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Case Study

Company	Industry	Application	Benefit
Exxon	**Energy**	**Shipping**	**Cost effective valuation for shipping methods**

Exxon Chemicals Model Ship Movements

Exxon Chemicals in Europe is one of the world's largest and most successful petrochemical producers. Key to its European operations is an integrated system of three chemical plants, two in Britain and one in France, which feed large plastics plants in Belgium via the Exxon terminal in Antwerp.

Fife, Fawley and Le Havre refinery's and ports produce approximately 30 product groups of which one, Ethylene, is shipped to Antwerp for conversion into plastic. In 1990 planning was in progress to increase throughput in Belgium and to increase ethylene output at Fife. A key factor in the success of this multi-million pound plan would be the ability to ship the increased production around a shipping circuit involving France, Britain and the Benelux countries.

The following report shows how Exxon Chemicals used computer-based simulation to evaluate its alternatives. The simulation had to take into account some two thousand ship movements per year between the four ports involved and allow for the effects of weather and tides, also storage tank capacities, pipe sizes and pumping rates. As with all business plans, it is invaluable to be able to review a number of alternative strategies each of which will have its own strengths and weaknesses, and simulation has long been regarded as a good methods of doing this. Recent advances in simulation software through visual and interactive PC based products such as WITNESS, used by Exxon, make it a rapid exercise to build large and sophisticated models. Time can now be spent on modifying the logic and testing for good results.

Two separate areas were modelled, the shipping circuit between the three dispatching ports and Antwerp and, as part of an ongoing jetty automation project, the detailed handling of products at one of the sites - Fawley.

The shipping circuit was causing concern because it was approaching berth capacity at some locations, and this had the potential to result in unacceptable queuing times whenever there was bad weather. On top of this, the key site at Fife (targeted for increased production) was particularly susceptible to disruption through bad weather in the form of high winds. Three options were available; increasing shipping capacity, investing in jetty operational improvements, and increasing tankage. Millions of pounds were at stake, both through the high cost of operating disruption and the probable capital costs of improvements.

Exxon are experienced users of the WITNESS simulation software and this was used by them to build a model that allowed extensive sensitivity analysis of the competing options. By careful use of the visual and interactive modelling features it was possible not just to test already known alternatives, but to develop others previously unsuspected. Being able to watch the interaction of multiple events in an animated graphical form, and then to make instant changes, is a very powerful aid to creativity.

continued

In the case of the shipping circuit the events that were modelled included:

- size and number of ships
- schedule of production and consumption
- schedule of ships
- pattern of ships for other products
- tank sizes at the production and user sites
- ship journey times
- product pumping rates
- use of additional jetties at the producer sites
- use of third party tanks at user areas
- weather effects on the jetty operations

The four major results being monitored were:

- the risk of operating disruption to either a producing or consuming plant
- the implied cost of capital to meet the simulated outcomes
- the operational costs
- the impact on the supply of non-modelled products from the plants

The information for the simulation was read into WITNESS from a spreadsheet. This included the proposed schedule of shipping which WITNESS would then attempt to meet after simulating what could happen during the time span of the schedule. Any event, which might reasonably be expected to affect the circuit and therefore the results, was statistically modelled. This included: wind speed and direction, tides, fog, and other shipping movements.

The most complex part of the whole model was not the pipes and tanks as these are covered in WITNESS, but the allocation of ships to berths. This involved testing some 15 decision conditions before choosing which ship would berth next and in what berth.

Conditions considered included: weather, tides, tugs and pilots, product availability, line preparation, and ship size and type.

The model confirmed that there is a base case operating problem and that corrective action is required. The use of the model has allowed Exxon to identify and evaluate economically several potential solutions involving in combination.

1. Changes shipping patterns
2. Changes in non ethylene inventories to reduce interference problems
3. A review of terminal flexibility within the Benelux countries.

Exxon's experience demonstrates how flexible modern simulation tools can be, and in particular the faith with which major companies entrust simulation as a means of planning both small incremental improvements to daily running and major strategic initiatives that can make or break a company's competitiveness.

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About Lanner

Lanner helps organisations achieve rapid and effective business change. Based in the UK with subsidiaries and partners in Europe, the Americas and the Far East, Lanner works with more than 3000 top multi-national companies.

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