</th>
<th>TGT NO</th>
<th>DESCRIPTION</th>
<th>T1 REL TO BASETIME</th>
<th>EL (DEG)</th>
<th>DT (MIN)</th>
<th>DX (KFT)</th>
<th>DY (KFT)</th>
<th>DZ (KFT)</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>9</td>
<td>NCC</td>
<td>-0/00:56:18</td>
<td>0</td>
<td>56.3</td>
<td>-48.6</td>
<td>0</td>
<td>+1.2</td>
<td></td>
<td>BASETIME = Ti TIG</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Ti</td>
<td>0/00:00:00</td>
<td>0</td>
<td>75.1</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>MC1</td>
<td>0/00:20:00</td>
<td>0</td>
<td>55.1</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>MC2</td>
<td>0/00:48:06</td>
<td>28.46</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>MC3</td>
<td>0/00:17:00</td>
<td>0</td>
<td>10.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>MC4</td>
<td>0/00:27:00</td>
<td>0</td>
<td>13.0</td>
<td>0</td>
<td>0</td>
<td>+0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>MC2 ON TIME</td>
<td>0/00:00:00</td>
<td>0</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>170</td>
<td>9</td>
<td>NCC</td>
<td>-0/00:56:48</td>
<td>0</td>
<td>56.8</td>
<td>-48.6</td>
<td>0</td>
<td>+1.2</td>
<td></td>
<td>BASETIME = Ti TIG</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Ti</td>
<td>0/00:00:00</td>
<td>0</td>
<td>75.7</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>MC1</td>
<td>0/00:20:00</td>
<td>0</td>
<td>55.7</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>MC2</td>
<td>0/00:48:42</td>
<td>28.66</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>MC3</td>
<td>0/00:17:00</td>
<td>0</td>
<td>10.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>MC4</td>
<td>0/00:27:00</td>
<td>0</td>
<td>13.0</td>
<td>0</td>
<td>0</td>
<td>+0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>MC2 ON TIME</td>
<td>0/00:00:00</td>
<td>0</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>190</td>
<td>9</td>
<td>NCC</td>
<td>-0/00:57:12</td>
<td>0</td>
<td>57.2</td>
<td>-48.6</td>
<td>0</td>
<td>+1.2</td>
<td></td>
<td>BASETIME = Ti TIG</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Ti</td>
<td>0/00:00:00</td>
<td>0</td>
<td>76.3</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>MC1</td>
<td>0/00:20:00</td>
<td>0</td>
<td>56.3</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>MC2</td>
<td>0/00:49:18</td>
<td>28.85</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>MC3</td>
<td>0/00:17:00</td>
<td>0</td>
<td>10.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>MC4</td>
<td>0/00:27:00</td>
<td>0</td>
<td>13.0</td>
<td>0</td>
<td>0</td>
<td>+0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>MC2 ON TIME</td>
<td>0/00:00:00</td>
<td>0</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>210</td>
<td>9</td>
<td>NCC</td>
<td>-0/00:57:42</td>
<td>0</td>
<td>57.7</td>
<td>-48.6</td>
<td>0</td>
<td>+1.2</td>
<td></td>
<td>BASETIME = Ti TIG</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Ti</td>
<td>0/00:00:00</td>
<td>0</td>
<td>76.9</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>MC1</td>
<td>0/00:20:00</td>
<td>0</td>
<td>56.9</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>MC2</td>
<td>0/00:49:54</td>
<td>29.07</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>MC3</td>
<td>0/00:17:00</td>
<td>0</td>
<td>10.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>MC4</td>
<td>0/00:27:00</td>
<td>0</td>
<td>13.0</td>
<td>0</td>
<td>0</td>
<td>+0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>MC2 ON TIME</td>
<td>0/00:00:00</td>
<td>0</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>230</td>
<td>9</td>
<td>NCC</td>
<td>-0/00:58:12</td>
<td>0</td>
<td>58.2</td>
<td>-48.6</td>
<td>0</td>
<td>+1.2</td>
<td></td>
<td>BASETIME = Ti TIG</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Ti</td>
<td>0/00:00:00</td>
<td>0</td>
<td>77.6</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>MC1</td>
<td>0/00:20:00</td>
<td>0</td>
<td>57.6</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>MC2</td>
<td>0/00:50:36</td>
<td>29.32</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>MC3</td>
<td>0/00:17:00</td>
<td>0</td>
<td>10.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>MC4</td>
<td>0/00:27:00</td>
<td>0</td>
<td>13.0</td>
<td>0</td>
<td>0</td>
<td>+0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>19</td>
<td>MC2 ON TIME</td>
<td>0/00:00:00</td>
<td>0</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## TARGETING DATA (Cont)

<table>
<thead>
<tr>
<th>SPEC 34 ITEM NO</th>
<th>TGT ALTITUDE</th>
<th>TGT NO</th>
<th>DESCRIPTION</th>
<th>T1 REL TO BASETIME</th>
<th>EL (DEG)</th>
<th>DT (MIN)</th>
<th>DX (KFT)</th>
<th>DY (KFT)</th>
<th>DZ (KFT)</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>250</td>
<td>9</td>
<td>NCC</td>
<td>-00:58:42</td>
<td>0</td>
<td>58.7</td>
<td>-48.6</td>
<td>0</td>
<td>+1.2</td>
<td>BASETIME = Ti TIG</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Ti</td>
<td>0/00:00:00</td>
<td>0</td>
<td>78.2</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>MC1</td>
<td>0/00:20:00</td>
<td>0</td>
<td>58.2</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>MC2</td>
<td>0/00:51:12</td>
<td>29.55</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>MC3</td>
<td>0/00:17:00</td>
<td>0</td>
<td>10.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>MC4</td>
<td>0/00:27:00</td>
<td>0</td>
<td>13.0</td>
<td>0</td>
<td>0</td>
<td>+0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>MC2 ON TIME</td>
<td>0/00:00:00</td>
<td>0</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>270</td>
<td></td>
<td>9</td>
<td>NCC</td>
<td>-00:59:06</td>
<td>0</td>
<td>59.1</td>
<td>-48.6</td>
<td>0</td>
<td>+1.2</td>
<td>BASETIME = Ti TIG</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Ti</td>
<td>0/00:00:00</td>
<td>0</td>
<td>78.9</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>MC1</td>
<td>0/00:20:00</td>
<td>0</td>
<td>58.9</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>MC2</td>
<td>0/00:51:54</td>
<td>29.80</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>MC3</td>
<td>0/00:17:00</td>
<td>0</td>
<td>10.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>MC4</td>
<td>0/00:27:00</td>
<td>0</td>
<td>13.0</td>
<td>0</td>
<td>0</td>
<td>+0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>MC2 ON TIME</td>
<td>0/00:00:00</td>
<td>0</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>290</td>
<td></td>
<td>9</td>
<td>NCC</td>
<td>-00:59:36</td>
<td>0</td>
<td>59.6</td>
<td>-48.6</td>
<td>0</td>
<td>+1.2</td>
<td>BASETIME = Ti TIG</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Ti</td>
<td>0/00:00:00</td>
<td>0</td>
<td>79.5</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>MC1</td>
<td>0/00:20:00</td>
<td>0</td>
<td>59.5</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>MC2</td>
<td>0/00:52:30</td>
<td>30.03</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>MC3</td>
<td>0/00:17:00</td>
<td>0</td>
<td>10.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>MC4</td>
<td>0/00:27:00</td>
<td>0</td>
<td>13.0</td>
<td>0</td>
<td>0</td>
<td>+0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>MC2 ON TIME</td>
<td>0/00:00:00</td>
<td>0</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>310</td>
<td></td>
<td>9</td>
<td>NCC</td>
<td>-00:60:06</td>
<td>0</td>
<td>60.1</td>
<td>-48.6</td>
<td>0</td>
<td>+1.2</td>
<td>BASETIME = Ti TIG</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Ti</td>
<td>0/00:00:00</td>
<td>0</td>
<td>80.1</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>MC1</td>
<td>0/00:20:00</td>
<td>0</td>
<td>60.1</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>MC2</td>
<td>0/00:53:06</td>
<td>30.25</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>MC3</td>
<td>0/00:17:00</td>
<td>0</td>
<td>10.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>MC4</td>
<td>0/00:27:00</td>
<td>0</td>
<td>13.0</td>
<td>0</td>
<td>0</td>
<td>+0.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>MC2 ON TIME</td>
<td>0/00:00:00</td>
<td>0</td>
<td>27.0</td>
<td>-0.9</td>
<td>0</td>
<td>+1.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>310 INTRL APPROACH</td>
<td></td>
<td>9</td>
<td>NCC</td>
<td>-00:60:06</td>
<td>0</td>
<td>60.1</td>
<td>-48.6</td>
<td>0</td>
<td>-1.2</td>
<td>BASETIME = Ti TIG</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>Ti</td>
<td>0/00:00:00</td>
<td>0</td>
<td>85.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td>MC1</td>
<td>0/00:26:24</td>
<td>0</td>
<td>59.1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td>MC2</td>
<td>0/00:52:48</td>
<td>29.49</td>
<td>32.7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td>MC3</td>
<td>0/00:10:00</td>
<td>0</td>
<td>22.7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td></td>
<td>MC4</td>
<td>0/00:20:00</td>
<td>0</td>
<td>12.7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td>MC2 ON TIME</td>
<td>0/00:00:00</td>
<td>0</td>
<td>32.7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
POST MC3

THETA (DEG)
(F ADI PITCH)

KFT

20 (290)
30 (300)
40 (310)
50 (320)

0 1 2 3 4 5 6 7 8 9 10

60 (330)
70 (340)
80 (350)
90 (0)
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCTV CONFIG FOR DOCKING/UNDOCKING</td>
<td>7-2</td>
</tr>
<tr>
<td>RNDZ TOOLS CHECKOUT</td>
<td>7-4</td>
</tr>
<tr>
<td>TROUBLESHOOTING</td>
<td>7-5</td>
</tr>
<tr>
<td>TCS CADS NOT RECEIVING TCS DATA</td>
<td>7-6</td>
</tr>
<tr>
<td>RPOP NOT RECEIVING PCMMU DATA</td>
<td>7-7</td>
</tr>
<tr>
<td>HHL DATA</td>
<td>7-8</td>
</tr>
<tr>
<td>TCS DATA (CADS RCV DATA ON SAME PGSC)</td>
<td>7-9</td>
</tr>
<tr>
<td>PGSC REBOOT</td>
<td>7-9</td>
</tr>
<tr>
<td>TOOLS CONFIGURATION STATUS</td>
<td>7-10</td>
</tr>
<tr>
<td>HAND-HELD LIDAR CHECKOUT/OPS</td>
<td>7-14</td>
</tr>
<tr>
<td>STOW</td>
<td>7-14</td>
</tr>
<tr>
<td>RPOP INITIALIZATION</td>
<td>7-15</td>
</tr>
<tr>
<td>OPS</td>
<td>7-16</td>
</tr>
<tr>
<td>TCS ACTIVATION</td>
<td>7-18</td>
</tr>
<tr>
<td>MANUAL ACQUISITION</td>
<td>7-19</td>
</tr>
<tr>
<td>DEACTIVATION</td>
<td>7-20</td>
</tr>
<tr>
<td>TRAD FAIL RANGE AND RANGE RATE DETERMINATION</td>
<td>7-21</td>
</tr>
<tr>
<td>RNDZ TOOLS REFERENCE DATA</td>
<td>7-22</td>
</tr>
<tr>
<td>RPOP FUNCTION KEY SUMMARY</td>
<td>7-22</td>
</tr>
<tr>
<td>KEYSTROKE SUMMARY</td>
<td>7-25</td>
</tr>
<tr>
<td>RPOP TRAJECTORY DATA SOURCE OPTIONS</td>
<td>7-26</td>
</tr>
<tr>
<td>HHL REF DATA</td>
<td>7-28</td>
</tr>
<tr>
<td>TCS LIMIT DATA</td>
<td>7-28</td>
</tr>
</tbody>
</table>
CCTV CONFIG FOR DOCKING/UNDOCKING

1. ACTIVATION
   Perform ACTIVATION (Cue Card, TV)
   √Monitors set to USCAN – ON
   √MCC: VSU Sync/Async configuration

   Pwr up Cameras for Docking/Undocking:
   CENTERLINE
   Camrs A,C,D
   Camr B
   Install Monitor Sunshades

2. SET CCTV CAMERA FUNCTIONS
   2.1 For Centerline Camera:
      ALC pb – press
      AVG pb – press
      √GAM BLK STR – ON
      √COLOR BAL – SUN
   2.2 For Cameras A,C,D:
      ALC pb – press
      AVG pb – press
      GAM BLK STR – ON
      √COLOR BAL – SUN
      SHUTTER – ON pb press as reqd
   2.3 For Camera B:
      ALC pb – press
      AVG pb – press
      LT LEVEL pb – press
      NIGHT pb – press
      GAM BLK STR – ON

3. SET CAMERA ZOOM SETTINGS
   CAMERA          ZOOM OVERLAY
   Centerline     40.0° (Corridor) Corridor
                   10.1° (full zoom) Grid

4. MONITOR SETUP
   MON 1,2 L-DATA – on
   C-DATA – grn
   XHAIR – grn

5. CAMERA SETUP – CAMERA A,D
   A7 MON 2 – Camr A (Range Ruler), D (Backup Range Ruler)
   Zoom = 74.4° FOV (full unzoom), Focus = 12 ft
   Pan: as reqd to center ODS in monitor (see figure next page)
   Tilt: as reqd until bottom of ODS Interface Ring touches bottom of
         screen (see figure next page)

6. FINAL CONFIG FOR APPROACH AND UNDOCKING/SEP
   MON 1 – CENTERLINE
   MON 2 – RANGE RULER

   Install CORRIDOR overlay:
      Use green XHair to center overlay

   Install RANGE RULER overlay:
      Place contact ring tangent line on top of ODS Contact Ring (see Figure 7-1)
Figure 7-1.– Camr A,D Range Ruler Vew Approach Config.
RNDZ TOOLS CHECKOUT

1. √MCC uplink to TGT SV
   [GNC 33 REL NAV]
   RNDZ NAV ENA – ITEM 1 EXEC (*)

2. √RNDZ TOOLS connected per PGSC Usage Chart (if available) or UTILITY
   OUTLET PLUG-IN PLAN ORBIT CONFIGURATION (REF DATA FS,
   UTIL PWR)

3. Perform WINDECOM OPS – ACT (ORB OPS, PGSC)
   If WinDecom data is static:
   Perform WINDECOM OPS – TROUBLESHOOTING (ORB OPS, PGSC)
   Steps C-1 through C-5 as required to receive data
   Report status to MCC

4. Perform RPOP INITIALIZATION, 7-15
   Verify good WinDecom data to RPOP
   If “RPOP is not receiving PCMMU Data” is displayed:
   Perform RPOP not receiving PCMMU Data, 7-7
   Report status to MCC

   On MCC GO:
5. Perform TCS ACTIVATION, steps 1 and 2, 7-18

6. Perform HAND-HELD LIDAR CHECKOUT/OPS, 7-14

   On MCC GO:
7. When checkout complete, perform TCS DEACTIVATION, 7-20, then:
   Exit RPOP – [SHIFT]/[F10], then:
   HHL PWR SW – OFF, then:
   Temp stow Rndz Tools as reqd

8. [GNC 33 REL NAV]
   RNDZ NAV ENA – ITEM 1 EXEC (no *)
RNDZ TOOLS TROUBLESHOOTING

Notify MCC of problem, verify the configuration, then perform each step from the appropriate procedure, one at a time, until functionality restored. Inform MCC of the status after each step.

The objective of these actions is to quickly return functionality to a minimum TRAD system (one RPOP with PCMMU data via serial RS422 data) and minimize time spent trying to recover the Network/Telemetry Server or determine the root cause of the problem.

Troubleshooting steps assume RPOP is configured to receive PCMMU data via the network with Telemetry Server, but the RS-422 data cables are connected as a backup.

INITIAL CONFIGURATION

Verify the current configuration before contacting MCC (and inform MCC of the status)

**COMM Port Config:**

On RPOP: Config [CNTL]/[F10] > Comm Ports

<table>
<thead>
<tr>
<th>Config</th>
<th>Com1</th>
<th>Com2</th>
<th>Com3</th>
<th>Com4</th>
<th>DLL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tlm Server</td>
<td>HHL</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>PCMMU TCS</td>
</tr>
<tr>
<td>Serial</td>
<td>HHL</td>
<td>None</td>
<td>None</td>
<td>PCMMU</td>
<td>TCS</td>
</tr>
</tbody>
</table>

On TCS CADS: Config > Comm Port > COM2 (√)

**WinDecom**

TFL Correct per (ORB OPS FS, COMM/INST)

Telemetry Monitor

Status and Packet data not backlit yellow or red
Telemetry Tab > Stream > “STSXXX-rt gnc”

Status = OK
Packet 40 Present (may need to scroll down)

Telemetry Server (status icon in Windows system tray)

Verify green (GO) indicator displayed
TROUBLESHOOTING

Each step below is an independent troubleshooting attempt. Inform MCC the status after each step. These may repeat some of the steps from the INITIAL CONFIGURATION section.

A. TCS CADS not receiving TCS data

NOTE: Assumes TCS ACTIVATION has been completed successfully

NOTE: If problem on Backup RPOP PGSC, continue use of Prime RPOP PGSC (do not alter config of Prime RPOP PGSC or TCS unit)

A1. If TCS MODE = Acq and reflector out of field-of-view

A2. √TX/RX end of TCS cable securely connected to Prime RPOP PGSC Quatech card COM2 (A)

√RX end of TCS cable securely connected to Backup RPOP PGSC Quatech card COM2 (A)

√PDIP PORT end of TCS cable connected to PDIP J101 port

If serial extension cables in use, verify all connections are secure

A3. If TCS CAD “Error Reading from Device” message (Quatech card problem)

If on Prime RPOP PGSC:

TCS PWR – OFF (tb-bp)

Perform RPOP PGSC Reboot, 7-9

Perform TCS ACTIVATION, 7-18 steps 1–3 (expect “Auto Seed” message)

If on B/U RPOP PGSC:

If time permits, check connections (Quatech card and serial cable)

If serial cable unplugged – reconnect cable

If Quatech card unseated: Perform RPOP PGSC Reboot, 7-9

Perform TCS ACTIVATION 7-18, step 1 and 3 (expect “Auto Seed message”)

If TCS status information restored:

If reqd, perform RPOP INITIALIZATION, 7-15

perform RPOP OPS, 7-16

If Prime RPOP PGSC, perform TCS ACTIVATION, 7-18, step 4

If TCS data not restored, inform MCC

A4. Perform TCS CADS software restart (per the following sequence):

If problem on Prime RPOP PGSC, TCS PWR – OFF (tb-bp)

TCS CADS: File > Exit TCS CAD

Perform TCS ACTIVATION, 7-18 (if backup RPOP, step 1 and 3 only)

A5. Remove and replace TCS cable (including serial extension cables, if applicable) and Quatech card (per the following sequence):

If problem on Prime RPOP PGSC, TCS PWR – OFF (tb-bp)

Shut down suspect PGSC

Install backup TCS cable and Quatech card

Disconnect PCMMU data cables

Verify TX/RX end of TCS cable connected to Quatech card COM2

Perform RPOP PGSC Reboot, 7-9

Perform RPOP INITIALIZATION, 7-15

Perform RPOP OPS, 7-16

Perform TCS ACTIVATION, 7-18 (if backup RPOP, step 1 and 3 only)

If TCS data not restored, inform MCC

A6. MCC for steps in RNDZ TOOLS CONFIGURATION STATUS, 7-10

Cont next page
B. RPOP not receiving PCMMU data
If either RPOP PGSC is receiving good PCMMU data, the WinDecom PGSC is NOT the source of the problem. Start on step B2

B1. On WinDecom PGSC, verify WinDecom receiving dynamic data
If WinDecom data is static,
\[\sqrt{\text{PCMMU cable connection to Panel O5 (port as reqd) and WinDecom PGSC}}\]
If WinDecom data active and RPOP not receiving PCMMU Data:
Reboot WinDecom PGSC and restart WinDecom – Prime

NOTE
Perform steps B2 thru B5 for both Prime and/or Backup RPOP PGSC

B2. Verify Telemetry Server status indicator in the Windows system tray
If red (STOP) indicator:
Double left click the red (STOP) indicator to open [Telemetry Server] window
If “Not Connected to WinDecom” displayed:
> File > Reset Server
Wait 30 seconds, then reassess PCMMU data to RPOP
If yellow (TFL) indicator: Contact MCC >>
If green (GO) indicator:
Shut down any other programs running on that PGSC (except TSC CADS), then
Double left click the green (GO) indicator to open [Telemetry Server] window
> View > Applications Using The Server
Verify RPOP is the only application listed

B3. On [RPOP], verify configuration for PCMMU data
Config [CNTL]/[F10] > [Comm Ports…]
Under DLL, verify that PCMMU is selected
Verify “PCM” mode selected – status displayed above F6 in Function Key Menu
If “No PCM” displayed,
Select PCM mode with [CNTL]/[F6]
TCS Data [CNTL] / [F3] > Select “NAV (filtered)”

B4. Verify correct end of RS-422 Y-cable connections to Quatech card COM4 (B) lead
Prime RPOP PGSC: TX/RX
B/U RPOP PGSC: RX
WinDecom PGSC: SRC
If serial extension cables in use, verify all connections

B5. Configure [RPOP] ports for serial data:
Config [CNTL]/[F10] > [Comm Ports…]
Under COM4, select PCMMU, then “OK” both RPOP Config windows
If “Access is denied” error message received, repeat step B5.
If no joy, repeat step B5 one more time

NOTE
This terminates the Telemetry Server, so expect the status indicator in the Windows system tray to disappear

Cont next page
B6. Verify Quatech card securely seated in the RPOP PGSC
   If connection not secure or card temporarily disconnected:
     Perform RPOP PGSC Reboot, 7-9
     Perform RPOP INITIALIZATION, 7-15
     Perform step B5 to configure RPOP for serial port
   If PCMMU data recovered:
     Perform RPOP OPS, 7-16
     If Prime RPOP: Perform TCS ACTIVATION, 7-18 (all steps) >>
     If B/U RPOP: Perform TCS ACTIVATION, 7-18, step 1 and 3 only >>

B7. Remove and replace RS-422 PCMMU serial cable (including serial extension cables, if applicable) and Quatech card (per the following sequence):
   If Prime RPOP PGSC:
     Perform RPOP PGSC Reboot, 7-9 (install new card/cable at step E2)
     Perform RPOP INITIALIZATION, 7-15
     Perform step B5 to configure RPOP for serial port
     Perform RPOP OPS, 7-16
     Perform TCS ACTIVATION, 7-18
   If B/U RPOP PGSC: inform MCC >>
     (Do not alter config of Prime RPOP PGSC if it is working)

B8. ¬MCC for steps in RNDZ TOOLS CONFIGURATION STATUS, 7-10

C. RPOP not receiving HHL data
C1. Verify good raw HHL data displayed on HHL unit
C2. ¬HHL cable securely connected to HHL unit and COM1
C3. ¬RPOP port config for HHL
    Config [CNTL][F10] > [Comm Ports…]
    Under COM1, verify that HHL is selected
C4. Connect HHL cable to other RPOP PGSC (COM1 port) and check data flow
C5. As reqd, swap to backup HHL data cable or backup HHL unit
C6. ¬MCC for steps in RNDZ TOOLS CONFIGURATION STATUS, 7-10
D. RPOP not receiving TCS data (TCS CADS is receiving data on the same PGSC)

D1. √RPOP configured to receive TCS data via DLL
   Config [CNTL]/[F10] > [Comm Ports…]
   Under DLL, verify that TCS is selected

D2. On [RPOP], verify that RPOP is receiving PCMMU data
   If RPOP not receiving PCMMU data, perform RPOP is not receiving PCMMU data, 7-7

D3: On [RPOP], reset DLL function by cycling TCS config
   Config [CNTL]/[F10] > [Comm Ports…]
   Under DLL, deselect TCS, then “OK” both RPOP Config windows
   Config [CNTL]/[F10] > [Comm Ports…]
   Under DLL, reselect TCS, then “OK” both RPOP Config windows
   Wait 30 seconds, then reassess TCS data to RPOP

D4. Quit and restart RPOP:
   Exit RPOP – [SHIFT]/[F10], (Expect TCS CADS “Auto seed message”) then:
   Perform RPOP INITIALIZATION, 7-15
   Perform RPOP OPS, 7-16

D5. Reboot RPOP PGSC and restart RPOP (per the following sequence):
   Perform RPOP PGSC Reboot, 7-9 (step E2 not reqd)
   Perform RPOP INITIALIZATION, 7-15
   Perform RPOP OPS, 7-16
   Perform TCS ACTIVATION, 7-18

D6. √MCC for steps in RNDZ TOOLS CONFIGURATION STATUS, 7-10

E. RPOP PGSC Reboot
   E1. Shut down/power off PGSC
   E2. Eject and reseat Quatech card
   E3. Disconnect serial data cables from Quatech card
   E4. Reboot PGSC

When “Time-Vector Server” finished (in Windows task bar)
E5. Reconnect serial data cables
RNDZ TOOLS CONFIGURATION STATUS

On MCC request, provide the answers to the following questions:

RPOP (answer for all suspect RPOP PGSCs)

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Which PGSC is being used?</td>
<td>1.</td>
</tr>
<tr>
<td>2</td>
<td>Which version of RPOP (per RPOP title bar)? (On request, report the exact location of the RPOP icon)</td>
<td>2.</td>
</tr>
<tr>
<td>3</td>
<td>COM1 port (on PGSC aft)</td>
<td>3a. 3b</td>
</tr>
<tr>
<td></td>
<td>a. Report associated cable label</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Cable securely connected?</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>COM4 port (on Quatech card, B leg)</td>
<td>4a. 4b 4c 4d</td>
</tr>
<tr>
<td></td>
<td>a. Report associated cable label</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Cable securely connected?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Grey box installed in proper orientation?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. If serial cable extension in use, verify 4a and 4b at extension cable interface</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Network</td>
<td>5a. 5b 5c 5d</td>
</tr>
<tr>
<td></td>
<td>a. Network card securely installed in PGSC?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Cable securely connected?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Verify secure network cable connections between WinDecom and RPOP PGSCs (and/or wireless router)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. If wireless network, report wireless router status.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Check Quatech card status</td>
<td>6a. 6b 6c</td>
</tr>
<tr>
<td></td>
<td>a. Start &gt; Settings &gt; Control Panel &gt; Administrative Tools &gt; Computer Management &gt; Device Manager &gt; Ports &gt; Quatech PCMCIA Serial Ports (COM2 and/or COM4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Quatech card securely installed in PGSC?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Verify correct orientation of card(s), i.e., right side up</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>RPOP &gt; Config (CNTL/F10) &gt; Comm Ports: report config</td>
<td>7a. 7b</td>
</tr>
<tr>
<td></td>
<td>a. COM1, COM2, COM3, COM4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. DLL</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>PCMMU data to RPOP</td>
<td>8a. 8b 8c</td>
</tr>
<tr>
<td></td>
<td>a. Red error message “RPOP not receiving PCMMU data” displayed?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Is there active data on SV (F1) or Radar (F2)? (check for “Prop Age” updates in upper-left corner of display)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. What is displayed above F6 in the Function Key Menu? (“PCM” or “No PCM”)</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>TCS data to RPOP (if applicable)</td>
<td>9a. 9b 9c</td>
</tr>
<tr>
<td></td>
<td>a. Red error message “RPOP not receiving TCS data” displayed?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Is there active data on TCS (F3)? (check for “Prop Age” updates in upper-left corner of TCS(F3) display)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. What is displayed above F3 in the Function Key Menu? (TCS NAV, TCS AUTO, TCS MAN, NONE)</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>HHL data to RPOP (if applicable)</td>
<td>10a. 10b 10c</td>
</tr>
<tr>
<td></td>
<td>a. When taking an HHL marks, does “Prop Age” update? (RPOP &gt; HHL(F4), upper-left corner of display)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. When taking an HHL marks, does HHL data “Age” update? (RPOP &gt; Rdot window (F5))</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Does RPOP request orbiter attitude with each mark? (If not, is attitude override box checked on SHIFT/F5?)</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Any unusual messages (popup windows, state vector messages, etc)?</td>
<td>11.</td>
</tr>
<tr>
<td>12-20</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td></td>
<td>TCS (answer for all suspect RPOP PGSCs)</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------------</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Which PGSC is being used?</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Which version of TCS CADS (per Help &gt; About TCS CAD…)? (On request, report the exact location of the CADS icon)</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>COM2 port</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Report associated cable label</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Cable securely connected?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Grey box installed in proper orientation?</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>PDIP panel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Report associated cable label</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Report associated PDIP port</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Cable securely connected?</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Check Quatech card status</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Start &gt; Settings &gt; Control Panel &gt; Administrative Tools &gt; Computer Management &gt; Device Manager &gt; Ports &gt; Quatech PCMCIA Serial Ports (COM2 and/or COM4)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Quatech card securely installed in PGSC?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Verify correct orientation of card(s), i.e., right side up</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>TCS OPS window</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Report Mode status (Acq, Stby, blank)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Report Data status (Good or Bad)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Report hardware status</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Report messages in message box</td>
<td></td>
</tr>
<tr>
<td></td>
<td>e. If self-test failed, click “Self-Test” button and report status (Shutter, Z-Latch, CW laser, Pulse laser)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>f. If TCS CADS processing TCS data (active Range, Rdot, etc.), does the data appear stable and reasonable?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>g. If TCS CADS processing TCS data (active Range, Rdot, etc.), is the data being received by RPOP?</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>TCS C&amp;DI (menus)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Macros &gt; report macros available (not greyed out)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Commands &gt; report cmds available (not greyed out)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Override &gt; report any selected items</td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Config &gt; Com Port &gt; report current config</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Was TCS CADS started before TCS was powered on?</td>
<td></td>
</tr>
<tr>
<td>29-40</td>
<td>Reserved</td>
<td></td>
</tr>
</tbody>
</table>
### HHL (answer for all suspect RPOP PGSCs)

<table>
<thead>
<tr>
<th></th>
<th>Question</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>HHL unit unresponsive?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Report power status -- switch ON, battery connected?</td>
<td>41a.</td>
</tr>
<tr>
<td></td>
<td>b. Did you adjust the display brightness?</td>
<td>41b.</td>
</tr>
<tr>
<td>42</td>
<td>HHL marks unsuccessful</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Did you try “test” mode? If so, what were the results?</td>
<td>42a.</td>
</tr>
<tr>
<td></td>
<td>b. Have you tried taking test marks on alternate targets?</td>
<td>42b.</td>
</tr>
<tr>
<td>43</td>
<td>HHL marks successful, but no transfer to PGSC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Which PGSC is being used?</td>
<td>43a.</td>
</tr>
<tr>
<td></td>
<td>b. Verify cable securely connected on HHL unit</td>
<td>43b.</td>
</tr>
<tr>
<td></td>
<td>c. Check COM port config -- refer to question 7</td>
<td>43c.</td>
</tr>
<tr>
<td>44-60</td>
<td>Reserved</td>
<td></td>
</tr>
<tr>
<td>Question</td>
<td>Answer</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>81 Which PGSC is being used?</td>
<td>81.</td>
<td></td>
</tr>
<tr>
<td>82 What indicator is shown in the system tray?</td>
<td>82.</td>
<td></td>
</tr>
<tr>
<td>(red “stop” sign, green “go” light, etc)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>** Double left click this icon to open Telemetry Server window</td>
<td></td>
<td></td>
</tr>
<tr>
<td>83 Which version of Telemetry Server (window title bar)</td>
<td>83.</td>
<td></td>
</tr>
<tr>
<td>84 What message is being displayed? (e.g., green highlight</td>
<td>84.</td>
<td></td>
</tr>
<tr>
<td>“Receiving serial data from…”)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>85 Report packets being processed (main TlmSrvr window)</td>
<td>85.</td>
<td></td>
</tr>
<tr>
<td>86 View &gt; Applications Using the Server -- report results</td>
<td>86.</td>
<td></td>
</tr>
<tr>
<td>87 Source &gt; report current config</td>
<td>87.</td>
<td></td>
</tr>
<tr>
<td>(Serial Windecom; Networked Windecom; Networked ISP)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>88 If Serial Windecom:</td>
<td>88a.</td>
<td></td>
</tr>
<tr>
<td>a. Port -- report current config (COM1 thru COM7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Baud -- report current config (9600, 19200, 38400)</td>
<td>88b.</td>
<td></td>
</tr>
<tr>
<td>89 Report any other messages</td>
<td>89.</td>
<td></td>
</tr>
<tr>
<td>90 Did you attempt a “File &gt; Reset Server”?</td>
<td>90.</td>
<td></td>
</tr>
</tbody>
</table>
HAND-HELD LIDAR CHECKOUT/OPS

1. Unstow HHL, Battery Pack(s), and RS-232 cable
   - Connect RS-232 cable from HHL to PGSC
   - Plug Battery Pack into HHL
   - Display Intensity knob – Adjust intensity to minimum acceptable level
   - Verify RPOP program enabled per RPOP INITIALIZATION, 7-15

2. Power sw – ON

   NOTE
   - If msg ‘LoB’ or flashing [8888] on display or irregular tone emitted, replace battery

3. Take multiple (~10) Range and Velocity measurements using top center of aft
   - PLB bulkhead or S0 Truss Segment as TGT
   - Select Range or Velocity decimal place by toggling RANGE/VELOCITY buttons
     - Range pb – 1 ft or 0.1 ft
     - Velocity pb – 0.1 fps or 0.01 fps
   - √HHL data received by RPOP (HHL trajectory source must be selected)
   - Range check:
     - √Range from aft port window to bulkhead = 60 ft
     - or
     - √Range from overhead window to S0 Truss Segment = ~44 ft
   - Velocity check:
     - Depress trigger for 5 sec
     - √Velocity = 0.0 fps
   - Report range and velocity discrepancies to MCC
   - Self-Test: Press and hold Test Mode button, 8.8.8.8. Select range

HAND-HELD LIDAR STOW

Power sw – OFF
- Remove RS-232 cable
- Unplug Battery Pack
- Stow HHL, Battery Pack(s), and RS-232 cable
RPOP INITIALIZATION

1. Power on RPOP/TCS PGSCs
   √Data, power cables installed per PGSC Usage Chart (if available) or UTILITY OUTLET PLUG-IN PLAN, ON-ORBIT CONFIG (REF DATA FS, UTIL PWR)

2. Select Shuttle Apps Icon
   Select RPOP folder
   Select appropriate RPOP icon
   [RPOP logo display]
   Initialization

3. Enter current MET:
   Days>___/Hrs>___:Min>___:Sec>___
   Click [OK] to continue
   
   NOTE
   Time synchronized on [OK]

4. √RPOP window title bar – verify mission-specific scenario
   √MET correct (upper right corner of trajectory display)

5. √PCM selected – status displayed above F6 in Function Key Menu
   If “No PCM” displayed, select PCM mode with [CNTL]/[F6]
   √RPOP is receiving PCMMU data
     If RPOP not receiving PCMMU data,
     “RPOP is not receiving PCMMU data” message on display
     Inform MCC and refer to RNDZ TOOLS TROUBLESHOOTING, 7-5

   NOTE
   If no target state vector on board, expect error message
   If RNDZ NAV not enabled, expect bad relative state
1. Select desired trajectory/sensor data as needed (F1 thru F4 keys)
   Reference TRAD FAIL RANGE AND RANGE RATE DETERMINATION, 7-21, for recommended RPOP and TRAD configuration

2. Configure HHL settings
   [CNTL][F4] \text{HHL}
   √Appropriate aimpoint configuration per table

<table>
<thead>
<tr>
<th>Manual phase</th>
<th>+Vbar</th>
<th>Flyaround</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tgt CG</td>
<td>Node2-Fwd/Top</td>
<td>As appropriate</td>
</tr>
</tbody>
</table>

   Configure Vert(deg) and Horiz(deg) angles to 0 deg
   Lock Vert(deg) and Horiz(deg) angles (click box below input field)
   NOTE: User may unlock angles and input angle data if desired
   Click [Update Settings] button to close \text{HHL} window

3. Use [F5] to display/hide \text{Rdot} window
   Click [sources] button to select/deselect additional data sources
   NOTE: Nominal configuration is to display “HHL/dt” and “HHLRaw”

4. Adjust configuration as required
   Use [SHIFT]/[F1] thru [SHIFT]/[F4] to show/hide trajectory plots
   NOTE: Cannot hide currently selected trajectory/sensor
   Use [CNTL]/[F8] to cycle through Points of Reference (POR)
   Use [F11] to cycle thru declutter levels
   Use [F12] to snap a range ruler mark; [SHIFT]/[F12] to delete it
   Use [SPACEBAR] to toggle on-screen Function Key Menu ON/OFF
   Move axes or zoom in/out per RPOP KEYSTROKE SUMMARY, 7-25
   For other options, reference RPOP FUNCTION KEY SUMMARY, 7-22

   \textbf{NOTE}
   Display of some data input windows (such as [CNTL]/[F4] \text{HHL}) prevents background sensor processing (e.g., TCS NAV). Minimize the time that these data input windows are displayed as much as practical.

   Sensor processing is \textbf{NOT} affected by display of the \text{Rdot} or \text{THC-to-Go} windows or associated sub-windows

5. To exit RPOP program – [SHIFT]/[F10]
* Configure TCS reflectors
  * [CNTL]/[F10] [RPOP Configuration]
  * Select [TCS/Ref... button] [Select TCS/Reflector Set]
  * Select appropriate Reflector No.
  * NOTE: for a single TCS unit, TCS No. selection is irrelevant
  *
* Configure RPOP Guidance, if desired for approach
  * [CNTL]/[F5] [Select Guidance Type]
  * Select desired flight phase to start prox ops guidance sequence
  * If +Rbar Acquisition,
    * If no RPM, uncheck “with RPM” option
    * If RPM stationkeeping (SK) required,
      * Select “with SK until MET”
  * Enter RPM start window open time (per APPROACH cue card)
  *
* Update target attitude
  * \MCC for target attitude data
  * [SHIFT]/[F6] [Enter Target Vehicle Attitude Info]
  * Input appropriate reference frame and attitude (PYR Seq)
    * Pitch>____ Yaw>_____ Roll>____
  * Input appropriate attitude rate mode and rates
  * NOTE: nominal dock and undock settings are “LVLH to Tgt Body”,
    * 0 / 0 / 0 deg attitude, and “LVLH Hold” rate
  *
* Input subtended angle data
  * [F6] [Rdot]
  * Click [sources] button, then select “SubAng” option
  * Click [SubAng] button or [F6] to open data input window
  * NOTE: timetag is recorded when [SubAng] or [F6] button is clicked
  * Input appropriate structural element and angle (measured via COAS or
    * CCTV with SUB ANG RULER overlay)
  * Click [OK] to incorporate mark, or [Back 1] to delete previous mark
  *
* Configure comm ports
  * [CNTL]/[F10] [RPOP Configuration]
  * Select [Comm Ports... ] button [RPOP Communications Setup]
  * Configure com ports and DLL
    * NOTE: TCS source must be set to DLL
    * HHL source must be set to COM1
    * PCMMU source if TLMServer (network or serial) is DLL
    * PCMMU source if no TLMServer (serial) is COM4
  *
* For assistance with other options, \MCC, [F10] [Help], or RPOP FUNCTION
* KEY SUMMARY, 7-22
TCS ACTIVATION

1. CADS BOOTUP
   - RPOP/TCS PGSC powered ON
   - Data cables installed per PGSC Usage Chart (if available) or UTILITY OUTLET
     PLUG-IN PLAN ORBIT CONFIGURATION (REF DATA FS, UTIL PWR)
   - SHUTTLE APPS
     > RPOP > TCS_CADS

2. TCS PWRUP/INITIALIZATION
   - L12 TCS PWR – ON (tb-gray)
     - * If tb – bp, cycle sw
     - * Verify Pnl R1: AUX – ON
     - * If no joy, notify MCC

   - PGSC TCS Self Test
     - Status
       - Override
       - Shutter: Passed Off
       - Z Latch: Passed Off
       - CW Laser: Passed Off
       - Pulse Laser: Passed Off

   - TCS OPS
     - Messages – INITIALIZATION COMPLETE
       - If “Initialization Complete” not received,
         - Record the last message received _______________________________
         - Macro > Initialization
       - Continue when “Initialization Complete” message received
         - * If error msg received during initialization, or
         - * “Initialization Complete” not received, √MCC

   - TCS OPS
     - Mode: Stby
     - Z Latch: Unlocked
     - CW: Active
     - Pulse: Avail

     * If not in config, √MCC

3. TIME REFERENCE SELECT
   - TCS C&DI
     - Commands > Send TCS Time
       - CAD Clock
       - Enter MET
       - [Send]
     - Messages – ‘TCS Clock has been set’

4. ENABLE AUTO ACQUISITION
   - TCS C&DI
     - Config > Automatic > Acquisition
     - Automatic Acquisition
     - Update ‘Maximum Range’ for auto acquisition to begin as desired
     - [OK]
   - Inform MCC of range entered
TCS MANUAL ACQUISITION

1. **ACQUIRE**

   PGSC
   
   \[TCS\text{ OPS}\]
   
   √ Pulse: Avail
   √ CW: Active
   
   \[TCS\text{ C\&DI}\]
   Macros > ACQUISITION
   
   Target Acquisition Data
   
   RANGE > current estimate of range to Target
   AZIMUTH > 0
   ELEVATION > 0
   
   √ 95% RANGE GATE – (no X)
   [Send]
   
   \[TCS\text{ OPS}\]
   If first acquisition:
   √ Shutter – Open (after ~22 sec)
   
   * If shutter fails to open:
   * Commands > Standby
   * Commands > Open Shutter
   * Commands > Acquire
   
   √ Mode – Acq
   
   √ Data – Good (and active tracking data)
   
   * If TCS not tracking and no RPOP (or Auto Seed Update disabled),
   * [TCS\text{ C\&DI}]
   * Commands > Acquire
   * Update Range estimate and zero AZ & EL
   * [Send]

2. **ENABLE AUTO ACQUISITION**

   √ Data – Good (and active tracking data)
   
   \[TCS\text{ C\&DI}\]
   Config > Automatic >
   
   If Seed Update – (no √)
   Select Seed Update
   [Automatic Acquisition]
   √ Maximum Range (ft): 5000
   [OK]
   
   Config > Automatic >
   If Acquisition – (no √)
   Select Acquisition
   [Automatic Acquisition]
   √ Maximum Range (ft): 5000
   [OK]
   
   Config > Automatic >
   √ Initialization – (√)
   √ Seed Update – (√)
   √ Acquisition – (√)
TCS DEACTIVATION

1. SHUTDOWN TCS

PGSC

TCS C&DI

Macros > SHUTDOWN

* If error msg received during SHUTDOWN, *

* \MCC

TCS OPS

√Shutter: Closed (takes ~22 sec)

* If shutter fails to close: *

* Commands > Close shutter *

If Final TCS deactivation for mission:

2. SECURE Z AXIS

PGSC

TCS C&DI

Commands > Lock Z Axis Latch

TCS OPS

√Z Latch: Locked

* If Z Latch fails to lock: *

* If Z Latch: Transit *

* TCS C&DI *

* Commands > Lock Z Axis Latch *

* Otherwise *

MCC

3. POWERDOWN TCS

L12

TCS PWR – OFF (tb-bp)

* If tb – gray, cycle sw *

* If no joy, notify MCC *

4. SHUTDOWN CADS

PGSC

TCS C&DI

File > Exit TCS CAD
# TRAD FAIL RANGE AND RANGE RATE DETERMINATION

1. Maintain a prime and a backup range and rdot estimate from independent sensor sources
2. Maintain prime and backup RPOP PGSCs
3. Refer to table and notes below for recommended prime/backup source/configuration.

<table>
<thead>
<tr>
<th>Man Phase</th>
<th>TCS Lock (&gt;3 kft)</th>
<th>1200 ft</th>
<th>800 ft</th>
<th>Vbar</th>
<th>15 ft - dock</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NOMINAL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: SV</td>
<td>1: TCS NAV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: HHL/dt</td>
<td>2: HHL/dt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: TCS raw</td>
<td>2: Rng ruler</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>RADAR</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: HHL/dt</td>
<td>1: TCS NAV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: SubAng</td>
<td>2: HHL/dt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: TCS raw</td>
<td>2: Rng ruler</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>HHL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: SV</td>
<td>1: TCS NAV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: SubAng</td>
<td>2: Raw radar and SubAng</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: TCS raw</td>
<td>2: Rng ruler</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TCS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: SV</td>
<td>1: HHL/dt</td>
<td>1: HHL/dt and raw radar Rdot</td>
<td>2: SubAng</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: HHL/dt</td>
<td></td>
<td></td>
<td></td>
<td>1: Rng ruler</td>
<td>2: HHL raw or HHL/dt</td>
</tr>
<tr>
<td><strong>PCMMU</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: G33 FLTR</td>
<td>1: HHL/dt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: HHL/dt or TCS-Pulse (Generic)</td>
<td>2: TCS-Pulse (Generic)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: TCS-CW</td>
<td>1: TCS-CW or TCS Auto</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: HHL/dt</td>
<td>2: HHL/dt</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: TCS raw</td>
<td>2: Rng ruler</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PGSC</strong> (No RPOP, No TCS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: SV, raw radar</td>
<td>1: HHL raw: short pull for mg, long pull for Rdot</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: HHL raw: raw range, Rdot vs ΔR/Δt cue card for Rdot</td>
<td>2: SubAng: Rdot vs ΔR/Δt cue card for Rdot</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: HHL raw</td>
<td>1: Rng ruler</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(table on overlay)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2: HHL raw</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Nominal notes:**
1. If no TCS lock by 1200 ft, start SubAng ops to backup HHL/dt inside 1000 ft.

**Radar fail notes:**
2. State vector data suspect.

**HHL fail notes:**
3. Radar data will be unusable at close ranges. The range at which the data becomes unusable is dependent on target size, geometry, and physical characteristics, but can not be accurately predicted. For ISS, the Radar can become too noisy to use at ranges as great as 1000 ft.

**TCS fail notes:**
4. State vector: G33 COVAR REINIT as desired.
5. Begin gradual transition to HHL/dt and SubAng at ~1500 ft.
6. HHL will not work if the aimpoint surface is closer than 12 ft (5 ft DP-DP). Refer to Note 3 (above)

**PCMMU fail notes:**
7. RPOP state data, TCS NAV, and HHL FLTR are not usable without PCMMU data.
8. RPOP prompts user for orbiter attitude after first TCS/HHL mark. Enter P/Y/R = 90/0/0 (LVLH to Orb Body) and check “Do not prompt for attitude.” Orbiter attitude on RPOP will not be correct until mnvr to Vbar attitude is complete. Until Vbar arrival, do not use RPOP trajectory data other than the data in the Rdot window.
9. TCS pulse laser Rdot may be noisy (range OK). Can manually enter raw TCS range marks into ‘Generic’ on the RPOP Rdot window to calculate Rdot. Monitor TCS pulse/CW status on RPOP or TCS CADS.
10. Begin gradual transition to HHL/dt and TCS raw at ~1500 ft.
11. For TCS AUTO [CNTL/F3], set orbiter attitude [SHIFT/F5] P/Y/R = 90/0/0 (LVLH to Orb Body) and set TCS data frequency to 30 sec [CNTL/F10].

**PGSC fail notes:**
Refer to note 6 (above).
RNDZ TOOLS REFERENCE DATA

RPOP FUNCTION KEY SUMMARY

RPOP TRAJECTORY DATA KEYS (Columns F1 → F4)

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
</table>
| [F1→F4] PRIME KEY | (SV, RR, HHL, CCTV or TCS) Make this Trajectory Prime Trajectory
| | – Only one trajectory can be Prime at a time
| | – Prime Trajectory has orbiter graphics, predictors, and color-coordinated digital data |
| [SHIFT]/[F1→F4] SHOW/HIDE KEY | (Show/Hide) Show or Hide this Trajectory (toggle)
| | – Prime Trajectory cannot be hidden
| | – Background processing of trajectory continues even when hidden
| | (Exception: HHL trajectory data will not prompt for user input when hidden) |
| [CTRL]/[F1→F4] DATA KEY | (Data) Configure/input data for trajectory
| | – Allows user to configure specific Trajectory Data Source Options
| | – Allows user to input manual data
| | – Allows user to reconfigure function key to another Trajectory Data Source
| | – Duplicate Trajectory Data Source configurations are permitted (e.g., HHL could be configured for both F3 and F4, if desired) |

NOTE
Although duplicate data source configurations are permitted, duplicate automatic data modes (namely, State Vector, RR Auto, TCS Auto and TCS Nav) are not permitted. In such a situation, duplicated auto mode option grayed out in Trajectory Data Source Options dialog box
# RPOP General Function Keys (Columns F5 → F12)

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>[F5]</strong></td>
<td>RDOT WINDOW&lt;br&gt;(Rdot)&lt;br&gt;Toggles display of Rdot Window</td>
</tr>
<tr>
<td><strong>[SHIFT]/[F5]</strong></td>
<td>ORBITER ATTITUDE&lt;br&gt;(Orb Att)&lt;br&gt;Update orbiter attitude and attitude rate</td>
</tr>
<tr>
<td><strong>[CTRL]/[F5]</strong></td>
<td>GUIDANCE&lt;br&gt;(Guid)&lt;br&gt;Select guidance cues on demand&lt;br&gt;Available options are:&lt;br&gt;+Rbar acquisition – provides THC recommendations for acquiring the +Rbar. Includes options for targeting pre-TORVA conditions, pre-RPM conditions, or a pre-RPM stationkeep.&lt;br&gt;TORVA – provides THC recommendations for performing the +Rbar to +Vbar transfer&lt;br&gt;+Vbar Acquisition – provides THC recommendations for acquiring the +Vbar in preparation for final approach&lt;br&gt;Glideslope Approach – provides THC recommendations for flying the final approach along a glideslope&lt;br&gt;CW Targeting – given a burn time, transfer time, and desired LVLH position, CW Targeting will provide required THC inputs&lt;br&gt;LVLH Velocity Null – provides THC recommendations for nulling LVLH velocities in each direction&lt;br&gt;Average Rdot – information for timed approach</td>
</tr>
<tr>
<td><strong>[F6]</strong></td>
<td>SUBTENDED ANGLE&lt;br&gt;(Sub Ang)&lt;br&gt;Enter subtended angle in Rdot Window to get range and range rate. Only active when SubAng source active on Rdot Window</td>
</tr>
<tr>
<td><strong>[SHIFT]/[F6]</strong></td>
<td>TARGET ATTITUDE&lt;br&gt;(Tgt Att)&lt;br&gt;Update Target attitude and attitude rate</td>
</tr>
<tr>
<td><strong>[CTRL]/[F6]</strong></td>
<td>PCMMU MODE&lt;br&gt;(PCMMMU)&lt;br&gt;No PCM mode (displays No PCM)&lt;br&gt;Requires orbiter attitude data to be entered manually with each sensor mark&lt;br&gt;PCM MODE (displays PCM)&lt;br&gt;Orbiter attitude is automatically computed using PCMMU data</td>
</tr>
<tr>
<td><strong>[F7]</strong></td>
<td>VIEW&lt;br&gt;(View)&lt;br&gt;If Tgt-Centered LVLH, cycle through views: XZ, XY, YZ&lt;br&gt;If Orb-Centered LVLH, cycle through views: XZ, XY, YZ, CAM&lt;br&gt;View identification displayed upper left-hand corner of Trajectory Display</td>
</tr>
<tr>
<td><strong>[SHIFT]/[F7]</strong></td>
<td>OVERLAY&lt;br&gt;(Ovrlay)&lt;br&gt;Cycle through displays of overlays</td>
</tr>
<tr>
<td><strong>[F8]</strong></td>
<td>REFERENCE FRAME&lt;br&gt;(Tgt/Orb)&lt;br&gt;Toggle display between Tgt-Centered LVLH plot and Orb-Centered LVLH plot</td>
</tr>
<tr>
<td><strong>[SHIFT]/[F8]</strong></td>
<td>LO Z&lt;br&gt;(Low Z)&lt;br&gt;Toggle jet-select between No Low Z and Low Z for making THC “What If” inputs. Displays Low Z</td>
</tr>
<tr>
<td><strong>[CTRL]/[F8]</strong></td>
<td>POINT OF REFERENCE&lt;br&gt;(POR)&lt;br&gt;Cycle through preselected orbiter Point-Of-Reference to Target Point-Of-Reference sets (e.g., CG to CG, Dock Port to Dock Port</td>
</tr>
<tr>
<td><strong>[F9]</strong></td>
<td>THC CLEAR&lt;br&gt;Cont next page</td>
</tr>
</tbody>
</table>
(THC Clr) Clear THC “What if” inputs from the Prime Trajectory

[SHIFT][F9] TRAJECTORY CLEAR
(TrajClr) Clear Prime Trajectory history of all but 2 most recent data inputs

[CTRL][F9] BACK 1
(Back 1) Delete last data input from the Prime Trajectory

[F10] HELP
(Help) Access on-line help information

[SHIFT][F10] EXIT
(Exit) Save output files and exit RPOP program

[CTRL][F10] RPOP CONFIGURATION
(Config) Configure following RPOP options:

  Debug
  Enable serial port I/O debug text to be displayed. Displays Debug

  Data Freq...
  Change frequency of automatic acceptance (plotting) of PCM data (SV or
  RR Auto) or TCS data (TCS Auto)

  Predictors...
  Change number and/or time increment of displayed predictors

  Update MET...
  Change the mission elapsed time

  Altitude...
  Change altitude of target vehicle

  Comm Ports...
  Reconfigure serial ports and/or the DLL

  TCS/Refl...
  Select TCS ID number (1-2) and reflector ID number (1-15)

  Views...
  Enable/disable Tgt- and Orb-Centered views

  NOTE
  Currently displayed view (both Tgt- and
  Orb-Centered) cannot be disabled

THC “What if”...
Select DAP setting (trans pulse size) to be used for THC “What if” inputs
Options include: Rndz DAP, Prox Ops DAP, and a User-Configurable DAP

Cont next page
RPOP GENERAL FUNCTION KEYS (Columns F5 → F12) (Cont)

[F11] DECLUTTER
Cycle RPOPs display through three different levels of declutter

[F12] RANGE RULER SNAP
Computes range rate based on time between snaps and assumed delta range interval. Feature available only if I-loaded delta range interval has non zero value

[SHIFT]/[F12] RANGE RULER CLEAR
Clears range ruler display from screen. Feature available only if I-loaded delta range interval has non zero value

RPOP KEYSTROKE SUMMARY

<table>
<thead>
<tr>
<th>Keystroke</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[CTRL]/[←] or l</td>
<td>Move Vertical axis left</td>
</tr>
<tr>
<td>[CTRL]/[→] or r</td>
<td>Move Vertical axis right</td>
</tr>
<tr>
<td>[CTRL]/[↑] or u</td>
<td>Move Horizontal axis up</td>
</tr>
<tr>
<td>[CTRL]/[↓] or d</td>
<td>Move Horizontal axis down</td>
</tr>
<tr>
<td>[CTRL]/[PGUP]</td>
<td>Zoom IN on Trajectory Display</td>
</tr>
<tr>
<td>[CTRL]/[X]/[PGUP]</td>
<td>Zoom IN on X axis only</td>
</tr>
<tr>
<td>[CTRL]/[Y]/[PGUP]</td>
<td>Zoom IN on Y axis only</td>
</tr>
<tr>
<td>[CTRL]/[Z]/[PGUP]</td>
<td>Zoom IN on Z axis only</td>
</tr>
<tr>
<td>[CTRL]/[PGDN]</td>
<td>Zoom OUT on Trajectory Display</td>
</tr>
<tr>
<td>[CTRL]/[X]/[PGDN]</td>
<td>Zoom OUT on X axis only</td>
</tr>
<tr>
<td>[CTRL]/[Y]/[PGDN]</td>
<td>Zoom OUT on Y axis only</td>
</tr>
<tr>
<td>[CTRL]/[Z]/[PGDN]</td>
<td>Zoom OUT on Z axis only</td>
</tr>
</tbody>
</table>

NOTE
Use [SHIFT] in combination with any of above keystrokes in order to scale/move axes in finer increments. Each view may be independently scaled and/or autoscaled

[CTRL]/[HOME] Resume autoscaling and reset scale
[SPACEBAR] Toggle on-screen Function Key Menu ON/OFF

THC “What if” (-Z sense) Keystrokes (Prime Trajectory only)

<table>
<thead>
<tr>
<th>Keystroke</th>
<th>DAP A8</th>
<th>DAP B8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z IN</td>
<td>[SHIFT]/[→]</td>
<td>[→]</td>
</tr>
<tr>
<td>Z OUT</td>
<td>[SHIFT]/[←]</td>
<td>[←]</td>
</tr>
<tr>
<td>X UP</td>
<td>[SHIFT]/[↑]</td>
<td>[↑]</td>
</tr>
<tr>
<td>X DOWN</td>
<td>[SHIFT]/[↓]</td>
<td>[↓]</td>
</tr>
</tbody>
</table>
RPOP TRAJECTORY DATA SOURCE OPTIONS

SV
STATE VECTOR
Options include:
State Vector – Enable automatic acceptance of the Onboard Nav states
None – Turn State Vector processing off
Config... – Reconfigure Trajectory Data Source for this function key

RR
RENDEZVOUS RADAR
Options include:
Manual – Manually enter Radar RNG, EL and AZ
Auto – Enable automatic acceptance of Radar RNG, EL and AZ
None – Turn Radar processing off
Config... – Reconfigure the Trajectory Data Source for this function key

HHL
HANDHELD LASER
Manually select HHL Aim Point, Angle Source, and Angle Source Aim Point
Manually enter HHL RNG and two Angle Source angles (an in-plane and out-of-plane)

Options include:
Lock – Hold the in-plane angle constant (locked) for each HHL mark
Lock – Hold the out-of-plane angle constant (locked) for each HHL mark
Update Settings – Accept configuration changes to Aim Points, Angle Source, and Lock option without incorporating a trajectory mark
Config... – Reconfigure the Trajectory Data Source for this function key

Angle Source options include:
Fwd CCTV, Aft CCTV, Dock Cam, COAS, Radar, TCS, Other

NOTE
Manual inputs reqd for all angle sources except Radar and TCS. If Radar or TCS selected, angles will be automatically snapped (if available). Other camera is optional, and may be completely specified via I-load

Aim Point options include:
HHL Aim Pt, Tgt CG, Point of Interest #1, Point of Interest #2, Point of Interest #3

NOTE
HHL Aim Pt is always available and may be completely specified via I-load. Tgt CG is always available Points of Interest 1-3 are optional, and may be completely specified via I-load. For Angle Source Radar, angle aim point is Tgt CG. For Angle Source TCS, angle aim point is current reflector number

CCTV
CLOSED CIRCUIT TELEVISION CAMERAS
Manually enter FWD and AFT CCTV tilt angles
Options include:
Config... – Reconfigure Trajectory Data Source for this function key

Cont next page
TRAJECTORY CONTROL SENSOR

Options include:

- **Manual** – Manually enter TCS RNG, EL and AZ
- **Auto** – Enable automatic acceptance of TCS RNG, EL and AZ
- **Nav** – Enable TCS NAV (Kalman Filtering)
  - Display Resids and Ratios
  - Force Measurements
  - Re-Initialize on [OK]
- **None** – Turn TCS processing off
- **Config** – Reconfigure the Trajectory Data Source for this function key
Velocity accuracy increases with trigger hold duration:

<table>
<thead>
<tr>
<th>Duration</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5s</td>
<td>±0.15 fps</td>
</tr>
<tr>
<td>1.0s</td>
<td>±0.06 fps</td>
</tr>
<tr>
<td>2.0s</td>
<td>±0.03 fps</td>
</tr>
<tr>
<td>5.0s</td>
<td>±0.01 fps</td>
</tr>
</tbody>
</table>

To verify lock-on (if desired):
1. Push Test Mode button
2. Center red dot on TGT
3. Depress and hold trigger. Pitch on tone proportional to received signal strength
4. Press Range or Velocity button to return to Operational Mode

Error Codes:
- **E01** Never acquired target because target out of range or target too close
- **E02** Excessive percentage of total laser pulses in measurement sample unsatisfactory
- **E03** Excessive number of consecutive laser pulses in measurement sample unsatisfactory

**TCS LIMIT DATA**

<table>
<thead>
<tr>
<th>TEMPERATURE (degC)</th>
<th>LOW ALERT</th>
<th>HIGH ALERT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CW Laser</td>
<td>-40.0</td>
<td>45.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50.0</td>
</tr>
<tr>
<td>APD</td>
<td>-40.0</td>
<td>65.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>70.0</td>
</tr>
<tr>
<td>CPU</td>
<td>-40.0</td>
<td>80.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>85.0</td>
</tr>
<tr>
<td>DC Power</td>
<td>-40.0</td>
<td>80.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>85.0</td>
</tr>
<tr>
<td>Galvos</td>
<td>-40.0</td>
<td>80.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>85.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>VOLTAGES</th>
<th>LOW ALERT</th>
<th>HIGH ALERT</th>
</tr>
</thead>
<tbody>
<tr>
<td>5V</td>
<td>4.75</td>
<td>5.25</td>
</tr>
<tr>
<td>5.5V</td>
<td>5.00</td>
<td>6.00</td>
</tr>
<tr>
<td>12V</td>
<td>11.00</td>
<td>12.75</td>
</tr>
<tr>
<td>15V</td>
<td>14.25</td>
<td>15.50</td>
</tr>
</tbody>
</table>
CUE CARD CONFIGURATION

RCS BURN (+X, -X, Multi-axis) (Front) ................................................................. CC 8-3
RENDEZVOUS PRPLT PAD (Back) ........................................................................ CC 8-4
KU OPS (Front) .................................................................................................. CC 8-5
   (Back) ........................................................................................................... CC 8-6
HST RBAR APPROACH (Front) .......................................................................... CC 8-7
   (Back) .......................................................................................................... CC 8-8
HST CONTINGENCY INRTL APPROACH (Front) ................................................ CC 8-9
   (Back) ......................................................................................................... CC 8-10
HST BREAKOUT FLOWCHART (Front) .............................................................. CC 8-11
TOOL-CHASING (Back) .................................................................................... CC 8-12
NOMINAL RADAR ANGLES AND CAMERA ANGLES RANGING CHART (Front) CC 8-13
   (Back) ......................................................................................................... CC 8-14
GPC/MDM FAILURE RESPONSE DURING RNDZ (Front) ................................ CC 8-15
RNDZ REF DATA (Back) .................................................................................... CC 8-16
C/L CAMERA CORRIDOR AND ALIGNMENT ............................................... CC 8-17
A31P PGSC DISPLAY OF C/L CAMERA CORRIDOR AND ALIGNMENT ........ CC 8-18
SUB ANG RULER ............................................................................................... CC 8-19
RCS BURN (+X, -X, Multi-axis)
1. GNC, OPS 202 PRO
   \(\sqrt{\text{GNC ORBIT MNVR EXEC}}\)
   \(\sqrt{\text{RCS SEL, ITEM 4 – (*)}}\)
2. If onboard computed burn:
   \(\sqrt{\text{TIG and TGT PEG 7 \DeltaVs per Final solution}}\)
   \(\sqrt{\text{Guidance option is LAMBERT}}\)
   If ground computed burn:
   \(\sqrt{\text{TGT data per Burn Pad (reload WT as reqd)}}\)
   LOAD – ITEM 22 EXEC
   TIMER – ITEM 23 EXEC
3. If +X burn:
   DAP: A/AUTO/ALT(B/ALT as reqd)
   MNVR – ITEM 27 EXEC (*)
   If RR ops:
   KU – AUTO TRK
   GNC 33 REL NAV
   INH Angles – ITEM 24 EXEC (*)
4. If +X burn:
   DAP TRANS: as reqd
   If Multi-axis:
   DAP: A/AUTO/PRI
   If +X or -X:
   DAP: A/INRTL/PRI
5. If VGO Z is neg, Z,X,Y seq;
   otherwise, X,Y,Z
   THC: Trim VGOs < 0.2 fps
   FLT CNTLR PWR – OFF
   DAP: ALT
   DAP TRANS: PULSE/PULSE/PULSE
   GNC, OPS 201 PRO
6. When in attitude:
   DAP: A/AUTO/VERN(ALT)
RENDEZVOUS PRPLT PAD

When L or R RCS QTY < 1:
I'CNCT: 2 OMS to RCS (ORB PKT, RCS)

When G23 OMS/RCS QTY > 4:
I'CNCT TK SWITCH: (ORB PKT, RCS)

When G23 OMS/RCS QTY > 6:
I'CNCT RETURN (ORB PKT, RCS)

When L or R RCS QTY < 7 or when FRCS QTY < 8:
DAP: NO LO Z

When L or R RCS QTY < 9 or when FRCS QTY < 10:
If prior to Ti,
Do not perform Ti
If after Ti, but prior to 500 ft:
Perform RNDZ BREAKOUT (CONTINGENCY OPERATIONS), 5-16
If after 500 ft, but prior to INRTL ALIGNMENT FLYAROUND:
Perform HST RBAR BREAKOUT (CONTINGENCY OPERATIONS), 5-13
If after INRTL ALIGNMENT FLYAROUND, but prior to 30 ft:
Perform HST FLYAROUND/LOSS OF LO Z BREAKOUT (CONTINENCY OPERATIONS), 5-14
If inside 30 ft:
Back out to 30 ft
Perform HST FLYAROUND/LOSS OF LO Z BREAKOUT (CONTINENCY OPERATIONS), 5-14
KU OPS

1. CONFIGURE KU FOR RR TGT ACQ

<table>
<thead>
<tr>
<th>GNC 33 REL NAV</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT</td>
</tr>
<tr>
<td>√SV SEL, ITEM 4 – FLTR</td>
</tr>
<tr>
<td>√INH RNG, ITEM 18 – (*)</td>
</tr>
<tr>
<td>RDOT, ITEM 21 – (*)</td>
</tr>
<tr>
<td>Angles, ITEM 24 – (*)</td>
</tr>
<tr>
<td>KU ANT ENA – ITEM 2 EXEC (*)</td>
</tr>
<tr>
<td>GNC I/O RESET</td>
</tr>
<tr>
<td>A2</td>
</tr>
<tr>
<td>DIGI-DIS sel – R/RDOT</td>
</tr>
<tr>
<td>A1U</td>
</tr>
<tr>
<td>KU PWR – STBY</td>
</tr>
<tr>
<td>MODE – RDR PASSIVE</td>
</tr>
<tr>
<td>√RDR OUTPUT – HI</td>
</tr>
<tr>
<td>CNTL – PNL (wait 3 sec)</td>
</tr>
<tr>
<td>PWR – ON</td>
</tr>
<tr>
<td>KU SEL – GPC &gt;&gt;</td>
</tr>
</tbody>
</table>

2. AUTO TRK ACQ

<table>
<thead>
<tr>
<th>GNC 33 REL NAV</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT</td>
</tr>
<tr>
<td>√EL, AZ angles &lt; 30 deg</td>
</tr>
<tr>
<td>KU SEARCH – SEARCH (tb–gray)</td>
</tr>
<tr>
<td>Repeat slew and search as reqd</td>
</tr>
<tr>
<td>If acquisition not successful, √MCC &gt;&gt;</td>
</tr>
</tbody>
</table>

3. RR NAVIGATION

<table>
<thead>
<tr>
<th>GNC 33 REL NAV</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT</td>
</tr>
<tr>
<td>√RADAR, ITEM 13 – (*)</td>
</tr>
<tr>
<td>* If RATIO &gt; 1.0: *</td>
</tr>
<tr>
<td>* √MCC</td>
</tr>
<tr>
<td>FLTR TO PROP – ITEM 8 EXEC (*)</td>
</tr>
<tr>
<td>AUT RNG – ITEM 17 EXEC (*)</td>
</tr>
<tr>
<td>RDOT – ITEM 20 EXEC (*)</td>
</tr>
<tr>
<td>Angles – ITEM 23 EXEC (*) &gt;&gt;</td>
</tr>
</tbody>
</table>

4. CONFIGURE KU FOR COMM

<table>
<thead>
<tr>
<th>GNC 33 REL NAV</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT</td>
</tr>
<tr>
<td>INH RNG – ITEM 18 (*)</td>
</tr>
<tr>
<td>RDOT – ITEM 21 (*)</td>
</tr>
<tr>
<td>Angles – ITEM 24 (*)</td>
</tr>
<tr>
<td>KU ANT ENA – ITEM 2 (no *)</td>
</tr>
<tr>
<td>A1U</td>
</tr>
<tr>
<td>KU PWR – STBY</td>
</tr>
<tr>
<td>MODE – COMM</td>
</tr>
<tr>
<td>√sel – GPC</td>
</tr>
<tr>
<td>CNTL – CMD</td>
</tr>
<tr>
<td>A2</td>
</tr>
<tr>
<td>DIGI-DIS sel – EL/AZ</td>
</tr>
</tbody>
</table>

(reduced copy)
TOP
BACK OF 'KU OPS'

HOOK
VELCRO

HOOK
VELCRO

(reduced copy)

CC 8-6

RNDZ-2b/125/O/A

RNDZ/125/FIN
HST RBAR APPROACH

RNDZ-3a/125/O/SIM-185

<table>
<thead>
<tr>
<th>RNG</th>
<th>RDOT</th>
<th>MC2 ET h:mm:ss</th>
<th>DAP</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>-3.0</td>
<td>0.27.00</td>
<td>A/R/R AUTO/VERN (PRI)</td>
<td>If RDOT falls below value for next gate TH: -Z (in) as req'd to maintain RDOT</td>
</tr>
<tr>
<td>1700</td>
<td>-2.6</td>
<td>0.29.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1500</td>
<td>-2.3</td>
<td>0.30.00</td>
<td>LO Z</td>
<td>AIL S BD PL XMTR PWR – LO PI to PWR – LO</td>
</tr>
<tr>
<td>1000</td>
<td>-1.5</td>
<td>0.34.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>↓</td>
<td>0.40.30</td>
<td>A9.B9</td>
<td>A1U KU OUTPUT – LO UPDATE SUNPT</td>
</tr>
<tr>
<td>600</td>
<td>↓</td>
<td>0.44.30</td>
<td></td>
<td>TIMER EXP</td>
</tr>
<tr>
<td>500</td>
<td>-0.5</td>
<td>0.41.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>-0.4</td>
<td>0.44.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>-0.3</td>
<td>0.51.30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>-0.2</td>
<td>0.58.00</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HST COMM CHECK

- SM 210 HST SYS
- TLM COUNT – incr
- RCVR 2(1) LOCK – *
- PCS MODE – NORM
  * If PCS MODE – SNPT: *
  * MCC prior to 120 ft *
  * PCS SNPT DIS – NO

- MGC 35 REL NAV
- RNDZ NAV ENA – ITEM 1 EXEC (no *)
- GNC 55 GPS STATUS
- GNC 22 S TRK/COAS CNTL
- GNC 20 DAP CONFIG
- Modify DAP A7 for SEP:
  - EDIT DAP A7 – ITEM 3 +7 EXEC
  - A VERN ROT RATE – ITEM 63 +0.2 EXEC
  - LOAD – ITEM 6b EXEC

- If VERNs available:
  - O14:F
  - O15:F
  - O16:F

TERMINATE RNDZ OPS

- CDR ASU FLT CNTLR PWR – OFF
- MS Perform HHL STOW (RNDZ TOOLS), 7 ‘14
- EXIT RPOP – [SHIFT][F10]
- Z COAS – OFF
- GNC 35 REL NAV
- RNDZ NAV ENA – ITEM 1 EXEC (no *)
- GNC 55 GPS STATUS
- DES RCVR – ITEM 27 (no*)
- GNC 22 S TRK/COAS CNTL
- Z-LY START TRK – ITEM 4(3) EXEC (*)
- GNC 20 DAP CONFIG
- Modify DAP A7 for SEP:
  - EDIT DAP A7 – ITEM 3 +7 EXEC
  - A VERN ROT RATE – ITEM 63 +0.2 EXEC
  - LOAD – ITEM 6b EXEC
- If VERNs available:
  - O14:F
  - O15:F
  - O16:F

HST TO DRIFT

- SM 210 HST SYS
- TLM COUNT – incr
- RCVR 2(1) LOCK – *
- PCS MODE – ITEM 7 +9.2 (9.1) EXEC (DRFT)
- PCS SNPT DIS – YES
### AUTO INERTIAL FLYAROUND ALIGNMENT

**NOTE**

THC as required to keep center point of payload centered in keel camera

1. **Maintain Range and Range Rate:**
   - $R < 150$ ft
   - $-0.3$ ft/sec $< R_\text{dot} < +0.3$ ft/sec

2. **Check Initial Config:**
   - Sense: -Z
   - DAP A9/B9
   - DAP TRANS: PULSE/PULSE/PULSE
   - DAP: B/INRTL/VERN (PRI)
   - DAP ROT: DISC/DISC/DISC

3. **Flyout Sequence – The Sox Sequence:**
   - **Z Sense:** Roll – align orbiter XZ plane with the HST V1
   - **Z Sense:** Pitch – align orbiter –Z with the HST V1
   - **Body Sense:** Yaw – align orbiter camera view with end of HST

   3a. **Align -Z Sense Roll (Orbiter Body Yaw):**
   - To Start Rotation:
     - GNC UNIV PTO
     - Body Vec = 5
     - P = 270
     - Y = 0
     - ROT – ITEM 20 EXEC
     - DAP: A/AUTO/VERN (PRI)
     - To Stop Rotation:
     - DAP: A/INRTL/VERN (PRI)

   3b. **Align -Z Sense Pitch (Orbiter Body Pitch):**
   - To Start Rotation:
     - GNC UNIV PTO
     - Body Vec = 5
     - P = 0
     - For -Z Sense -Pitch (+Body pitch): Y = 90
     - For -Z Sense +Pitch (-Body pitch): Y = 270
     - ROT – ITEM 20 EXEC
     - DAP: A/AUTO/VERN (PRI)
     - To Stop Rotation:
     - DAP: A/INRTL/VERN (PRI)

   3c. **Align -Z Sense Yaw (Orbiter Body Roll):**
   - To Start Rotation:
     - GNC UNIV PTO
     - For -Z Sense +Yaw (+Body Roll): BV(ITEM 14 + 1)
     - For -Z Sense -Yaw (-Body Roll): BV(ITEM 14 + 2)
     - ROT – ITEM 20 EXEC
     - DAP: A/AUTO/VERN (PRI)
     - To Stop Rotation:
     - DAP: A/INRTL/VERN (PRI)

   **NOTE**
   Orbit body roll rotations will require Orbiter body Y translations.
   In DAP: Lo Z, body Ys cause a relatively large closing rate, which in turn costs prop to fly out

4. **Check Final Config:**
   - GNC UNIV PTO
   - CNCL – ITEM 21 EXEC
   - DAP: B/INRTL/VERN (PRI), LO Z

### MANUAL INERTIAL FLYAROUND ALIGNMENT TRIM

**NOTE**

THC as required to keep center point of payload centered in keel camera

1. **Maintain Range and Range Rate:**
   - $R < 150$ ft
   - $-0.3$ ft/sec $< R_\text{dot} < +0.3$ ft/sec

2. **Check Initial Config:**
   - Sense: -Z
   - DAP A9/B9
   - DAP TRANS: PULSE/PULSE/PULSE
   - DAP: B/INRTL/VERN (PRI)

3. **Flyout Sequence:**
   - **Z Sense:** Pitch/Yaw/Roll
   - **Body Sense:** Pitch/Roll/Yaw

   3a. **Align -Z Sense Pitch (Orbiter Body Pitch):**
   - To Start Rotation:
     - DAP ROT: DISC/PULSE/DISC
     - RHC: Pitch as reqd
   - To Stop Rotation:
     - DAP ROT: DISC/DISC/DISC

   3b. **Align -Z Sense Yaw (Orbiter Body Roll):**
   - To Start Rotation:
     - DAP ROT: DISC/DISC/PULSE
     - RHC: Yaw as reqd
   - To Stop Rotation:
     - DAP ROT: DISC/DISC/DISC

   **NOTE**
   Orbit body roll rotations will require Orbiter body Y translations.
   In DAP: Lo Z, body Ys cause a relatively large closing rate, which in turn costs prop to fly out

3c. **Align -Z Sense Roll (Orbiter Body Yaw):**
   - To Start Rotation:
     - DAP ROT: PULSE/DISC/DISC
     - RHC: Roll as reqd
   - To Stop Rotation:
     - DAP ROT: DISC/DISC/DISC

4. **Check Final Config:**
   - GNC UNIV PTO
   - CNCL – ITEM 21 EXEC
   - DAP: B/INRTL/VERN (PRI), LO Z

### RBAR YAW ALIGNMENT

**NOTE**

Complete RBAR YAW ALIGN prior to selecting INRT

1. **Check Initial Config**
   - Sense: -Z
   - DAP: A9/B9
   - DAP TRANS: PULSE/PULSE/PULSE
   - DAP: A/LVLH/VERN (PRI)

2. **Align -Z Sense Roll (Orbiter Body Yaw):**
   - DAP ROT: PULSE/DISC/DISC
   - RHC: Roll as reqd
   - To Stop Rotation:
     - DAP ROT: DISC/DISC/DISC
### HST CONTINGENCY INRTL APPROACH

#### RNDZ-4a/125/O/SIM-185

<table>
<thead>
<tr>
<th>RNG</th>
<th>RDOT</th>
<th>MCZ ET h:mm:ss</th>
<th>DAP</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BRAKING GATES</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0:22:00</td>
<td>0:27:00</td>
<td>A/B7 INRTL/VERN (PRI)</td>
<td>TH: -X as reqd until TGT stationary in COAS&lt;br&gt;ADI ATT - LVLH&lt;br&gt;RHC: as reqd until Yaw = 0&lt;br&gt;<strong>GNC UNIV PTG</strong>&lt;br&gt;CNRL - ITEM 21 EXEC&lt;br&gt;<strong>ERR (TOT) DAP as desired - ITEM (23) 24 EXEC (*)</strong>&lt;br&gt;<strong>IF RDOT falls below value for next gate, TH: -Z (in) as reqd to maintain RDOT</strong></td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>-4.0</td>
<td>0:22:00</td>
<td>A1L S-BD PL XMTR PWR - LO&lt;br&gt;Pto PWR - LO</td>
<td></td>
</tr>
<tr>
<td>1500</td>
<td>-2.0</td>
<td>0:30:00</td>
<td>LO Z</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>-1.0</td>
<td>0:35:30</td>
<td></td>
<td></td>
</tr>
<tr>
<td>900</td>
<td>-0.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>-0.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>-0.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>700</td>
<td>-0.7</td>
<td>0:44:00</td>
<td>A9,B9</td>
<td>HHL range callouts every 100 ft</td>
</tr>
<tr>
<td>600</td>
<td>-0.7</td>
<td>0:47:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>-0.5</td>
<td>0:51:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>-0.4</td>
<td>0:59:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>-0.2</td>
<td>1:05:30</td>
<td>HST in capture attitude</td>
<td><strong>HST COMM CHECK</strong></td>
</tr>
<tr>
<td>150</td>
<td>-0.2</td>
<td>1:09:30</td>
<td>If HST out of attitude, perform flyaround as reqd: MANUAL INERTIAL FLYAROUND ALIGNMENT or AUTO INERTIAL FLYAROUND</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>-0.2</td>
<td>1:12:00</td>
<td>CONFIGURE KU FOR COMM (Cue Card, KU OPS)</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>-0.2</td>
<td>1:14:00</td>
<td>If capture within 5 min of HST sunpt mvr, DISABLE SUNPT TIMER</td>
<td></td>
</tr>
<tr>
<td>140</td>
<td>-0.2</td>
<td>1:26:00</td>
<td>THC: +Z (out) to null rates&lt;br&gt;Perform HST CAPTURE (PDRS OPS, NOMINAL HST RETRIEVAL), When Captured (within 30s) HST TO DRIFT&lt;br&gt;Then TERMINATE RNDZ OPS&lt;br&gt;Go to FLIGHT PLAN</td>
<td></td>
</tr>
<tr>
<td>180 MIN SUNPOINT TIMER EXPIRATION TIME:</td>
<td></td>
<td>*</td>
<td><strong>SM 210 HST SYS</strong>&lt;br&gt;PCS SNPT DIS - ITEM 8 +9 EXEC&lt;br&gt;*DIS - YES&lt;br&gt;IF PCS SNPT DIS - NO&lt;br&gt;PCS SNPT DIS - ITEM 8 +9 EXEC&lt;br&gt;IF PCS SNPT DIS - NO&lt;br&gt;Perform PROXIMITY OPERATIONS BACKOFF (CONT OPS), 5-12</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>-4.0</td>
<td>0:22:00</td>
<td>A/B7 INRTL/VERN (PRI)</td>
<td>TH: -X as reqd until TGT stationary in COAS&lt;br&gt;ADI ATT - LVLH&lt;br&gt;RHC: as reqd until Yaw = 0&lt;br&gt;<strong>GNC UNIV PTG</strong>&lt;br&gt;CNRL - ITEM 21 EXEC&lt;br&gt;<strong>ERR (TOT) DAP as desired - ITEM (23) 24 EXEC (*)</strong>&lt;br&gt;<strong>IF RDOT falls below value for next gate, TH: -Z (in) as reqd to maintain RDOT</strong></td>
</tr>
<tr>
<td>1500</td>
<td>-2.0</td>
<td>0:30:00</td>
<td>LO Z</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>-1.0</td>
<td>0:35:30</td>
<td>A1L S-BD PL XMTR PWR - LO&lt;br&gt;Pto PWR - LO</td>
<td></td>
</tr>
<tr>
<td>900</td>
<td>-0.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>-0.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>800</td>
<td>-0.7</td>
<td>0:44:00</td>
<td>A9,B9</td>
<td>HHL range callouts every 100 ft</td>
</tr>
<tr>
<td>600</td>
<td>-0.7</td>
<td>0:47:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>500</td>
<td>-0.5</td>
<td>0:51:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>400</td>
<td>-0.4</td>
<td>0:59:00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>200</td>
<td>-0.2</td>
<td>1:05:30</td>
<td>HST in capture attitude</td>
<td><strong>HST COMM CHECK</strong></td>
</tr>
<tr>
<td>150</td>
<td>-0.2</td>
<td>1:09:30</td>
<td>If HST out of attitude, perform flyaround as reqd: MANUAL INERTIAL FLYAROUND ALIGNMENT or AUTO INERTIAL FLYAROUND</td>
<td></td>
</tr>
<tr>
<td>120</td>
<td>-0.2</td>
<td>1:12:00</td>
<td>CONFIGURE KU FOR COMM (Cue Card, KU OPS)</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>-0.2</td>
<td>1:14:00</td>
<td>If capture within 5 min of HST sunpt mvr, DISABLE SUNPT TIMER</td>
<td></td>
</tr>
<tr>
<td>140</td>
<td>-0.2</td>
<td>1:26:00</td>
<td>THC: +Z (out) to null rates&lt;br&gt;Perform HST CAPTURE (PDRS OPS, NOMINAL HST RETRIEVAL), When Captured (within 30s) HST TO DRIFT&lt;br&gt;Then TERMINATE RNDZ OPS&lt;br&gt;Go to FLIGHT PLAN</td>
<td></td>
</tr>
<tr>
<td>180 MIN SUNPOINT TIMER EXPIRATION TIME:</td>
<td></td>
<td>*</td>
<td><strong>SM 210 HST SYS</strong>&lt;br&gt;PCS SNPT DIS - ITEM 8 +9 EXEC&lt;br&gt;*DIS - YES&lt;br&gt;IF PCS SNPT DIS - NO&lt;br&gt;PCS SNPT DIS - ITEM 8 +9 EXEC&lt;br&gt;IF PCS SNPT DIS - NO&lt;br&gt;Perform PROXIMITY OPERATIONS BACKOFF (CONT OPS), 5-12</td>
<td></td>
</tr>
</tbody>
</table>

### DISABLE SUNPT TIMER

180 MIN SUNPOINT TIMER EXPIRATION TIME:

- **MET =**
- **PET =**

**SM 210 HST SYS**

- PCS SNPT DIS - ITEM 8 +9 EXEC<br>\*DIS - YES<br>IF PCS SNPT DIS - NO<br>PCS SNPT DIS - ITEM 8 +9 EXEC<br>IF PCS SNPT DIS - NO<br>Perform PROXIMITY OPERATIONS BACKOFF (CONT OPS), 5-12

**HST COMM CHECK**

**SM 210 HST SYS**

- TLM COUNT – incr<br>- RCVR 2(1) LOCK – *<br>- PCS MODE – NORM
  * If PCS MODE – SNPT: *
  * \*MCC prior to 120 t *
  \*PCS SNPT DIS – NO

**TERMINATE RNDZ OPS**

- **CDR A6U** \*FLT CNTLR PWR – OFF
- **MS** Perform HHL STOW (RNDZ TOOLS), 7-14<br>EXIT RPOP – [SHIFT][F10]<br>-Z COAS – OFF
- **PLT**
  - **GNC 33 REL NAV**
  - RNDZ NAV ENA – ITEM 1 EXEC (no *)
  - **GNC 55 GPS STATUS**
  - DES RVCR – ITEM 27 (no *)
  - **GNC 22 S TRK/COAS CNTL**
  - -Z(Y) STAR TRK – ITEM 4(3) EXEC (*)
- **GNC 20 DAP CONFIG**
  - Modify DAP A7 for SEP:
    - EDIT DAP A7 – ITEM 3 +7 EXEC<br>    A VERN ROT RATE – ITEM 63 +0.2 EXEC<br>    LOAD – ITEM 5 EXEC<br>    If VERNS available:
      - **O14:F** Pri RJD LOGIC, DRIVER(sixteen) – OFF
      - **O15:F** R/JDA 1A L2/R2 MANF DRIVER – ON
      - **O16:F**

**HST TO DRIFT**

**SM 210 HST SYS**

- TLM COUNT – incr<br>- RCVR 2(1) LOCK – *
- PCS MODE – ITEM 7 +9 EXEC (DRFT)<br>- PCS SNPT DIS – YES

(reduced copy)
AUTO INERTIAL FLYAROUND ALIGNMENT

NOTE
THC as required to keep center point of payload centered in keel camera

1. Maintain Range and Range Rate:
   - R < 150 ft
   - -.3 ft/sec < Rdot < + .3 fps

2. Check Initial Config:
   - Sense: Z
   - DAP A9/B9
   - DAP TRANS: PULSE/PULSE/PULSE
   - DAP: B/INRTL/VERN (PRI)
   - DAP ROT: DISC/DISC/DISC

3. Flyout Sequence – The Sox Sequence:
   - Z Sense: Roll – align orbiter XZ plane with the HST V1
   - Pitch – align orbiter Z with the HST V1
   - Roll – align orbiter camera view with end of HST
   - Body Sense: Yaw – align orbiter XZ plane with the HST V1
   - Pitch – align orbiter Z with the HST V1
   - Yaw – align orbiter camera view with end of HST

3a. Align Z Sense Roll (Orbiter Body Yaw)
   To Start Rotation:
   - GNC UNIV PTG
   - Body Vect = 5
   - For Z Sense -Roll (+Body yaw): P = 270
   - For Z Sense +Roll (-Body yaw): P = 90
   - Y = 0
   - ROT – ITEM 20 EXEC
   - DAP: A/AUTO/VERN (PRI)
   - To Stop Rotation:
     - DAP: A/AUTO/VERN (PRI)

3b. Align Z Sense Pitch (Orbiter Body Pitch)
   To Start Rotation:
   - GNC UNIV PTG
   - Body Vect = 5
   - For Z Sense -Pitch (+Body pitch): Y = 90
   - For Z Sense +Pitch (-Body pitch): Y = 270
   - ROT – ITEM 20 EXEC
   - DAP: A/AUTO/VERN (PRI)
   - To Stop Rotation:
     - DAP: A/AUTO/VERN (PRI)

3c. Align Z Sense Yaw (Orbiter Body Roll)
   To Start Rotation:
   - GNC UNIV PTG
   - Body Vect = 5
   - For Z Sense -Yaw (+Body Roll): BV(ITEM 14 + 1)
   - For Z Sense +Yaw (-Body Roll): BV(ITEM 14 + 2)
   - ROT – ITEM 20 EXEC
   - DAP: A/AUTO/VERN (PRI)
   - To Stop Rotation:
     - DAP: A/AUTO/VERN (PRI)

   NOTE
   Orbiter body roll rotations will require Orbiter body Y translations.
   In DAP: Lo Z, body Ys cause a relatively large closing rate, which in turn costs prop to fly out

4. Check Final Config
   - GNC UNIV PTG
   - CNCL – ITEM 21 EXEC
   - DAP: B/INRTL/VERN, LO Z

MANUAL INERTIAL FLYAROUND ALIGNMENT TRIM

NOTE
THC as required to keep center point of payload centered in keel camera

1. Maintain Range and Range Rate:
   - R < 150 ft
   - -.3 ft/sec < Rdot < + .3 fps

2. Check Initial Config:
   - Sense: Z
   - DAP A9/B9
   - DAP TRANS: PULSE/PULSE/PULSE
   - DAP: B/INRTL/VERN (PRI)

3. Flyout Sequence:
   - Sense: Pitch/Yaw/Roll
   - Body Sense: Pitch/Roll/Yaw

3a. Align Z Sense Pitch (Orbiter Body Pitch)
   To Start Rotation:
   - DAP ROT: DISC/PULSE/DISC
   - RHC: Pitch as reqd
   - To Stop Rotation:
     - DAP ROT: DISC/DISC/DISC

3b. Align Z Sense Yaw (Orbiter Body Roll)
   To Start Rotation:
   - DAP ROT: DISC/DISC/PULSE
   - RHC: Yaw as reqd
   - To Stop Rotation:
     - DAP ROT: DISC/DISC/DISC

3c. Align Z Sense Roll (Orbiter Body Yaw)
   To Start Rotation:
   - DAP ROT: DISC/PULSE/DISC
   - RHC: Roll as reqd
   - To Stop Rotation:
     - DAP ROT: DISC/DISC/DISC

4. Check Final Config
   - GNC UNIV PTG
   - CNCL ITEM 21 EXEC
   - DAP: B/INRTL/VERN (PRI), LO Z

(reduced copy)
HST BREAKOUT FLOWCHART

**BREAKOUT**
- **NO SENSOR DATA** during RNDZ (RR, STRK, COAS) – Breakout NLT MC2 + 20 min unless tgt acquired visually or with radar
- **If GOOD SENSOR DATA** during RNDZ (RR, STRK, COAS) BREAKOUT NLT MC2 + 24 min unless target is acquired visually or with radar
- **TARGET >30 DEG** from COAS horizontal at start of radar fail correction
- **PROP quantities violate BINGO #’s**
- **OMS – ENG, HE, PROP ↓**
- **LOSS OF LO Z (see below)**

**POST MC 4. TRANSITION FOR**

- **VERNS FAIL**: FROM ALT/AUTO TO PRI/AUTO. PRI/INERTIAL IF INERTIAL APPR

**PROX OPS BACKOFF**
IF < 250 FT FOR LOSS OF REDUND: 5-12
- < 2 GNC GPCs/IMUs
- Loss of redundant +Z trans. (Lo Z & 1 up jet/pod, or 2 up jets/pod)

- Failure of PRCS trans or rotation
- All THC -1 contact per char/axis, except -Z needs 2 contacts
- RCS lk -B/O to 120 ft

**RNDZ-5a/125/O/B**

(reduced copy)
1. √SENSE: -Z
   
   GNC 20 DAP CONFIG
   √Dap A trans pulse size = .05 fps
   √DAP TRANS: PULSE/PULSE/PULSE, no LO Z

   O14:E, O16:E
   O14:F, O15:F, O16:F

2. √cb DDU AFT (two) – cl
   
   O14:E, O16:E
   PRI RJD DRIVER, LOGIC (sixteen) – ON

   O15:F, O16:F
   DAP: A/LVLH/VERN(ALT)
   A6U
   FLT_CNTL PWR – ON

3. Tool-Chasing burns:

   CAUTION
   Maintain 5 ± 1 sec between X pulses
   Maintain 5 ± 1 sec between Y pulses
   Maintain 5 ± 1 sec between Z pulses
   Do not exceed 3 pulses

   DAP: FREE
   THC: As reqd
   Record # of Pulses: __________________________

4. At TIG+5 min:
   If additional pulses required:
   Repeat step 3
   If additional pulses not required:
   FLT_CNTL PWR – OFF
   A/AUTO/VERN(ALT 10)

   O14:E, O16:E
   cb DDU AFT (two) – as reqd

   O14:F, O15:F, O16:F
   PRI RJD DRIVER, LOGIC (sixteen) – as reqd
NOMINAL RADAR ANGLES AND CAMERA ANGLES RANGING CHART

FWD AFT

85°/85°=342'
85°/90°=685'

85°/85°=342'
85°/90°=685'

POISE FOR CAPTURE POSITION

(reduced copy)
GPC/MDM FAILURE RESPONSE DURING RNDZ

NOTES
1. Perform appropriate ORB PKT procedure in parallel with IMMEDIATE ACTIONS on card as soon as practical
2. Use this card during Rndz T/L thru MC4 burn (if RR FAIL PROCEDURES, thru RR fail correction burn)
3. GPC assignments assume 1233 NBAT
4. Do NOT restring for Non-Universal I/O Errors. Otherwise, a restring for GPC 1,2,3 fails will recover everything (see expected restring below)
5. If any GNC GPC fails, VERNs ↓
6. If IMUs not commfaulted, THCs are normally GO
7. Loss of FF2, FF4, FA3, and FA4 do not impact Rndz (unless other failures)

<table>
<thead>
<tr>
<th>GPC</th>
<th>MDM</th>
<th>IMMEDIATE ACTION</th>
<th>MAJOR IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPC1 (3232*)</td>
<td>FF1</td>
<td>1. If -Z ST NAV, INH ST to NAV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. If -Z ST not recovered:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Use -Y ST, if reqd</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. C3 DAP lights latched (go out</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>with MDM pwr fail)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. -Z ST ↓</td>
<td></td>
</tr>
<tr>
<td>FA1</td>
<td></td>
<td>DAP: ALT/AUTO</td>
<td>VERNs ↓</td>
</tr>
<tr>
<td>GPC2 (1313*)</td>
<td>FA2</td>
<td>DAP: ALT/AUTO</td>
<td>VERNs ↓</td>
</tr>
<tr>
<td>Man OMS Shutdown</td>
<td>FF3</td>
<td>DAP: ALT/AUTO</td>
<td></td>
</tr>
<tr>
<td>GPC3 (1212*)</td>
<td></td>
<td>1. RR NAV, INH RR to NAV</td>
<td></td>
</tr>
<tr>
<td>Loss of Aft DAP</td>
<td></td>
<td>2. If -Y ST NAV, INH ST to NAV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Work RR FAIL procedures</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. VERNs ↓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. RR → NAV/RPOP ↓</td>
<td>Panel A2 OK</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. A6 DAP lights latched (go out</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>with MDM pwr fail)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. -Y ST ↓</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Also for loss of GPC3:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>R OMS GMBL PRI/SEC ↓</td>
<td></td>
</tr>
<tr>
<td>GPC4 (1212*)</td>
<td>PL1</td>
<td>If Ku breaks lock:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ku sel – AUTO TRK</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1. GPC Ku ptg ↓, slew in AUTO</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TRK if Ku breaks lock</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. No Ku self-test</td>
<td></td>
</tr>
</tbody>
</table>

* Expect this NBAT if GPC fail

---

NOTES:

1. Perform appropriate ORB PKT procedure in parallel with IMMEDIATE ACTIONS on card as soon as practical
2. Use this card during Rndz T/L thru MC4 burn (if RR FAIL PROCEDURES, thru RR fail correction burn)
3. GPC assignments assume 1233 NBAT
4. Do NOT restring for Non-Universal I/O Errors. Otherwise, a restring for GPC 1,2,3 fails will recover everything (see expected restring below)
5. If any GNC GPC fails, VERNs ↓
6. If IMUs not commfaulted, THCs are normally GO
7. Loss of FF2, FF4, FA3, and FA4 do not impact Rndz (unless other failures)
Note: Fabricate As Transparency

C/L CAMERA

CORRIDOR AND ALIGNMENT

CTVC 40.0 DEG HFOV - CORRIDOR
CTVC FULL ZOOM - ALIGNMENT
FLIGHT

H-FOV

40 deg

20 deg

10 deg

SUB ANG RULER
RENDEZVOUS

STS 125