Why the Vasa Sank: 10 Problems and Some Antidotes for Software Projects

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Source: www.vasamuseet.se

• Sweden was at war with Poland
• In January 1625, Sweden’s King Gustav ordered the construction of Vasa, a small war ship.
• Ship builders knew how to build 108-foot ships with 1 gun deck.
• A change in warfare tactics in the late 1600s and 1700s.
  – Before, warships fired cannon volleys to cripple their opponent’s ship so that they could board and seize it.
  – The objective became to fire broadside volleys and sink the opponent.
• In November 1625, King ordered modification to a 120-foot ship
• King ordered that VASA to be enlarged to 135 feet with 2 gun decks.
Changes in Tactics

– Before, warships fired cannon volleys to *cripple* their opponent’s ship so that they could *board and seize it*.
– The objective became to *fire broadside volleys* and *sink* the opponent.
– This why the King ordered that VASA to be enlarged with *2 gun decks*.

Changes in Requirements and Architecture

• Architect probably “scaled up” the dimensions of the original 108-foot ship
  – To meet the length and breadth requirements of the 111-foot ship and then scaled those up for the 135-foot
• The *keel was already laid* for a 111 foot ship, so they could make that *change in width only in the upper parts of the ship*.
  – This raised the *center of gravity*
• The upper deck had to carry the *added weight* of the 24-pound guns in cramped space that had been built for 12-pound guns,
  – Raising the ship’s *center of gravity*.
• The King ordered that the ship be outfitted with hundreds of *ornate, gilded, and painted carvings* depicting Biblical, mythical, and historical themes
  – The heavy oak carvings raised the *center of gravity*
System Tests

- The King had ordered that the Vasa be ready by 25 July and "if not, those responsible would be subject to His Majesty's disgrace.
- Pre-launch Stability Test
  - Having 30 men run from side to side
  - After 3 traversals, test was halted because the ship was rocking violently. The ship would have capsized if tests were not halted
- Shipbuilder, were not present during the stability test and were unaware of the outcome.
- The ship could not be stabilized because there was no room to add ballast under the floorboards
  - It would have needed more than twice that amount to stabilize

The Royal Swedish Navy launched the Vasa. After sailing only about 1,300 meters, it sank, losing 53 lives.
Are the problems of the VASA relevant to Software Development?
Vasa Project’s Problems also common to Software Projects

1. Excessive schedule pressure
2. Changing needs
3. Lack of technical specifications
4. Lack of a documented project plan
5. Excessive innovations
6. Excessive secondary innovations
   - Need to accommodate to constraints of the technologies used, addition of derived requirements to support primary requirements
7. Requirements creep
8. Lack of scientific methods
9. Ignoring the obvious
   - e.g. Ignoring the results of the tests: ship was dangerously unstable
10. Unethical behaviour
    - when it became obvious the ship was not seaworthy, those with authority to stop the launch did not do so.

Can you propose Antidotes to these problems?

Antidotes to Problems

1. Excessive schedule pressure
   - Objective estimates
   - More resources
   - Better resources
   - Prioritized requirements
   - Descoped requirements
   - Phased releases
2. Changing needs
   - Iterative development
   - Change control/baseline management
3. Lack of technical specifications
   - Development of initial specifications
   - Event-driven updating of specifications
   - Baseline management of specifications
   - A designated software architect
Antidotes to Problems

4. Lack of a documented project plan
   – Development of an initial plan
   – Periodic and event-driven updating
   – Baseline management of the project plan
   – A designated project manager

5 & 6. Excessive and secondary innovations
   – Baseline control
   – Impact analysis
   – Continuous risk management
   – A designated software architect

7. Requirements creep
   – Initial requirements baseline
   – Baseline management
   – Risk management
   – A designated software architect

8. Lack of scientific methods
   – Prototyping
   – Incremental development
   – Technical performance measurement

9. Ignoring the obvious
   – Back-of-the-envelope calculations
   – Assimilation of lessons learned

10. Unethical behaviour
    – Ethical work environments and work cultures
    – Personal adherence to a code of ethics
    – The ultimate effect of the work should be to the public good.
## VASA in Figures

<table>
<thead>
<tr>
<th>Category</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Length</strong></td>
<td></td>
</tr>
<tr>
<td>Total length</td>
<td>69 metres</td>
</tr>
<tr>
<td>Length of the hull</td>
<td>61 metres</td>
</tr>
<tr>
<td>Length of the hull between prow and stern</td>
<td>47.5 metres</td>
</tr>
<tr>
<td><strong>Width</strong></td>
<td></td>
</tr>
<tr>
<td>Maximum width</td>
<td>11.7 metres</td>
</tr>
<tr>
<td><strong>Height</strong></td>
<td></td>
</tr>
<tr>
<td>From keel to the top of the main mast</td>
<td>52.5 metres</td>
</tr>
<tr>
<td>Height of the stern</td>
<td>19.3 metres</td>
</tr>
<tr>
<td><strong>Depth</strong></td>
<td>4.8 metres</td>
</tr>
<tr>
<td><strong>Displacement</strong></td>
<td>1,210 tons</td>
</tr>
<tr>
<td><strong>Sail area</strong></td>
<td>1,275 square metres</td>
</tr>
<tr>
<td><strong>No. of sails</strong></td>
<td>10 - of which six have been preserved</td>
</tr>
<tr>
<td><strong>Armament</strong></td>
<td>64 guns, including:</td>
</tr>
<tr>
<td></td>
<td>24-pounders - 48</td>
</tr>
<tr>
<td></td>
<td>3-pounders - 8</td>
</tr>
<tr>
<td></td>
<td>1-pounders - 2</td>
</tr>
<tr>
<td></td>
<td>Mortars - 6</td>
</tr>
<tr>
<td><strong>Crew</strong></td>
<td>445 men, including:</td>
</tr>
<tr>
<td></td>
<td>Seamen - 145</td>
</tr>
<tr>
<td></td>
<td>Soldiers - 300 (not on board when the Vasa sank)</td>
</tr>
</tbody>
</table>