

Concept development – a new national research vessel

At the request of the Ministry for Rural Affairs, the Swedish University of Agricultural Sciences (SLU), the Swedish Meteorological and Hydrological Institute (SMHI) and the Swedish Coast Guard (KBV) were asked to, on a jointly basis, produce a basis for a government decision on a new national survey and research vessel. SSPA was contracted to provide coordination and project management, requirement analysis, concept development and cost estimates. The aim of the project was to guide the Ministry with recommendations on a vessel concept and associated budget. The subsequent decision was to build a new vessel in accordance with the recommendations set forth by the project.

As part of their undertakings, SLU and SMHI perform tasks within the national and international monitoring of fish populations and the ocean environment. The vessel primarily used for these activities, the research vessel “Argos”, has been decommissioned due to age.

As a result, in December 2013, SLU, SMH and KBV were assigned to compile a basis for a decision concerning the acquisition of a new survey and research vessel. SSPA was commissioned to lead, coordinate and to report the work to be done. The report was to include a requirement compilation, a vessel concept fulfilling the requirements, and cost estimates for acquisition and 25 years of operation.

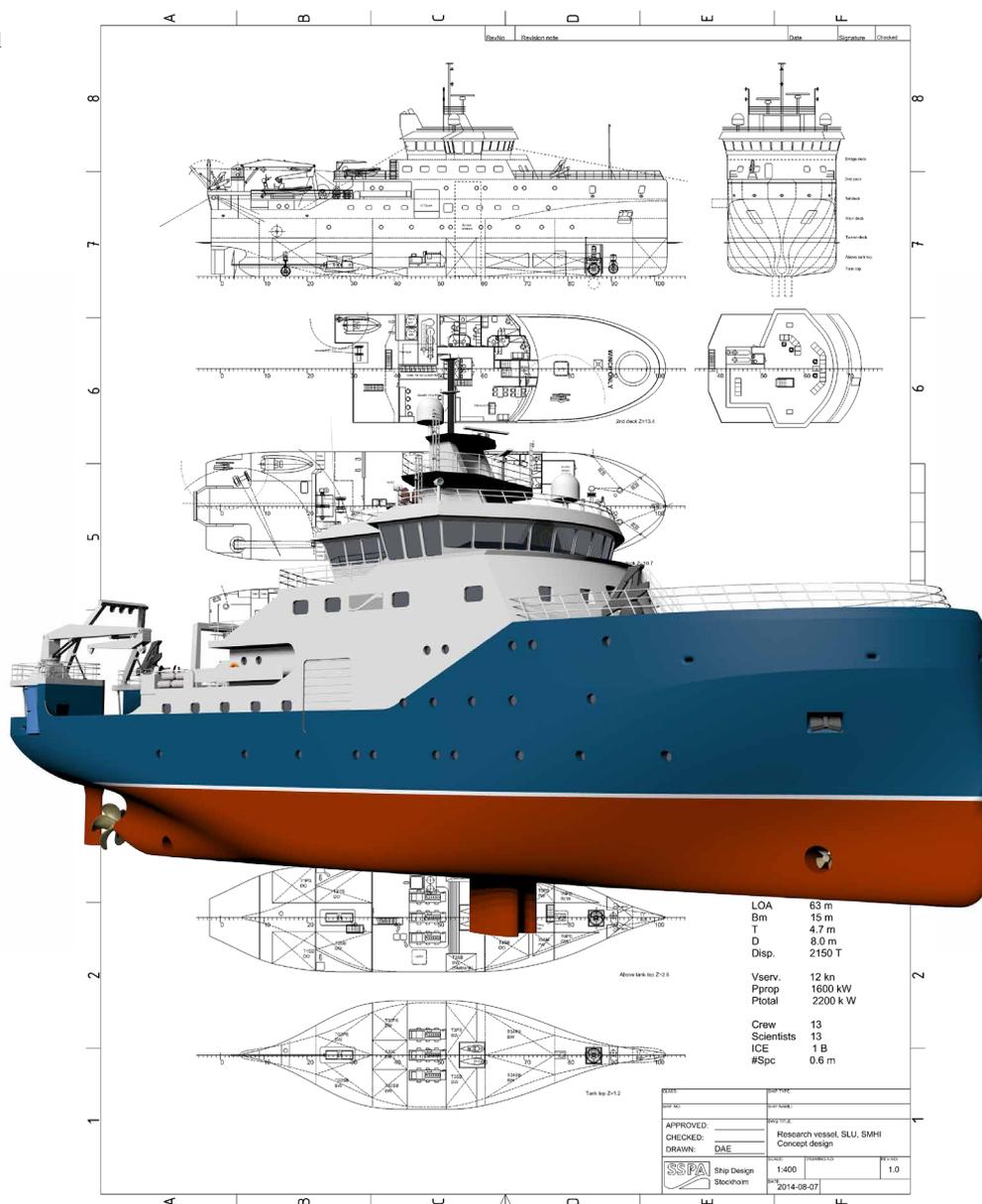
The assignment included two alternative main tracks, a new building and a conversion of an existing coast guard vessel from the KBV 001-series. The current vessels have relatively low yearly operating hours and are already being partly chartered for research purposes. Therefore, the Ministry wanted to investigate the potential to reduce costs by modifying an existing ship in order to meet all research requirements, while still fulfilling the main KBV capabilities.

Requirement analysis and concept development

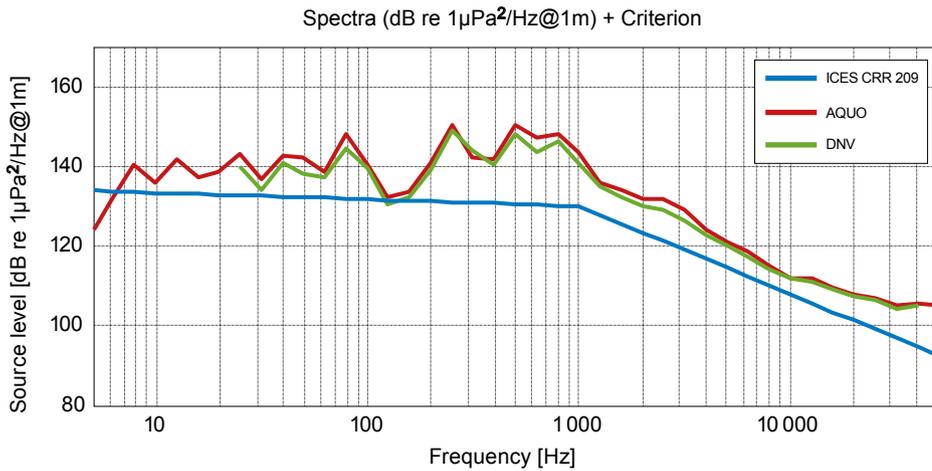
The fish research activities are decisive for the requirements on the vessel. To be able to localise and collect data on shoals, a number of advanced sonars are used.

In order to get accurate information from the sonars, the underwater radiated noise from the vessel must be kept low. This is partly because the noise interferes with the sonar signal and partly because of a phenomenon called Fish Avoidance Behaviour (FAB).

When the fish hears an incoming vessel it tries to avoid it by diving (positions downwards), which decreases the “radar cross section” of the fish. This in turn makes the fish more difficult to detect with the sonars.



SSPA designed a number of concepts, altering general arrangement, hull form and machinery.



KBV 001 underwater radiated noise compared to ICES 209.

There is a standard, ICES 209, providing guidelines for acceptable underwater radiated noise from research vessels in order to reach a certain level of quality in performed measurements. The new vessel had to fulfil the ICES standard. This requirement was decisive when designing the machinery and propulsion system.

The sonars are also disturbed by air bubbles drawn down along the bottom of the hull. The vessels are therefore normally equipped with one or two drop keels to allow the sonars to be lowered below the bubble layer. Still, minimising the amount of bubbles being drawn down is one of the highest priorities when designing the hull lines.

Regarding the layout of the general arrangement, the working environment was decisive. The focus lay on workflows from the deck, into and through the laboratories. As a part of the requirement analysis, SSPA designed a number of concepts, altering the general arrangement, hull form and machinery. The resulting concept was a vessel with an overall length and beam of 63 x 15 metres equipped with diesel electric machinery and a single, fixed propeller.



KBV 001. Photo: Swedish Coastguard

Conversion of the KBV 001

The challenge for the KBV-001 alternative was to investigate whether it was possible to find a working compromise between the research-related requirements and the present KBV capabilities. Technical design issues as well as operational questions (e.g. how would operational time be divided between the organisations) had to be handled.

Technically, the aim was that the vessel would keep, or be able to retrieve, the primary KBV capabilities, decisive for the vessel. These functions incorporate a large oil recovery capability and capacity for heavy towing.

In order to meet requirements regarding fire safety zones, set by the DNV Oilrec regulations, the fish laboratories and a number of new accommodation cabins had to be placed in removable modules. The remaining research-related requirements were permanently integrated in the modified general arrangement.

Concerning the bubble characteristics of the hull, no investigation was made. It was deemed an acceptable compromise to equip the vessel with drop keels.

The question of underwater radiated noise was, however, critical. In order to find out the status of the KBV 001, noise measurements had to be made.

The SSPA hydro acoustic and measurement experts set up a noise measurement station with sonars in the fjord of Gullmaren (on Sweden's west coast). Measurements in accordance with the DNV Silent requirements and the AQUO standard were performed.

The results were evaluated and compared to the ICES 209 standard. The conclusion was that the estimated measures to get the vessel to meet the ICES requirements were not economically viable.



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In summary, it was found complex but possible to modify the KBV 001 for the required dual purposes (with some acceptable compromises). It would, however, become a highly advanced and "system heavy" vessel, in turn constituting a risk to operational availability.

Cost analysis and results

Based on the results from the requirement analysis, the two alternatives were evaluated economically. The total cost for building/rebuilding and operating the vessels based on a 25-year period was estimated. Different operational profiles and crew set-ups were analysed, as well as a number of alternative solutions for owning and managing the alternative vessels.

The evaluation of the complete case resulted in a recommendation to build a new vessel at an estimated cost of SEK 430 million. The final report was handed over to the Ministry in August 2014 and the subsequent decision was made to adopt the recommendation.

The project represents a good example of SSPA's ability to support the customer in all aspects of a vessel concept development project.