Labor of love

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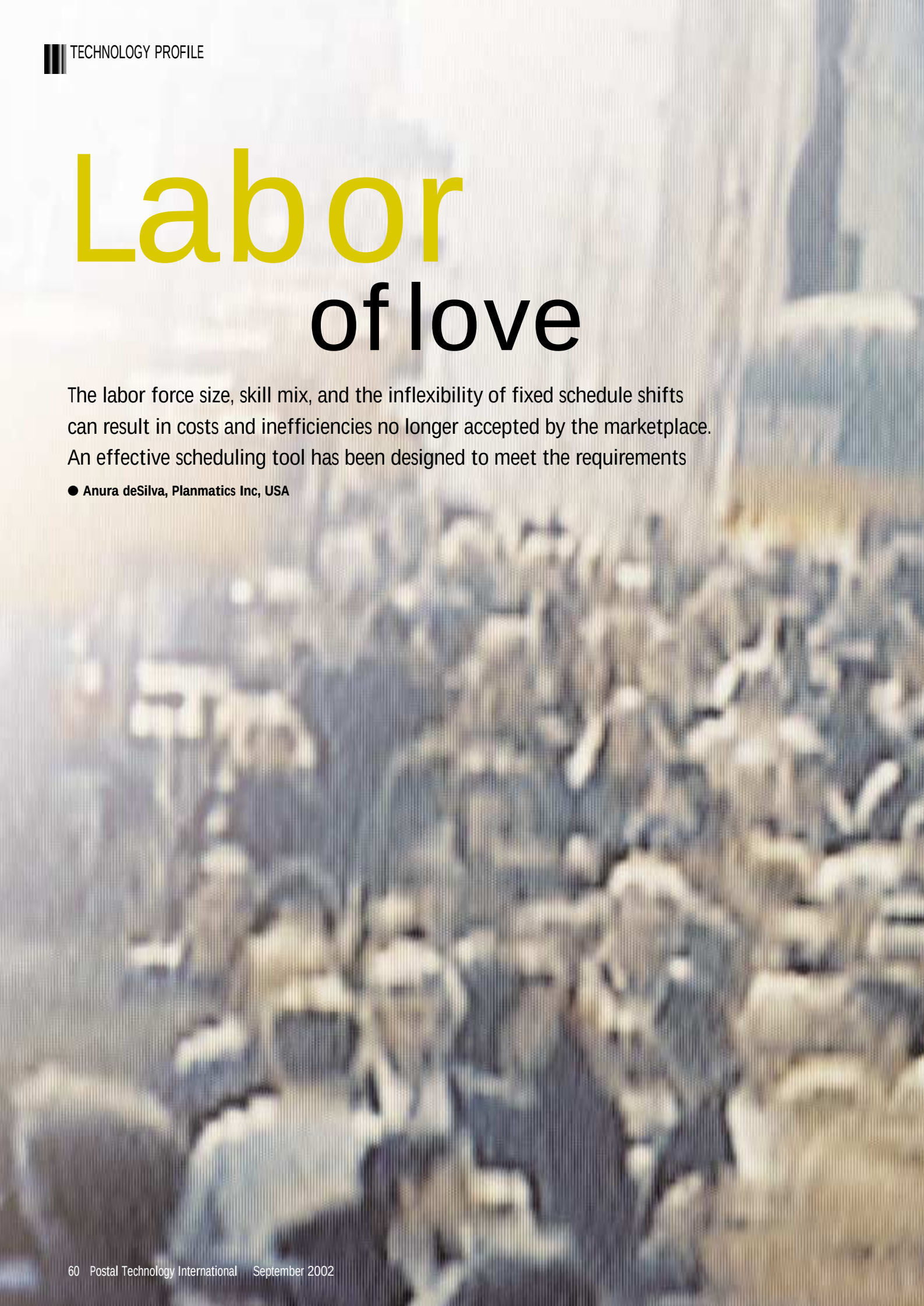

With most postal and courier services entering a new era of consolidation and increased global competition, the industry finds itself dealing with a labor force configuration that does not match current and evolving requirements for long term success. The labor force size, skill mix, and the inflexibility of fixed schedule shifts result in costs and inefficiencies no longer accepted by the marketplace. The challenge of scheduling a 24-hour, multi-shift operation to match varying workload demands over a day, a week, or for months, is nearly impossible to meet without a powerful decision support system. The industry needs a decision aid that addresses the scope, the complexity and the nuances of the labor force configuration issues. Over several years of research, development, and field testing, Planmatics, a US-based firm has created and refined a tool that is designed to meet rigorous requirements.

Staff scheduling

The key to eliminating staff scheduling inefficiencies lies primarily in using the scheduling flexibility already available to the management of most organizations. Unfortunately, most organizations lack the sophisticated tools to schedule labor effectively. The decision support aids that can optimize the application of the available labor to their needs, simultaneously minimize costs, and account for labor agreements and other needs, are not available. Planmatics' Schedule Optimization System (SOS) is a first in providing this level of decision-making power to the posts. This system allows postal and courier services to deploy resources precisely where and when they are most needed and deliver bottom-line savings.

What is SOS?

SOS is a management support tool for service delivery organizations that can provide cost-saving options through optimized labor scheduling. SOS encapsulates advanced mathematical optimization technology in a software package. It has been applied successfully at two large (more than 50,000m^2) mail sorting centers. SOS satisfies the demand for labor created by the operating plan of equipment or other work-defined requirements. It is also Web-enabled, so management can access and use it from anywhere in the world.

The system can be used to generate cost-optimal scenarios and examine trade-offs among different scenarios that are acceptable to both the workforce and management. With SOS, organizations can be fully prepared to negotiate fairly with labor unions, whether it is to establish new timing for schedules or to propose substituting labor types.

SOS success

The United States Postal Service (USPS) has conducted feasibility tests of SOS at a large and a medium-sized mail-sorting center. Subsequently, the USPS signed a license agreement with Planmatics to conduct further pilot testing of SOS at additional sorting centers. This advanced pilot is underway at some of the largest USPS sorting centers. This phase of testing means additional refinements will be made and cost-capture procedures firmly established.

Optimizing the decision making

Postal and courier service executives have had limited access to the mathematical optimization technology that can substantially improve planning and decision making. The reasons are twofold.

Professionally designed schedule optimizers have not yet been built for the postal industry. Schedulers developed internally by postal employees have not benefited from precision solutions generated through the expert use of mixed integer linear optimization. In general, internally developed systems have not gained wide acceptance because of deficiencies in capability, usability, or both. Internally developed schedule optimizers have lacked the budgets needed to develop and deploy this sophisticated technology.

Another reason is that attempts to use modified personnel optimizers from other industries have not succeeded. This approach has not provided the flexibility and versatility needed to address the complex work, management and union cultures of the postal industry.

Training the users within an organization to effectively apply a personnel schedule optimizer is an additional factor that will impact performance once a suitable system is available. Mechanistic training on how to use the buttons and tabs and to read the outputs of any single 'run' of such an optimizer is inadequate to make an optimization-based tool the powerful decision-making aid that it can be.

"All components of the system, including the training, are accessible through the Web"

The Planmatics SOS product has addressed all of these barriers in a multi-year design and development effort. It is designed and engineered by leaders in the field of mixed integer linear optimization and specialists in software interface design. It has been tested at field sites and is supported by a comprehensive training package. All components of the system, including the training, are accessible through the Web. In the future, a multilingual help desk will support international SOS users.

Cutting costs

Full-time, permanent postal employees have enjoyed long-term jobs with set benefit packages and steady work hours. The extent to which temporary and part-time workers are used is limited by labor agreements. Temporary and part-time workers may have lower benefit ratios, offer more flexible work schedules, or both.

Without a comprehensive decision support tool, management tends to significantly overstaff in order to guarantee service resulting in lost opportunities to minimize costs. Organizations are also unable to fully use the available labor force flexibility effectively without a decision tool. The results are excessive expenditures and frequent idle times for employees. There are no tools that exactly match staffing decisions with the demands placed by the equipment or facility operating plans. In the current competitive environment, service levels are of paramount importance – so the natural tendency in the absence of a proper planning tool has been to have high availability of excess labor – just in case the schedules developed by less sophisticated methods were inaccurate.

SOS allows postal organizations to use flexibility in scheduling while maintaining service levels, and to have convincing facts to present to the workforce.

Most large postal organizations have had the flexibility within their labor agreements to: Start shifts at multiple times; vary reporting times over the working week for any individual employee; limit or eliminate consecutive days; switch idle workers to other work areas, and use a percentage of part-time, flexible workers.

Few of these flexibilities have been consistently used to reduce operating costs and become more competitive. Planmatics' SOS allows postal managers to use every one of these in an understandable fashion.

Cost-cutting scheduling prescriptions of SOS or any other resource management system must be accepted as being manageable by facility managers and perceived to

be fair by the workforce. SOS has features that allow:

- Abiding strictly by the allowable ratios of part-time workers to full-time workers, and staying strictly within the limits set by labor contracts and quality of life criteria for start time variations, days-off rules, and lunch period allocations;
- Management to restrict the variety of shift start times initially prescribed by SOS so that schedules are more manageable by floor supervisors;
- Reporting on percentage of idle time and number of cross-area switches during the work days of each worker so that all stakeholders understand that the schedules are reasonable.

In summary, the SOS system allows organizations to cut costs, reduce idle time, and enhance efficiency by:

- Creating schedules that better match demand – with a wider variety of start times for full-time workers and varying shift lengths and start times for part-time workers;
- Giving management the ability to understand the impacts of options regarding consecutive days off;
- Allowing an easy way to vary the schedules over the days of the week;
- Allowing workers to switch among areas to lower idle times with minimal inconvenience to the worker.

The initial application of SOS at a large sorting center of the USPS revealed that it is possible to achieve significant savings. The reduction ratios proved to be greater than what most postal organizations can achieve in one or two years by attrition and other avenues permitted by labor agreements or other limitations.

How does it work?

SOS works in five steps. The user selects the data from an historical week to run the model. An external algorithm

Graphical screen and editing feature

optimizes this selection. Relevant data is then inputted. This can include an increased number of shift start-times that management allows, equipment/operating schedules and wage rates.

The user then defines the parameters related to labor agreements, i.e. full or part-time headcount ratios; which shifts must be given days off consecutively; how much variation in starting times to require from one day of the week to the next, and in what windows to allow placement of the lunch period.

The optimization technology then processes the input data and parameters and generates schedules that achieve minimum cost. The user then varies any of the parameters to examine the cost impact of these variations and the practicality of the resulting schedules.

Functionality

The use of SOS involves several steps. SOS is basically a weekly work schedule optimization model. A SOS scenario is user-defined by specifying an equipment-operating plan (consistent with a level of volume well below the peak level for the year) as a major input. It is also necessary to select a 'modeling week'.

The first SOS screen permits the user to input a year's worth of weekly data. In turn, a heuristic algorithm selects a suitable modeling week that will still leave flexibility to adjust the SOS schedule for the entire year.

The next screen allows the user to select from 48 possible starting times representing every half-hour. For full-time employees, both a five-day, eight-hour schedule (the eight being variable by the user) and a four-day, 10-hour schedule is allowed. For part-time workers, the length of the schedule is either variable, or fixed at four hours per day.

The third screen allows the user to input workstation operating plans. These can either be generated by Planmatics' equipment schedule optimizer, a companion product, input manually, or by a combination of both. Other equipment schedulers may also provide this input. If manual entry is desired, SOS provides graphical screens and editing features.

The next screen is a wage set screen, to insert wages for each skill category.

The fifth screen is a template preparation screen. Templates are a powerful feature of SOS. A base template is created to help investigate each major theme that a facility may wish to study. Examples of such themes are separating shift start times for better management and giving consecutive days off to workers deployed at different periods. The templates feature allows managers to define many basic scenarios before asking the model user to run them on the SOS engine. Each template is a combination of shift start times, shift lengths, part-timer ratios and other cost-cutting dimension options. Once a base template is prepared, the user is ready to execute a series of 'runs' around the theme of that base template. Six to eight runs can be submitted with minor variations of the selected parameters in the base template for the theme being investigated.

The final screen is a model running and run-monitoring screen. Templates are 'called' from this screen, parameter adjustments are made to depict the desired

variations from the theme being investigated, and runs are named in a manner that is meaningful to the user. Runs are then submitted to the job queue of Planmatics' bank of optimization servers.

Model outputs

SOS currently produces a fixed set of outputs. Development plans call for on-demand reports by early 2003. Sophisticated graphical expositions and a super layer or 'cockpit' for managers is being designed. Another layer for studying the trade-offs among the runs within a theme, or even for studying trade-offs across different themes, is also being designed for implementation in early 2003. Current outputs consist of the following reports:

- A report of what shift start times of each skill category is prescribed by SOS for each day and how many workers of that category will come to work at that start time;
- A report of the weekly schedules of the start time for each day and the off days;
- A specific assignment report that indicates how each worker reports to various work areas during each day of a selected week;
- A work area specific assignment report of which worker should be expected by the supervisor of that area at each time in a work day.

The technique

Planmatics' SOS uses a technique called Integer Linear (Programming) Optimization. Why linear? Because two similar jobs cost twice as much as one job; three jobs, three times as much, and so on. If the union gave a quantity discount on the number of workers employed by management, you cannot use linear optimization. Why optimization? Because this is a technique that presents the least cost schedules that meet all the requirements for labor. Why integer? If you were using Linear Optimization (or Programming) for material planning in a factory that made steel tables, chairs, and cabinets, for instance, the system might indicate that you need 5,734 tons of steel per day for the cost minimum production program. But in personnel planning, we cannot use 5,734 people working for 7.32 hours. It is either five, six, or seven, etc, working for six, seven or eight hours. Only integer values are allowable in personnel assignments. The use of Integer Linear Optimizations is the key to SOS' success in its results. ■