TO: MO-2/Gemini Mission Director

ROM: MGS/Director, Gemini Systems Engineering

SUBJECT: Gemini Spacecraft Times to Roll 90°

One Thruster Operating

The results of the computations you requested are summarized below. We have not attempted a highly refined analysis, but these numbers should be representative of what can be anticipated under the conditions noted. In particular, these numbers assume that resultant motion is pure roll whereas elements of pitch and yaw are also present. A summary of the basic data used is attached.

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Condition</th>
<th>Thrust (lbs)</th>
<th>Time to 90° (sec)</th>
<th>Acceleration (radians/sec²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spacecraft</td>
<td>Prerendezvous</td>
<td>25</td>
<td>7.63</td>
<td>.0540</td>
</tr>
<tr>
<td></td>
<td>Post docking</td>
<td>25</td>
<td>7.37</td>
<td>.0579</td>
</tr>
<tr>
<td>Docked</td>
<td>Pre-PPS</td>
<td>25</td>
<td>8.25</td>
<td>.0462</td>
</tr>
<tr>
<td></td>
<td>10(ACS)</td>
<td>17.</td>
<td></td>
<td>.0108</td>
</tr>
<tr>
<td></td>
<td>½(ACS)</td>
<td>58.</td>
<td></td>
<td>.000542</td>
</tr>
<tr>
<td>Docked</td>
<td>Agena Empty</td>
<td>25</td>
<td>7.98</td>
<td>.0493</td>
</tr>
<tr>
<td></td>
<td>10(ACS)</td>
<td>16.5</td>
<td></td>
<td>.0116</td>
</tr>
<tr>
<td></td>
<td>½(ACS)</td>
<td>73.8</td>
<td></td>
<td>.000577</td>
</tr>
</tbody>
</table>

* $t^2 = \frac{20}{\theta}$, assuming spacecraft is not rolling and no thrusters are on at $t=0$; only one thruster operates to produce roll, it operates continuously for time indicated at 100% effectiveness.

---

*Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan*
Comparison with C. Mathews' Gemini VIII charts, NASA-S-66-4039 thru 4042

Docked, pre-PPS, 25 lb. thrust,
  Gemini VIII, ACS on, time to reach 20°/sec 10 sec
  Above data, ACS off, time to reach 20°/sec 7.5 sec

Spacecraft, postdocking, 25 lb. thrust
  Gemini VIII, time to reach 300°/sec 1.71 min
  Above data, time to reach 300°/sec 1.51 min

Eldon W. Hall

cc: MG/Mr. Day
    MGO/Mr. Edwards
Gemini Missions

As a result of our discussions today, a suggested list of missions (enclosed) is being considered. I would appreciate your review of these missions and comments on your ability to support them. If you are unable to support any of the missions, please identify those aspects which cause the difficulty.

I am also interested in any suggestions you may have for improving the overall missions for the Gemini Program. A response is needed by July 15.

Eldon W. Hall
Gemini V
1. Long duration (7 days primary, 1 additional day secondary)
2. REP exercise
3. Full pressure suits; no hatch opening
4. Experiments

Gemini VI
1. Agena rendezvous (radar, computer guidance)
2. Simultaneous countdown
3. Docked vehicle attitude maneuvers and SPS exercises
4. After final separation - SC and ground commanded Agena PPS maneuvers. Insert Agena into n. mi. circular orbit.
5. Experiments
   a. Rerendezvous with Agena (radar monitored optical)
   b. Cabin movies of crew and instrument console during rendezvous

Gemini VII
1. Long duration (14 days)
2. Ground controlled optical rendezvous with inactive Agena VI
3. Shirtsleeve environment
4. Experiments

Gemini VIII
1. Agena rendezvous (by fourth darkness/apogee)
2. Docked vehicle maneuvers with Agena PPS
3. EVA. Externally mounted camera for docking. Improved hand held maneuvering unit
5. SC experiments
   a. Rerendezvous with Agena (LEM abort simulation)
   b. ATMU systems test
   c. Agena tether
Gemini IX  1. Agena rendezvous (by second darkness/apogee)  
          2. 3-day duration  
          3. Dual rendezvous with Agena VIII in docked configuration  
          4. EVA. Retrieve Agena VIII experiments.  
          5. MMU checkout  
          6. Experiments  
              a. Onboard computing for dual rendezvous if possible.

Gemini X  1. Agena rendezvous  
          2. 3-day duration  
          3. Dual rendezvous with Pegasus C  
          4. Onboard computing for dual rendezvous  
          5. EVA  
          6. Experiments

Gemini XI  1. Agena rendezvous  
          2. 3-day life  
          3. Dual rendezvous with Pegasus C or other satellite  
          4. Onboard computing for dual rendezvous  
          5. EVA  
          6. Experiments

Gemini XII  1. Agena rendezvous  
          2. 2 days  
          3. EVA  
          4. MMU  
          5. Apollo simulations  
          6. Experiments