Asset Management Control

A new concept for those who depend on capital assets

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How to get the best value for money?

This is a question that has been on practically every person's mind at one time or another, but finding the answer is not so simple for large technical systems, and it is becoming increasingly difficult as the technical complexity of such systems increases. The purchase price of a frigate, an aircraft, or railway line is more or less known, but what is the price of capital assets like these during their lifecycle, and to what extent will they satisfy the requirements of the purchaser?

The new concept 'Asset Management Control' provides an answer to these increasingly pressing questions by modeling the whole system in a so-called Asset Management Information & Communication tool, for short 'AMICO'. AMICO is a computer application which enables the management to communicate all relevant information to all actors involved throughout the lifetime of the asset. The AMICO tool was tested on the real-life experiences of HNLMS Rotterdam, a troopship of the RNLN. It appears to be the first time that an integral modeling tool could handle Life Cycle Management (LCM). AMICO can be used to 'supervise' ships, trains, and infrastructures, but also other complex systems, such as wind farms and highway systems [Schrauwers, 2003].

Figure 1: HNLM Rotterdam, the Royal Netherlands Navy's troopship. The ship's sensor, weapon, and communication system (SEWACO) served as model for the first test with AMICO, a management system for capital-intensive assets. The lifecycle costs of the ship have been estimated at approximately 300 million euro.

How to control the Total Cost of Ownership?

Large enterprises such as oil companies, with vast capital-intensive installations, find it very difficult to determine the cost-effectiveness of their equipment. Government organizations like the RNLN also feel the need for an instrument that can show the financial pros and cons of different investments since the taxpayer's money can only be spent once. A number of models are available to establish the effectiveness of expenditure, the most popular of which is American Joseph M. Juran's. His model divides a system's effectiveness into the parameters of availability, dependability, and capability, each of which is then further subdivided. In this case, the expenses have been specified per cost type.

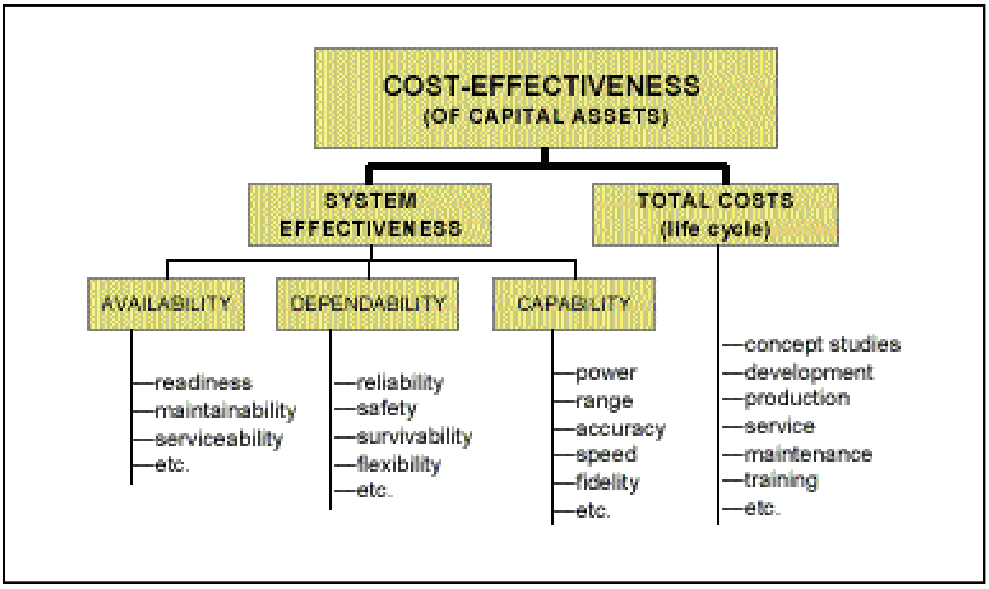

Figure 2: The cost-effectiveness diagram of Juran [1999].

Which system of cost-effectiveness is really needed?

Over the past years, there has been much heated discussion on the proposed purchase of a successor to the Royal Netherlands Air Force's F-16 jet fighters. Finally, the American aircraft-to-be, the Joint Strike Fighter, won the fight. What its initial cost will ultimately prove to be remains unclear, and that is without taking into account the additional costs involved in keeping the aircraft operational during its lifecycle. The amount of money that is going to take will be even harder to define. Lifecycle costs cannot be disregarded, far from it; they can easily amount to several times the purchase price.

The Dutch department of public works builds lots of roads, bridges and tunnels. A budget is made available for the construction of each road, but strangely enough, the department cannot tell offhand how much a certain road has cost. The figures can be supplied, but unearthing them from the sea of data would take a team of employees several days. Small wonder one is all too easily persuaded to think that budget overruns for large investments are the rule rather than the exception (not to mention the subject of fraud, which is probably made easy partly by this lack of budgetary control) [Schrouwers, 2003].

How to improve performances and/or reduce cost?

Suppose the Royal Netherlands Navy wants to invest in an aircraft carrier. In public service terms the question would be how to get the best possible return from such a huge investment, taking into account the operational requirements?

The current practice in the RNLN, as elsewhere, is that the Admiralty have a certain need and operational requirements, so they go to the government to try to get the funding, or more funding. The image of engineers is that they tend to regard the question of funding as no more than an obstacle preventing them from fully realizing their brilliant plans. It is important to explain to the people involved that even engineers will have fun trying to maximize the return on a certain investment, especially when it concerns high-tech systems.

The AMC system approach aims to stimulate all logistic actors to fulfil their part in the most cost-effective way by telling them what the result should be and to show them the impact of their contribution to the whole system. The Logistic Process Cycle is used to establish a relationship between costs and system effectiveness. The material logistic process has been subdivided into eight process steps. Each step has to be in balance with the preceding and subsequent steps in the cycle, all related to the ILS/LCM analysis.

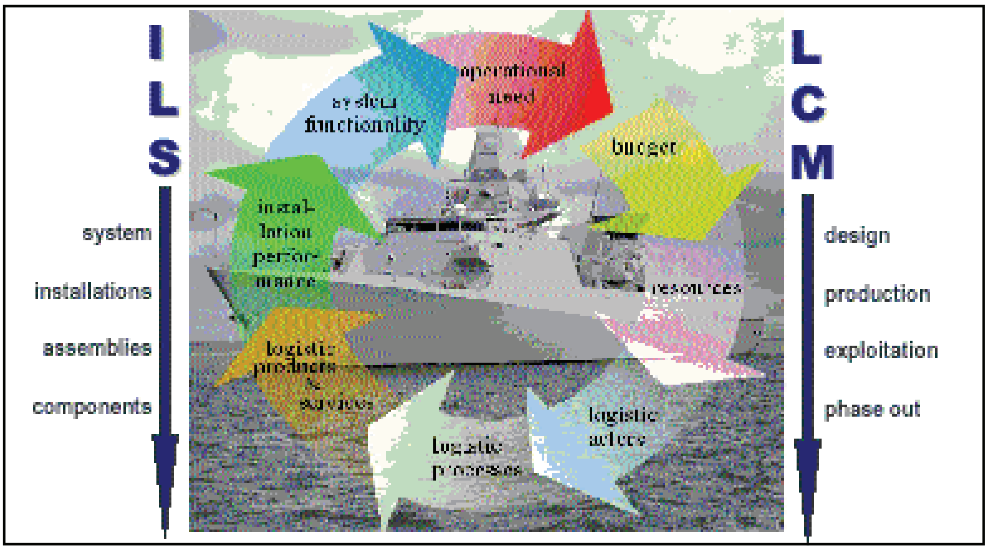

Figure 3: The Logistic Process Cycle.

To be able to manage the asset throughout its lifecycle, the process cycle must be kept in constant balance. For a ship, the circle starts at the design office, and ends at the breaker's yard. As a prerequisite, the process steps must be continuously adapted to the ship's lifecycle (about 30 years).

For the material logistic system four sub-systems are distinguished. They are the operational system (which includes the owner and user), the management system (run by the LCM-team), the logistic system (which consists of operational processes) and the technical system (the ship itself).

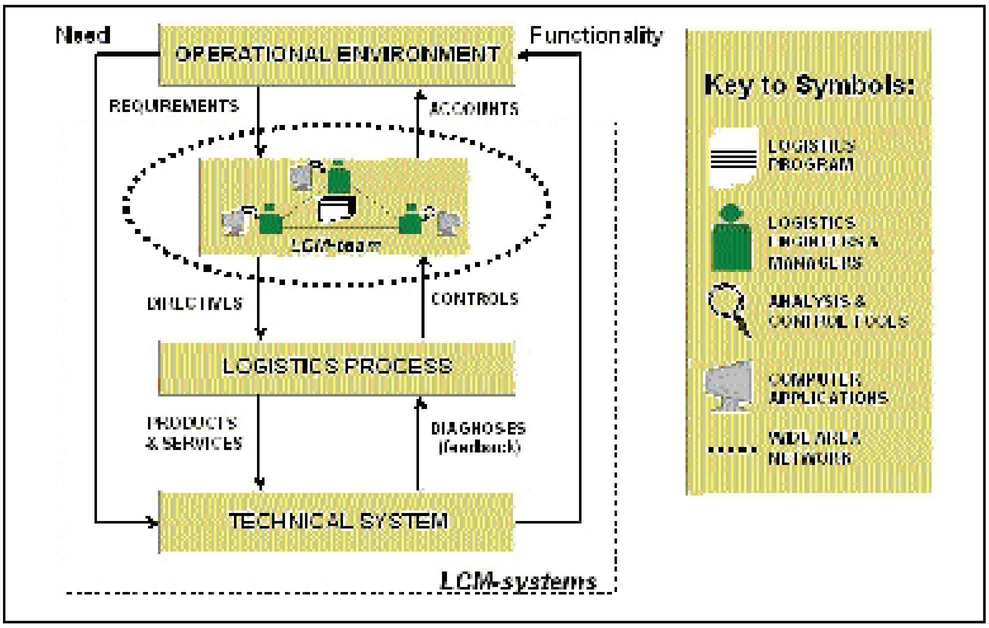

Figure 4: The AMC system approach.

The management system plays a crucial role in the model, since it converts the requirements into directives, and controls the results. Based on these results, the responsibility is transferred to the requirement source (the customer or user). To enable the management to purchase (or build) the right equipment at the lowest cost, and to control its performance and cost during use, the following are essential: a logistics program based on an ILS/LSA analysis, in which all the functions, installations, as well as the actions needed to acquire and maintain them, have been specified; technical staff and expert managers who can be held responsible for obtaining the right results; adequate analysis and control tools to report the results and if necessary, take corrective action; sufficient information processing capacity in the shape of computer power; open and direct communication facilities in the form of an intranet or the secured Internet [Stavenuiter, 2002].

How to get and hold a grip?

AMICO was able to give a lot of clarity in this kind of situations. Looking at the model of HNLM Rotterdam, which resembles somewhat a flow diagram, the relationships between various parts, as well as the current status of any part of Rotterdam's inventory, which includes two very expensive Goalkeeper guns (installed at a cost of more than 40 million euros) gives a clear insight into the ship system. By clicking on a symbol for one of the aerials, a window pops up showing, among other data, the cost, both estimated and actual, of the aerial, together with a comment field.

You can see a ship's number of operational days, and how they relate to the planned revision date, as well as what an extension of the maintenance period will mean to the system's operational availability, and which know-how - and consequently, which training - is required. A short demonstration should be enough to make clear that AMICO does not miss a beat where the ship is concerned. Besides this, it is possible to list reports on many different queries to show expenses, complaints, actions, planned or not, etc..

The system model is composed of three types of diagrams:

- Function Diagrams;
- Installation Diagrams;
- Activity Diagrams.

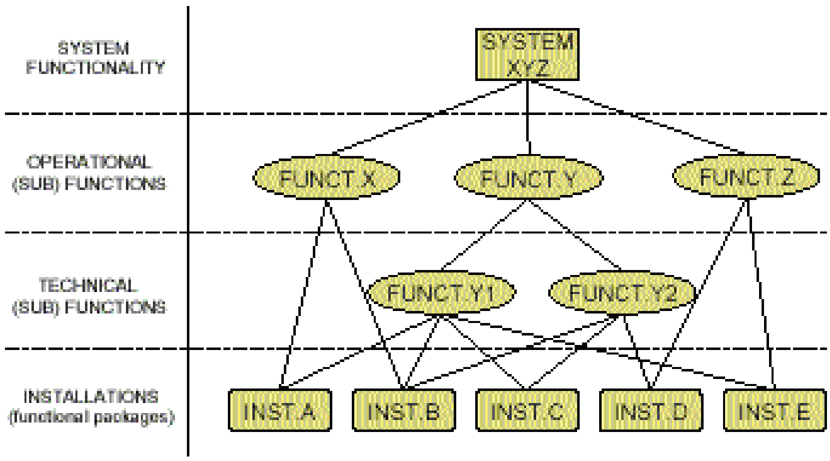

Figure 5: Function Diagram

The Function Diagram is based on a number of predefined steps. To begin with, the operational functions are defined. These are functions the principal/user wishes to pay

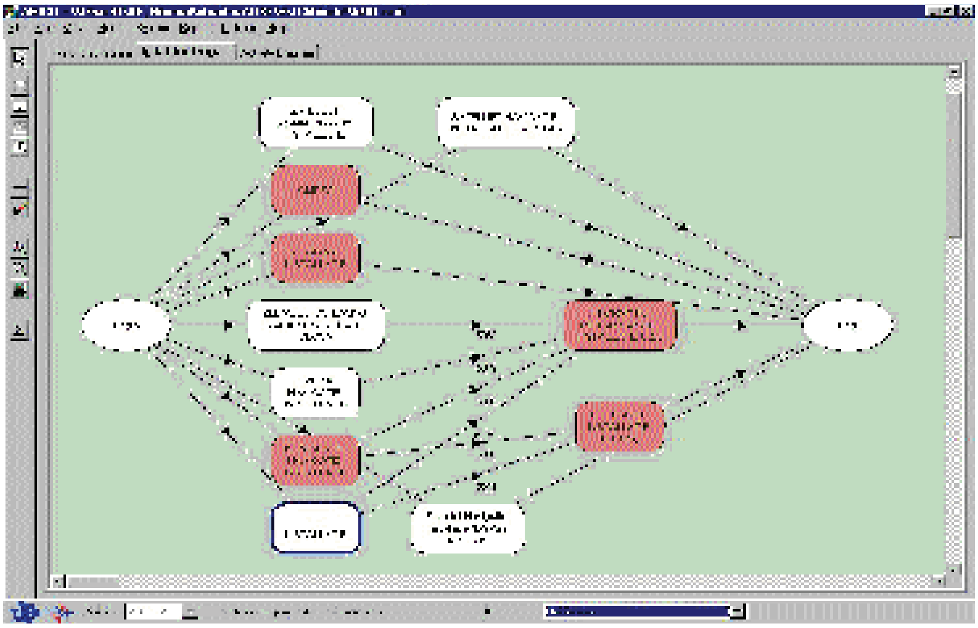

Figure 6: Function Diagram

for, e.g. transport and safety. These functions are then logically subdivided until the final

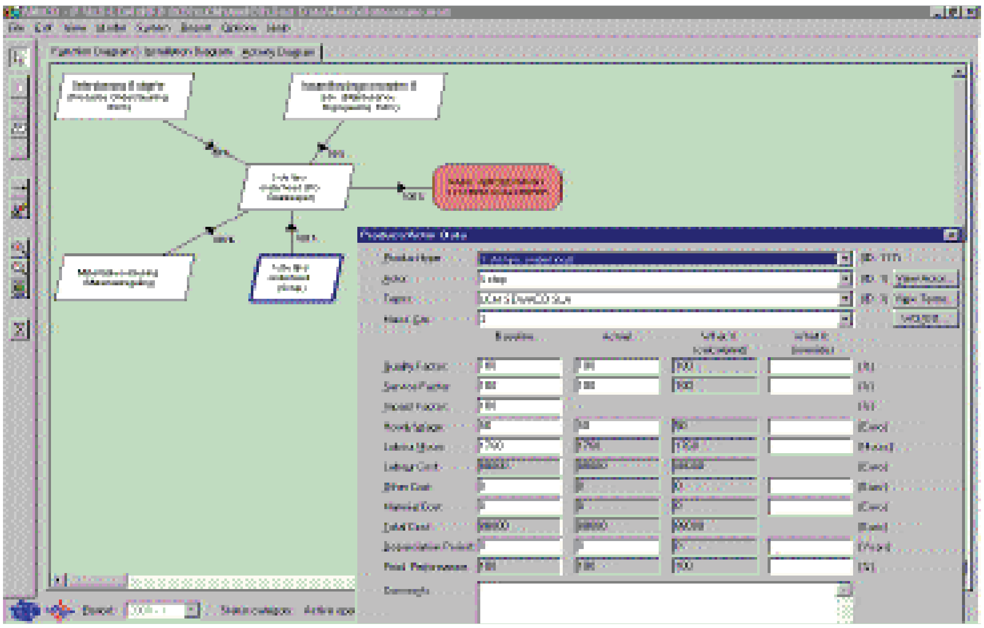

Figure 7: Activity Diagram

so-called technical base functions, are reached. These are the functions that have an unambiguous relationship with one or more installations.

The Installation Diagram provides an insight into the relationships between installations and their order of precedence. A functional block diagram is prepared for each base function. This is used, in combination with the Function Diagram, to enter the entire capital asset into a model, which can then be used to perform calculations that will provide an insight into the effects of insufficiently reliable installations at a higher level, both performance-wise and cost-wise.

The activity diagram shows the logistic processes/actor chains per installation. For example, the HNLM Rotterdam carries 2 automatic rapid-firing guns that provide a last-ditch defense against incoming missiles. The requirements regarding the performance, reliability, and operational availability of these guns are extreme. In addition, they are among the ship's most expensive pieces of equipment. The Navy, and the ship's complement in particular, have a need to know at any time who does what when, and why. The Activity Diagram fills this need by modeling the required operational processes for each installation and for each period. Even more important is the need for communicating this information to all those involved in order to be able to pinpoint the source of the problem in the event of a malfunction and to decide which of the parties involved (workshop, maintenance engineer, configuration manager, magazine) may require additional support to solve the problem in the shortest possible time.

Since the entire system modeler is digital in nature, and easily accessible though the Internet or an intranet, the model can be browsed at system level (e.g. a ship's commanding officer, or a general manager) down to activity level (first-line management, i.e. the production manager) to display essential information to the parties involved using data windows.

Finally, the Logistics Program is constructed by linking together the various models for each phase of the lifecycle. This effectively creates a filing cabinet in which every period of the lifecycle is defined, including design, construction, commissioning, operational period, support, maintenance, and finally, at the end of the lifecycle, decommissioning. For the future these are plans, for the past they are reports in which the current results are compared with the planned results. It is a bit like comparing a company's annual reports.

How to control?

The basis for a system model like this is a regular update of all data needed. A link has been created to the RNLN data collection system, which continuously refreshes the data. For land use, the system runs on servers that provide the parties involved and other

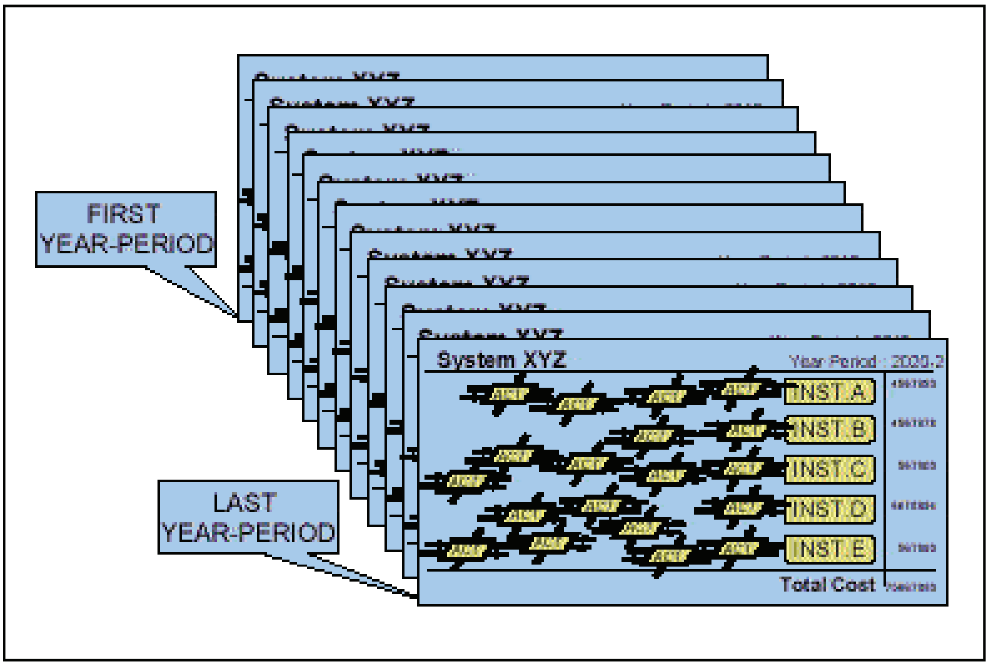

Figure 8: The Logistic Program illustrated as an imaginary card-tray.

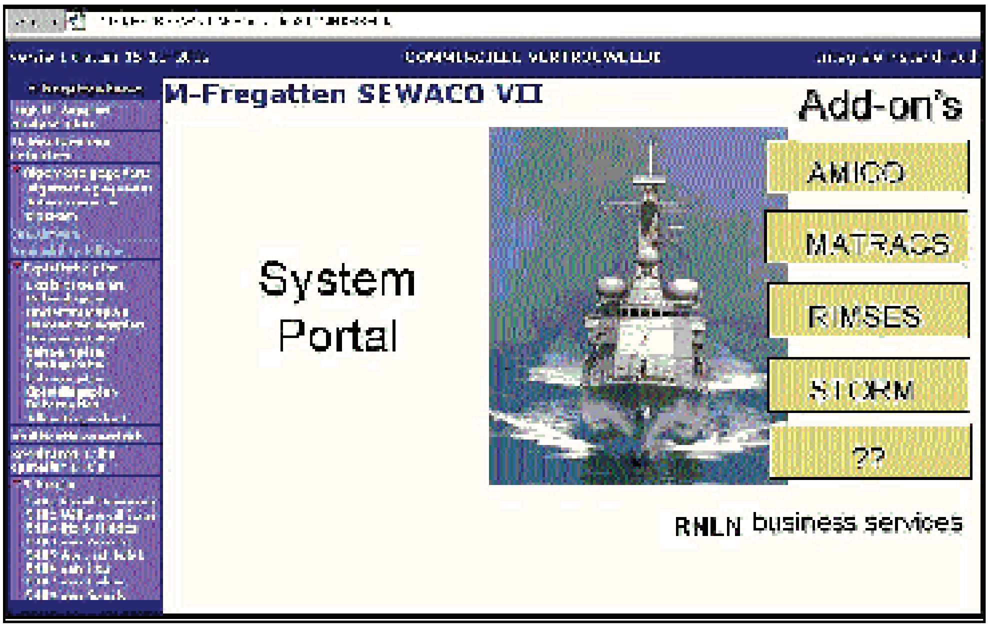

Figure 9: The System Portal home page of the RNLN Multi Purpose Frigate.

users access through an intranet or the Internet. Depending on authorization, a user can then enter or change data, or simply browse the available information. With the ship is at sea, the data should be loaded into an onboard server. This means they cannot be kept fully up-to-date, but even that can be accomplished using an Internet link via satellite.

Web technology is widely used to keep the mass of information as manageable as possible. This concept provides each capital asset (ship) with its own web site (the system portal) that links to all the relevant information, as illustrated in figure 9.

To manage the plethora of all the technical web sites and also to keep the underlying data up to date, the AMICO system modeller uses portals with index pages linked to the installations, which in turn are linked to the specific technical web sites able collect data from a specified logistic database on the network. The objective of this approach is to ensure that data management can be unambiguous and consistent at minimal cost. Workshop sessions conducted by the Royal Netherlands Navy have demonstrated that bad or incomplete information results in frustrating communication, which in its turns hampers collaboration. The consistent use of web-based PDM ensures from the source up that all the available information can be accessed by the parties involved.

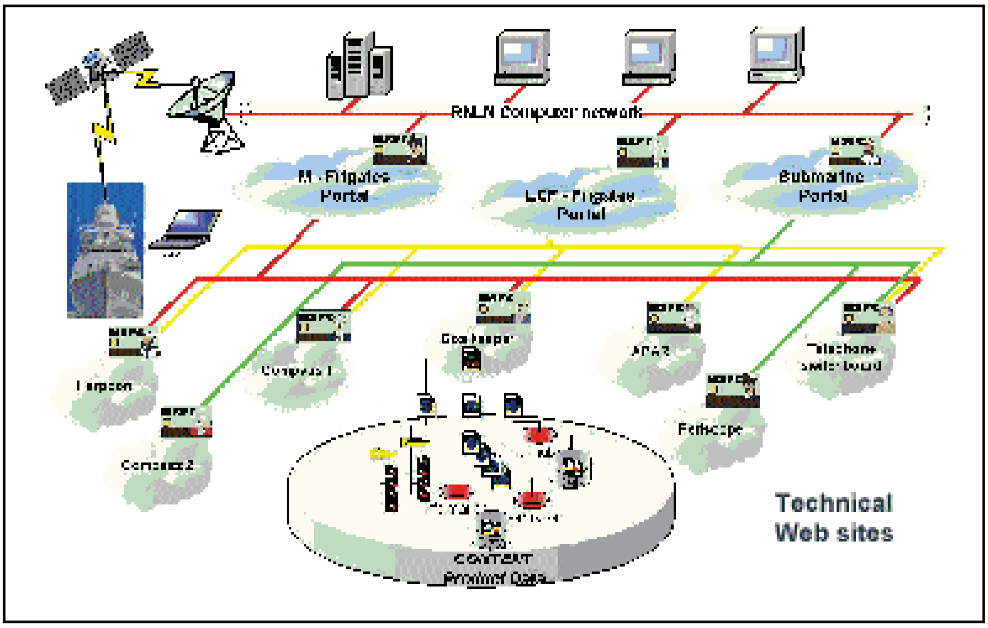

Figure 10: The System Portal web architecture of the RNLN.

Who is running the show?

In the AMC concept an LCM-team is introduced to keep AMICO up and running. In the beginning the model is built-up with so called 'base-line' data. When actors are getting involved and are delivering their products & services, also 'actual' data will be available as input for AMICO. Collecting the actual data is probably going to take most of the effort. By comparing baseline and actual data AMICO will highlights the bottlenecks, so the System Manager and all other actors involved can see at a glance where the problems are to tackle them.

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