PA Consulting Group

Nissan

Optimising production scheduling to achieve the unthinkable

"This was the biggest scheduling challenge so far for the plant. From the start of 2000, up to seventy percent of Nissan sales in Europe are being built at Sunderland. The new scheduling tool built by PA will not only give us a better scheduling capability but will also help us to reduce the order cycle time and give greater flexibility to our customers."

Frank Berkovits
Production Planning Manager
Nissan – Sunderland plant

Nissan is a global car manufacturer that produces around 334,000 cars each year at its Sunderland plant in northern England. The plant is recognised as the most efficient in Europe and the eleventh most efficient in the world. As a result of the plant's production excellence and efficiency, Nissan decided that the Sunderland plant would produce the new Almera model for the European market.

Nissan Sunderland was then faced with the complex issue of how to meet production requirements within very tight deadlines. The plant was to begin production of the new Nissan Almera in early 2000 whilst maintaining production of the Micra and Primera models. To deliver this third model required Nissan to increase output efficiency, making optimal use of existing facilities which in time required tighter and more accurate planning.

A scheduling system developed by PA Consulting Group in close co-operation with Nissan and ILOG, the market leading supplier of complex scheduling software, has enabled scheduling of the third vehicle model to be mixed along the existing two main production lines, whilst maintaining production of the two other models. In parallel, the plant has realised an increase in the potential plant throughput by 30% without major additional plant investment.

Scheduling complexity like never before

Upon the award of the contract for the production of the new Almera model, the Sunderland plant had to refine its plans for the increase in plant capacity and the highly complex issue of producing three car models with only two main production lines. Nissan wished to produce the new model as cost-effectively as possible and reduce the capital investment associated with building a new production line.

Nissan needed to build a large number of vehicles each week in the optimal sequence while satisfying a large number of operational constraints. Each of the many different combinations of model specifications and colours available to the consumer can have a different workload impact affecting all of the production steps.

"This was a hugely challenging project, both because of the technical complexity involved and because we had to develop a system to model an operation that did not yet exist. This meant that there were many unknowns whose solutions could only evolve over time, so we needed to assist Nissan to reach operational decisions about the uncertainties and be able to accommodate these within the system."

Jack McMullan
Member of PA's management group and project leader

Scheduling in this environment is a hugely complex process. It requires an advanced computerised scheduling tool to produce rapid, highly efficient sequences of cars to meet all the practical constraints that are present within the plant. The tool also needs to be very user-friendly and visually-based, so that the impact on the plant of the sequences produced can be clearly seen.

Developing the scheduling system in partnership

PA Consulting Group developed the Body Build scheduling system that generates an end-to-end sequence for a whole week's production for the Nissan plant in Sunderland. The system uses PA's own algorithmic methods, together with advanced scheduling tools provided by ILOG.

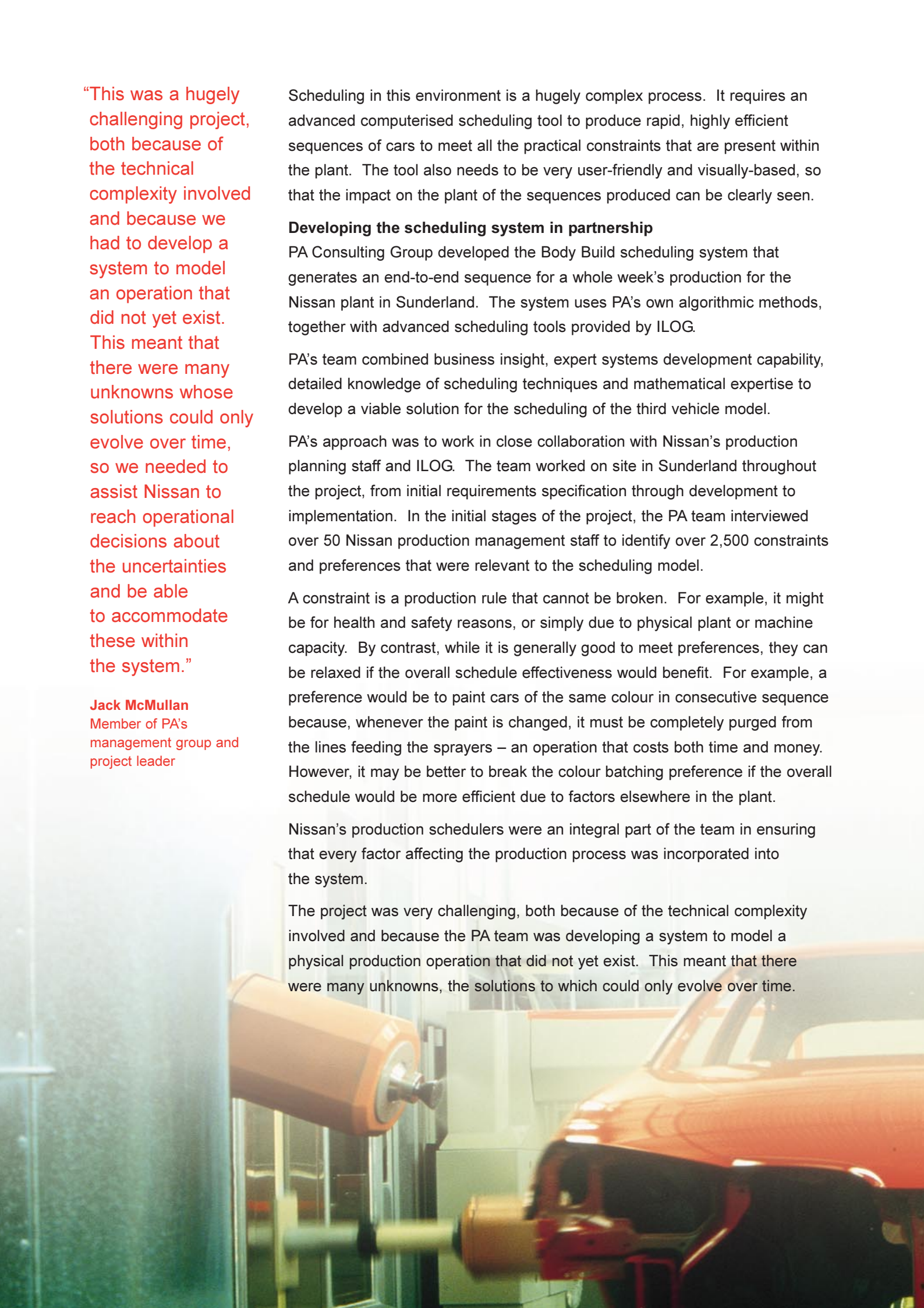
PA's team combined business insight, expert systems development capability, detailed knowledge of scheduling techniques and mathematical expertise to develop a viable solution for the scheduling of the third vehicle model.

PA's approach was to work in close collaboration with Nissan's production planning staff and ILOG. The team worked on site in Sunderland throughout the project, from initial requirements specification through development to implementation. In the initial stages of the project, the PA team interviewed over 50 Nissan production management staff to identify over 2,500 constraints and preferences that were relevant to the scheduling model.

A constraint is a production rule that cannot be broken. For example, it might be for health and safety reasons, or simply due to physical plant or machine capacity. By contrast, while it is generally good to meet preferences, they can be relaxed if the overall schedule effectiveness would benefit. For example, a preference would be to paint cars of the same colour in consecutive sequence because, whenever the paint is changed, it must be completely purged from the lines feeding the sprayers – an operation that costs both time and money. However, it may be better to break the colour batching preference if the overall schedule would be more efficient due to factors elsewhere in the plant.

Nissan's production schedulers were an integral part of the team in ensuring that every factor affecting the production process was incorporated into the system.

The project was very challenging, both because of the technical complexity involved and because the PA team was developing a system to model a physical production operation that did not yet exist. This meant that there were many unknowns, the solutions to which could only evolve over time.



It was vital to support the Nissan team of engineers to make operational decisions about the uncertainties and to be able to accommodate these within the scheduling system.

Each of the many different combinations of model specifications can have a different workload, impacting all of the production steps – spanning the initial body build, paint shop and fitting out in the trim and chassis lines. The challenge is to balance the flow of work to avoid problems that would cause the production line to stop. This is a very complex situation because a production sequence that seems ideal for the body shop, where there is a need to maximise the number of one body type at a time, may ultimately prove to be totally impractical in other production areas.

The system went live in August 1999 and has scheduled the production in the plant since then. It is believed to be the first such tool of its type in the world that is capable of producing an end-to-end sequence, whilst accommodating crossovers in the plant and allowing multiple models on a single production line.

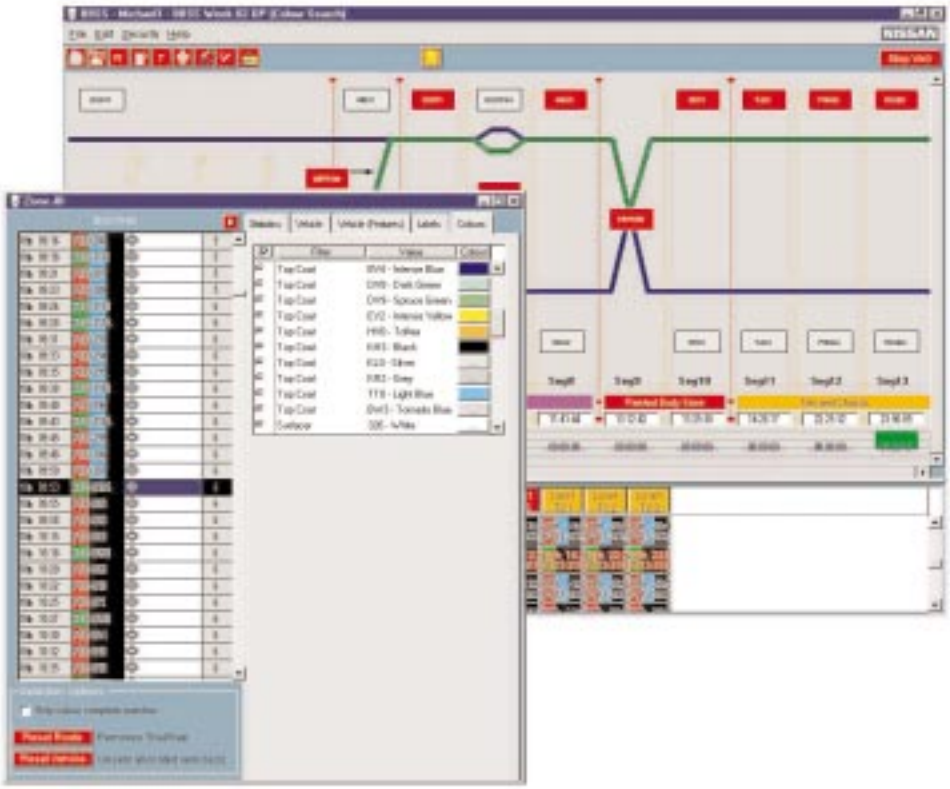
Optimised scheduling – delivering the business benefits

The primary benefit of the system is that it enables the three models to be built within existing facilities at Sunderland. In addition to this, the system also produces schedules that are far more practical to build than previously. It does so rapidly, allowing time for discussion of the proposed schedules with production staff.

Further benefits of the new scheduling system include:

- All production scheduling is done without the need for re-sequencing vehicles while they are in ‘storage buffers’ between major sections of the plant. Storage buffers are used by many car manufacturers to help overcome scheduling problems
- The system also supports strategic ‘what if’ investigation so that, for example, the impact of potential changes to operational rules or constraints within the plant can be fully investigated
- Schedule adherence rose from 3% pre-system to 85% after the system’s implementation
- Schedule results can be produced in minutes instead of days.

Figure 1: The user-friendly Body Build scheduling system



This leading-edge scheduling tool reinforces Nissan's position at the forefront of technology applications in car production. It is a major achievement for the Nissan Sunderland plant to be operating the first such tool of this type in the world that is capable of producing an end-to-end sequence, whilst accommodating crossovers in the plant and allowing multiple models on a single production line.

Corporate headquarters

123 Buckingham Palace Road
London SW1W 9SR
United Kingdom
Tel: +44 20 7730 9000
Fax: +44 20 7333 5050
www.pa-consulting.com
E-mail: info@pa-consulting.com
Contact: Stacey McGown

PA Consulting Group is a leading management, systems and technology consultancy, operating worldwide from over 30 offices in some 20 countries.

Principal national offices in

Australia, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hong Kong, Ireland, Japan, Malaysia, Netherlands, New Zealand, Norway, Singapore, Sweden, United Kingdom, United States.

Lon ~ 6396