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# A DSS Based on Simulation to Make Decisions for the Cuban Cruise Industry

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## ABSTRACT

This paper describes a decision support system (DSS) developed to plan the allocation of resources for the Cuban cruise industry in the port of Havana over the near future. Simulation has been applied here to gain a better picture of the connections between the various processes involved in providing necessary services for both passengers and ships, as well as a better picture of bottlenecks and their causes. With the simulation models, future situations were presented on which long-term forecasts can be based.

The search for logistic bottlenecks in the handling of passengers, or in the services required by cruise ships, involved a study of both passenger flow and congestion in the buildings, the amount of time spent in waiting areas, and possible services required while the ship is in port. The DSS looks mainly at the amount of berths required and port resources such as immigration desks, tourist buses and service boats needed.

## Keywords

Decision support systems, computer simulation, cruise industry, tourism

## INTRODUCTION

The Caribbean remains the most popular cruise destination in the world. More than 120 ships operating in the region carry an estimated 5 million passengers. In 1999, according to statistics reported by the Caribbean Tourism Organization, an estimated 12.3 million cruise passengers arrived in the Caribbean. Passengers typically visit multiple ports on a single cruise, hence the difference between passenger capacity and the number of passenger arrivals. Some statistics also show that average spending per passenger during visits to ports of call and homeport was 87 USD, and average spending by crew members was 84 USD (Pricewaterhouse-Cooper, 2001).

But while Caribbean cruising is booming, the business climate is getting tougher. The change is driven partially by the cruise lines' need to generate additional revenue to compensate for discount ticket prices, and by 9/11, which has put ships into new U.S. homeports and has led to the development of itineraries closer to the mainland (Mathisen, 2003).

The immediate main benefactor of this development is the Western Caribbean, and Cuba is struggling to gain more space in this market, but with a limited "Bermuda" style cruise policy versus the open-ended model found elsewhere in the Caribbean (Miller, 2002).

In 2003 approximately 60,000 passengers arrived in Cuba on cruise vessels, and that number is expected to increase to as many as 100,000 in 2004. At the moment the port of Havana, which is the main port on the island, has a pier that can accommodate only two medium-size cruise ships at one time (Figure 1). This is not sufficient in view of the increase in cruise traffic that is anticipated over the next five years, an increase that will rise from 100,000 in 2004 to a figure somewhere between half a million and a million per year, depending on developments of a purely political nature arising from the unjustifiable economic embargo that the United States is imposing on Cuba.

Silares Terminales Caribe S.V., which operates in Cuba through a joint venture with the Cuban Ministry of Transport, is the company that handles cruise activities in the country, and operates in all Cuban ports of call and homeports.

The port authorities must take the decisions necessary to absorb these increases in the volume of passengers and ships, and this will require an expansion of docking facilities, buildings to accommodate passengers, boats to supply the ships with water and fuel, and other port services (Figure 2)

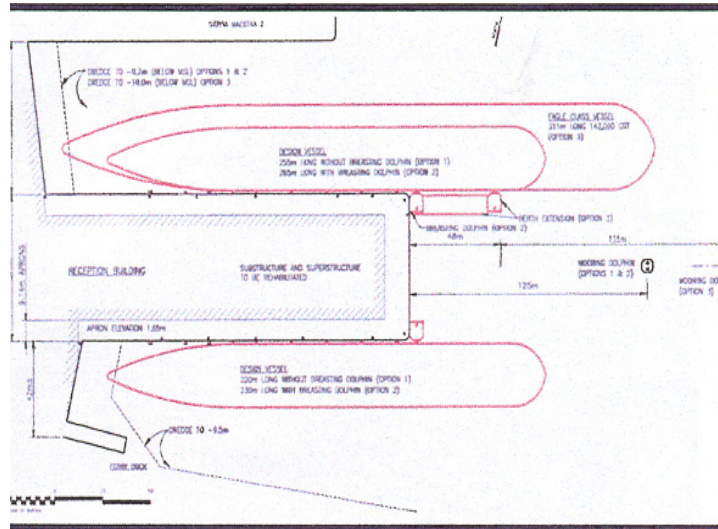


Figure 1: Refurbish of Havana cruise berths

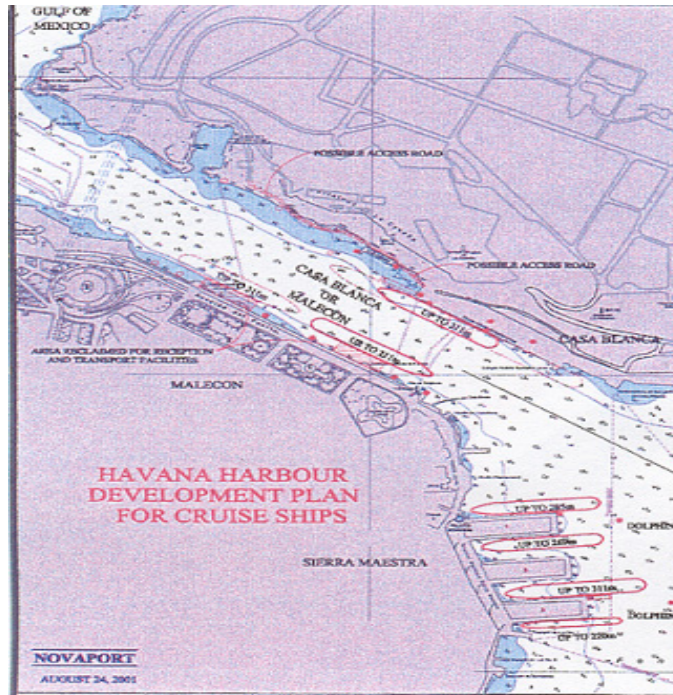


Figure 2: Havana harbor development plan for cruise ships

These are difficult decisions to make given the general uncertainty of the industry and the sums involved in such investments for the port authorities. This is why it was thought desirable to use a DSS.

The general purposes of a DSS are (Holsapple and Whinston, 1996):

- Increase decision-maker's productivity, efficiency and effectiveness
- Facilitate one or more of a decision-maker's abilities
- Aid the decision-making phases
- Help the flow of problem-solving episodes
- Assist in the making of semi-structured or unstructured decisions
- Help the decision-maker manage knowledge

This paper describes a DSS designed for the analysis of several possible scenarios for the Cuban cruise industry in the port of Havana over the near future. Simulation has been applied here to gain a better picture of the connections between the various processes involved in providing necessary services for both passengers and ships, as well as a better picture of bottlenecks and their causes. With the simulation models, future situations were presented on which long-term forecasts can be based.

With these models critical aspects both of passenger flow through the terminals and of ship services have been explored and studied. Steps must be taken to prevent potential bottlenecks and delays. These steps can involve an expansion of resources, but sometimes the improvement of existing facilities and processes can be a more effective solution.

The ultimate goal is to have a system that will provide the expected resources required to meet performance standards. By running the simulation repeatedly, increasing resource levels where standards are not met, a feasible resource allocation can be achieved and economically evaluated.

## THE SCENARIOS

In order to analyse the anticipated scenarios regarding the arrival of cruise ship tourists at the port of Havana over the next 5 years (2005-2009) the authorities responsible have considered two extreme situations:

- A worst-case scenario in which the numbers increase annually by 100,000 tourists starting in 2004, so that there would be 200,000 in 2005, and 600,000 in 2009.
- A more optimistic scenario in which there would be annual increases of 200,000 tourists starting in 2005, so that there would be 200,000 in 2005, and one million in 2009.

Considering that a medium-size cruise ship can carry on average 1,000 passengers, the preceding figures can be made to reflect average visits of one week by those vessels to the port of Havana, as shown in Table 1.

	2005	2006	2007	2008	2009
<b>Worst case</b>	4	6	8	10	12
<b>More optimistic</b>	4	8	12	16	20

**Table 1. Average visit of cruises per week in Havana**

This is one of the fundamental pieces of information from the DSS, but it must be borne in mind that cruise-ship tourism in the Caribbean is essentially seasonal, and high season falls between November and April. When estimating resources, therefore, we have to make allowances for the differences between high season and low season and the corresponding variations in the volume of cruise-ship traffic.

These variables and others that may be considered are analysed by the DSS in order to determine the amount of resources of various kinds that should be assigned each year in order to achieve a system that works well and meets the standards already spelled out.

## THE DECISIONS

The decisions to be taken by the port authorities relate to the levels of resources required to guarantee the services passengers and vessels need to have in each of the scenarios. The resources are:

- Available docking facilities
- Passenger service facilities
- Immigration desks
- Special boats to service the cruise ships (tugs, drinking water, fuel, waste removal)

Here the most significant investment will be in upgrading the docking facilities and the refurbishing of the surrounding facilities to service the tourists. This investment will be in the order of tens of millions of dollars.

Next are the investments required to service the cruise ships. This involves tug boats, boats that provide drinking water and fuel, and boats that collect waste. This investment will be in the order of hundreds of thousand of dollars.

As regards immigration procedures, it is not so much a question of the cost of the resources involved, which would be principally immigration agents and baggage inspectors, but rather, in the wake of the events of September 11, making sure that with the new security requirements in place, passengers are not delayed more than is strictly necessary. This is particularly important in view of the fact that in most cases a cruise ship spends relatively little time in the port, and the tourists want to make the most of their stay.

In order to determine the number of cruise ship dockings in the port of Havana for any scenario, the starting point has to be an estimate of the number of ships that arrive at the port during the high season. In this application the data given to the DSS are various predetermined amounts of available docking facilities and passenger service facilities, so that the DSS can arrive at the best option.

“What-if” analysis will enable Silares S.V. to simulate various business conditions. Utilizing this modeling tool, Silares S.V. can anticipate changes that may occur and determine necessary actions to minimize the resources involved in each scenario.

## THE SIMULATION

The DSS is based on simulation owing to the fact that services for passengers and for ships are basically queuing issues with specific characteristics, and consequently the application of simulation is more appropriate than the queuing theory since it allows for the use of non-stationary patterns of arrivals.

The simulation model here consists of two independent sub-models: these are the sub-model of services for passengers, and the sub-model of services for cruise ships. In both models the day and time of the arrival of the vessels during every week are generated, for each different scenario, according to some policies and historical data, but the number of passengers actually on board is simulated.

The sub-model of simulation of services for the passenger simulates the process passengers who will be requiring one or more of the tourist services the port offers, as well as the amount of income each service generates. In this sub-model, the simulation classifies groups of passengers according to the services they require and then queues are simulated. In the event that the capacity of a given service is not equal to the demand, the relevant information is filed and a new passenger demand is simulated. The simulation runs for the various levels of available resources and is then repeated in a search for the best decision in each case.

The sub-model of services for cruise ships reflects the various services the vessels could receive over time, factoring in the delays, waiting time and bottlenecks that may arise, and analysing alternatives to solve the problems that each scenario might present. This sub-model also looks at the ways other vessels in port could be affected, in view of the priority that would be given to cruise ships.

Here the various decision-variants are simulated in separate runs. The length of each run reflects the length of the “season” simulated within the year. The simulation language used was Arena 5.0 (Rockwell Software). For the purpose of testing the model and gaining Silares S.V. staff confidence in its outputs, it was critical to develop a graphical interface to view an animated representation of the model logic (Figure 3).



Figure 3: Animation background for Havana harbor

**THE DECISION SUPPORT SYSTEM**

Based on the problem definition and objectives communicated by Silares S.V. staff, it became apparent that they were looking for a DSS to help manage the allocation of their resources.

A DSS is designed to help companies make organizational decisions and comprises three main components: a data base, mathematical models of business processes, and a user interface for the decision-maker to communicate with the system. In its interactive environment, decision-makers can quickly manipulate data and models of business operations to allow for the identification of problems and evaluation of alternatives (Chong et al., 2003).

Figure 4 displays an overview of how the DSS was designed. The system uses Excel as both the interface and the database. A friendly work environment is created because the Visual Basic for Applications (VBA) interface hides the complexity of the simulation model and the raw data stored in various Excel worksheets.

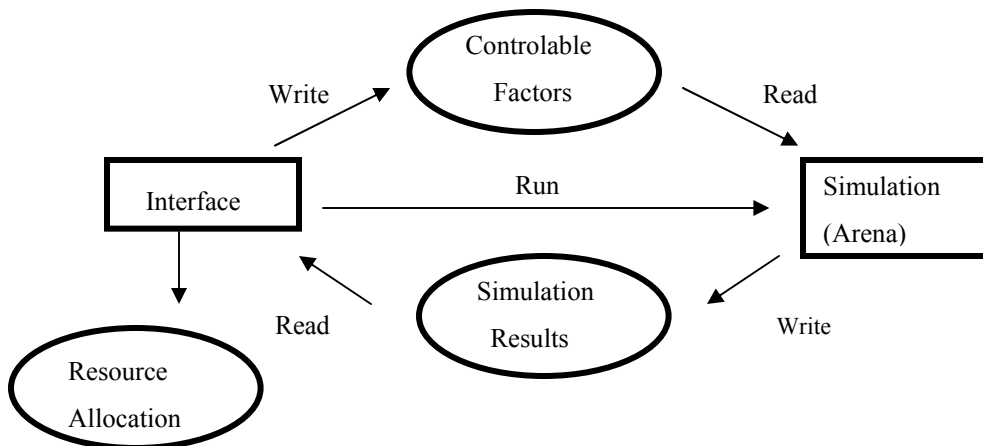


Figure 4: Overview of system design of Silares DSS

Most the information in the DSS for the interface/model is stored in .dat files, either created by Excel before executing Arena, or by Arena before returning control to Excel.

## CONCLUSIONS

The DSS resulted in huge quantities of statistical output, which were translated into resource allocation per year, resource utilization, waiting times and average net income per year.

This quantitative information serves as supporting material in making decisions about the development of the port of Havana over the near future. Expectations for the future quality of passenger handling and ship services are now available. Furthermore the timing of bottlenecks and delays that may arise, and corresponding solutions can reduce risks and investments.

It has been possible to estimate net revenues in order for the best decisions to be taken in each situation, and this revenue ranges from 25 million dollars per annum in the case of the least favorable scenario, up to 120 -130 million dollars in the case of the most favorable. The economic analysis has included the relevant expenditures relating to investment in port infrastructure in each case and the costs of various types of equipment to be used in each possible solution.

An important issue to consider is user knowledge, especially with Arena and VBA, and the trust and acceptance by Silares employees. To overcome these problems, both user interfaces and accuracy will be very important. The friendlier the user interface, the more likely it is that a user will find it easy to use. User interfaces also act as a shield, protecting the user from the complex programming. The designers of the model must provide sufficient training, and management staff requires hands-on training courses to become familiar with the computational tool. It is also essential that the user understand the information flow within the model to maximize its potential.

A further development of the DSS may include a “simulation-optimization approach” as in (Perez, 2001), or the use of the OptQuest utility from Arena, in order to obtain “optimal solutions”.

## REFERENCES

1. Chong, K., Grewal, M., Loo, J. and Oh, S. L. (2003) A Simulation-Enabled DSS for Allocating Check-In Agents. *INFOR*, 41, 3, 259-273.
2. Holsapple, C. W. and Whinston A. B. (1996) *Decision Support Systems, A Knowledge-Based Approach*, West Publishing.
3. Mathisen, O. (2003) Caribbean - Is the Cruise Business Changing Course? *Cruise News Industry Quarterly*, Spring 2003, 11-12.
4. Miller, G. (2002) Festival moves on Cuba, *Cruise News Industry Quarterly*, Spring 2002, 74-75.
5. Novaport (2002) *Proyectos Representativos*, Novaport International Consultants Limited, Halifax, Canada.
6. Pérez, I. G. (2001) *Un procedimiento para la optimización de decisiones en experimentos simulados*, Doctoral Thesis. Instituto Superior Politécnico J. A. Echeverría, Havana, Cuba.
7. Pricewaterhouse-Cooper (2001) *Economic Contribution of the FCCA Member Cruise Lines to the Caribbean and Florida*. Prepared for the Florida-Caribbean Cruise Association, Florida, USA.