Case for Class Discussion

This case, available with more detail on the website of NASA's Goddard Space Flight Centre at http://www.nasa.gov/centers/goddard/about/organizations/OCKO/casestudies/index.html shows how well the case method can be adapted to historical circumstances. It also shows how modern management tools such as risk analysis can retrospectively be used. It also calls into question key issues of setting direction, ethics and the harsh realities of implementation. The case is used with the permission of the Chief Knowledge Officer, NASA.

Group Discussion: Briefly (15 minutes), reflect on how implementation might have produced a better result. Consider, but do not be confined to or feel you have to w in detail, the following questions:

- Who is responsible for this catastrophe?
- What was lacking to mitigate the king's changes and, more significantly, his view that they were even possible?
- Were there any inappropriate risks that should not have been taken? How can these be identified and mitigated on future shipbuilding initiatives?
- How can unknown areas be addressed beyond relying on the shipbuilder's personal expertise? How do we advance into areas that are unknown in implementing public policy?
- How could the communications between the king, the shipbuilders, and the navy command be improved for the contracting, building, and delivery of future warships in a timely, on-schedule, and within-budget manner?
- Recognizing uneven levels of authority and power, what sort of governance could be put in place to ensure that the direction desired can be implemented without disasters like this?

Launch the Vasa

A lot rode on the men who were building the Swedish gunship *Vasa*, in 1626, and those who would sail her. It had been a calamitous decade for the Swedish navy. A dozen of Sweden's largest warships had been captured, wrecked, or scuttled; a violent storm in 1625 had destroyed 10 of those ships, prompting the imperious King Gustav II Adolf to order four new ones. Further losses had dramatically increased the king's impatience with his shipbuilders. This is a time known in Swedish history as its "great power period." Gustav was impatient to see the *Vasa* join the Baltic fleet in the Thirty Years' War.

Recreation of the building of the Vasa.
Credit: Vasa Museum

Make it Longer

The *Vasa* was first ordered as a small, traditional ship, but after numerous change orders from the king it was increased in both size and armament. A 111-foot keel was laid down, but almost immediately work stopped as the king learned that rival Denmark was building a larger ship with two gun decks, a new innovation. The *Vasa*'s keel was ordered to be increased to 135 feet, and the ship was now to include two enclosed gun decks.

No one in Sweden had ever built such a ship, and with the king making constant and ever-louder demands for both larger dimensions and faster delivery, there was no time for plans to be engineered. It was decided that scaling up the 111-foot keel, rather than laying a new, 135-foot keel, would save time.

There is the built-in complexity of the *Vasa* organization and the work packages-making system-interfaces complex. This is most apparent between the shipbuilding team and the king's court. Requirements, design, and implementation processes, procedures, and formal office-to-office agreements have not been documented. There are multiple approaches from different quarters in solving a common technical risk. The resulting impact to the *Vasa* project is in not meeting the schedule and inefficient implementation due to cultural differences and drivers with foci that are different from that of the mission.

The shipbuilders added a fourth scarf (or joint) to lengthen the keel, but the result was narrow in relation to its length and the draft very shallow for a ship of that size. A foot and a half was added to the beam, but because the keel was already laid it had to be added to the uppermost parts of the ship. This raised the center of gravity and contributed to the ship's instability. The shallow keel did not allow sufficient room for the ballast needed to stabilize a ship of that size, and the narrow beam required extra bracing timbers, further reducing room for the ballast.

More Guns

With a bigger ship, King Gustav demanded more—and bigger—guns, insisting on 64 24-pounders, half on each deck, plus numerous smaller ones. Though it was built for 12-pounders, the upper deck now had to carry the added weight of 24-pounders, which further raised the center of gravity. In the end, the rushed schedule allowed for 48 24-pounders.

Adding to the top-heavy condition: hundreds of ornate, gilded, and painted carvings made of heavy oak, also ordered by the king.

Meant to outshine the Danish ship, no cost was spared, and the *Vasa* became the most expensive ship of its time. In the end, almost 5% of Sweden's GNP would be spent on this venture.

Management Change

In 1626, the head shipbuilder, Henrik Hybersson, became very ill. While bedridden, he had to share his duties with two others, which led to confusion over project management. Division of responsibility and communication was weak, exacerbated by the king's impatience and ever-changing demands and resulting in further delays. In addition, the shipyard owned by Hybersson and his brother was facing a major cash crunch and eager to get ships built to increase their cash flow. With the largest workforce in Sweden's history essentially running amok, the shipbuilder died in 1627.

At the time, there were no standardized calculations for center of gravity, heeling characteristics, and stability factors. Ship captains learned their ships' characteristics by trial-and-error. Even naval experts believed that the higher and more impressive a ship, and the more guns it carried, the more indestructible the ship would be.

As well, historically some ship designs have failed (sunk due to instability) and required some redesign. Critical stability tests are driven by core ship-design issues. Current schedule analysis indicates significant overlap between subsystem qualifications and completion of seaworthiness build, assembly, and test cycles.

Launch Readiness Test

Finally, all that remained was a test of the *Vasa*'s seaworthiness. Called a "lurch" test, the ship's captain and the king's admiral had a skeleton crew of 30 men run from gunwale to gunwale amidships on a windless day in calm harbor waters. After three such sprints, the test was stopped because the ship was rocking so violently that the captain feared it would capsize. The shipbuilders were not present nor were they informed of the test

results. No action was taken after the alarming results because the only known corrective course was “more ballast,” which was not a viable option. Already loaded with 120 tons of ballast, there was no room for more. Even if there had been more room, the additional weight would have put the lower deck gun portals near or below the waterline. As it stood, those ports were only 3 feet above the waterline.

The Launch

It is July 25, 1628. The king’s admiral, is under orders to launch this day or suffer severe personal and professional consequences. He is being held responsible for the careers of the shipbuilder and shipwright, and the lives of the ship’s captain and his 150-man crew. However, in this high role, he is also responsible for the image of an expansionist Sweden and its main weapon, the Swedish Navy, now severely crippled by losses during wartime. He is deeply committed to the mission of restoring Swedish naval predominance in the face of the aggressive Danes.

Reluctant, but ever obedient, the admiral orders the launch. Unwilling to stall any longer, he orders the ship to be launched on August 10, 1628. Pulled away from the wharf, a few sails are raised just as a light breeze picks up to fill the sails. The breeze fills the ship’s sails and lifts the spirits of the crew and the anxious crowd of dignitaries gathered safely on the shore to see the outcome of this venture. The *Vasa* sails about 1000 yards, lurches, heels over and sinks in full view of the entire crowd. Fifty souls are lost along with the entire ship. King Gustav was in Poland and out of communication, though he had ordered that the ship be launched by July 25 and “if not, those responsible would be subject to His Majesty’s disgrace.” Neither the shipwright nor the shipbuilder had been present for the lurch test, and no one had suggested any ideas for increasing the *Vasa*’s stability.

Aftermath

The king was notified by letter of *Vasa*'s fate on 27 August. "Imprudence and negligence" must have been the cause, he wrote angrily in his reply, demanding in no uncertain terms that the guilty parties be punished. Captain Söfring Hansson, who survived the disaster, was immediately imprisoned awaiting trial. Under initial

interrogation, he swore that the guns had been properly secured and that the crew was sober.

A full inquest, organized by a committee, many members of which were also on the privy council, took place before a court of admirals and councilors on 5 September 1628. Each of the surviving officers was questioned, as was the supervising shipwright and a number of expert witnesses. Also present at the inquest was the Admiral of the Realm. The object of the inquest was as much or more to find a scapegoat as to find out why the ship had sunk. Whoever the committee might find guilty for the fiasco would face a severe penalty.

Surviving crew members were questioned one by one about the handling of the ship at the time of the disaster. Was it rigged properly for the wind? Was the crew sober? Was the ballast properly stowed? Were the guns properly secured? However, no one was prepared to take the blame. Crewmen and contractors formed two camps; each tried to blame the other, and everyone swore he had done his duty without fault and it was during the inquest that the details of the hushed-up stability test were revealed. Nevertheless, the answers were deemed satisfactory, and no incriminating evidence was found.

Later, the focus was turned on the ship builders. "Why did you build the ship so narrow, so badly and without enough bottom that it capsized?" the shipwright Jacobsson was asked by the investigators. He fell back on the classic strategy of civil servants; he had simply followed orders. Jacobsson stated that he built the ship as directed by Henrik Hybertsson (long since dead and buried), who in turn had followed the instructions of the king. Jacobsson had in fact widened the ship by 42 centimeters (1.38 ft) after taking over the construction, but the ship's construction was too far along to allow further widening.[

In the end, no guilty party could be found. The answer Arendt Hybertsson gave when asked by the court why the ship sank was "only God knows". Gustavus Adolphus had approved all measurements and armaments, and the ship was built according to the instructions and loaded with the number of guns specified. In the end, no one was punished or found guilty for negligence, and the sinking was explained as an act of God. The sinking of *Vasa* was a major economic disaster for the country.

Historical Note: in 1961, the *Vasa* was raised almost completely intact from the Stockholm harbor. It is housed in a special purpose museum in that city.

Resources

Cederlund, Carl Olof, and Hocker, Frederick M. ed., *Vasa I: The Archaeology of a Swedish Royal Ship of 1628.* Statens Maritima Museer (January 2007).

Fairley, Richard E., and Willshire, Mary Jane. "Why the Vasa Sank: 10 Problems and Some Antidotes for Software Projects." *IEE Software* March/April 2003, IEE Computer Society.

Hendrickson, Elizabeth. "Going Down with the Ship." http://www.stickyminds.com/sitewide.asp?Function=edetail&ObjectType=COL&ObjectId=3282 (March 18, 2002). Kvarning, Lars-Ake, and Ohrelius, Bengt. *The Vasa: The Royal Ship.* Sweden: Atlantic Bookforlag AB, 1998. Mallin, Dea A. "Before the *Titanic*, There Was the *Vasa.*"

http://www.crossculturedtraveler.com/Archives/APR2005/Vasa.htm Mayol, Dottie E. "The Swedish Ship *Vasa*'s Revival." http://www.abc.se/~pa/publ/vasa.htm "The Royal Ship *Vasa.*" http://hem.bredband.net/johava/WASA2e.htm. "The *Vasa* Capsizes: Managing Innovation." http://www.albany.edu/faculty/miesing/teaching/cases/vasahome.html