USER CENTERED DESIGN SERVICES, INC.
ACHIEVING EXCELLENCE IN OPERATIONS

BBB ACCREDITED BUSINESS

SERVICE BRIEF:

User Centered Console Operator Staffing Assessment

The Situation:

Do you ever wonder how many console operators you really need? Are your console positions equally loaded? Can you reduce the number of console operators and still safely operate the plant?

Industry comparisons indicate you have too many operators, but the Union screams anytime you discuss staffing reductions. The only guideline you have is that each operator should have between 200 and 280 loops, but no one knows where this guideline originated! You realize that a loop on a fast acting unit like a cat cracker is more work than a loop on a wastewater plant, but how do you quantify the difference?

An alternate method frequently used by other human-factor consultants in assessing workload is the time-in-motion study. It employs an old-fashioned task analysis along with random sampling to measure workload by observation. Unfortunately those being observed often changed their behavior and look busy because someone is observing them, or the observers themselves do not take into account the level of training and familiarity with displays and their navigation. The method does deliver information, but it is often biased. For example, in observing three identical Crude Units, one appeared to have a higher workload because during the observation period a process upset occurred. In truth, the workload is the same on all three units.

The Solution:

User Centered Design Services has developed a methodology that truly measures the operator's workload. This method is broad-based, fact-centered, highly objective, immune from the bias of daily problems, and comparable across the plant and across the industry.

THE METHOD:

The method is based on a three part model which includes Equipment Complexity, Interaction Complexity, and DCS Complexity.

The first model is Equipment Complexity. The console operator workload is impacted by the type and complexity of the equipment being operated. A highly dynamic reaction process is much more difficult to operate than a slow moving tank farm. To account for these variations, we assign a score to different types of process equipment. A simple pump or heat exchanger has a low score while reactors and complex distillation columns have high scores. For each unit we develop an equipment model and determine a score.

The second model is Interaction Complexity. The unit performance, and consequently the console operator workload, is significantly influenced by upstream and downstream units. A unit that has upstream and downstream tankage, and has stable utilities is much easier to operate than one that has hot feeds, sends products to downstream units, and is highly dependent on dynamic utility systems. To accurately measure the relative complexity of operating a given unit, we consider the number and type of interactions it has with the rest of the facility. We assign a score to each significant input, output and utility for each unit. This score is weighted to account for how dynamic the stream is, and how significant an impact it has on the operation of the unit. Streams between units under the control of a single console operator are set to zero, since the console operator has full knowledge and control of these interactions.

The third model is DCS Complexity. The DCS system extrinsic complexity (as measured by its observable behaviors and database examination) also has a significant impact on operator workload. Poor DCS performance often contributes to plant incidents, although it is not always recognized. This effect can come from poor alarm management, poor graphic design (Human Computer Interface), poor graphic navigation, poor tagging conventions, advanced control that does not promote plant stability during upsets, poor control valve maintenance, poor regularity PID control or loop tuning, non-linear control with linear algorithms, a badly trained operator making poor moves without a clear strategy, and a number of other weaknesses. To model the impact of the DCS performance on the console operator work load we calculate a score using the following data: operator changes, number of standing alarms, alarms per minute during upsets (alarm floods), steady state alarms (normal operation), chattering alarms, the number of operator changes, the number of controllers that are not in their optimum mode, the total number of control loops and total number of configured I/O. For an older pneumatic or single loop electronic plant, we use the controller count.

Using the scores from the three models we can establish a single normalized figure so that each console can be displayed based on total workload impact across the facility. This allows a rational comparison of console positions across the site. The model also provides us with the ability to mix and match units and generate fact-based

case studies of possible realignment and consolidation cases. Several scenarios can be developed and workload predicted. We can also use this model to determine the additional workload created by a new unit and determine the best console position to take on the additional work load.

We can also use the scores from the models to benchmark the Client's consoles against their peers, industry standards, and best in class performers using our extensive database of console loadings. This provides an objective and rational benchmark for analyzing staffing realignments and consolidations.

The Process:

The typical process for performing a Console Staffing Assessment starts with of a few preliminary conversations to determine the particulars of the study. Our methodology can be applied to a single console, an entire facility, or all facilities throughout a Client's system. The study can be done openly (including interviews with operators), or discretely (with interviews only with management and supervision) depending on the client's situation.

Data Collection. The Client needs to provide the following:

- Basic site data including the number and type of units, the current operations team structure (who works where and who controls what.)
- A complete set of current P&ID drawings for the Equipment Complexity model. We can use PFDs, but prefer P&IDs. Some consultation with engineering should be budgeted to answer questions relating to the drawings. This is typically not more than a few hours of the Client's time.
- A preliminary diagram showing the significant input, output, and utility streams for each unit. This information also can be noted on the PFDs.
- Gather and provide the DCS performance data. If the Client does not have software to gather this information, UCDS can make arrangements, at a minor additional cost, to have software provided for the study period.

After this initial data is collected and reviewed we will schedule a site visit. The number of UCDS personnel and the duration of the visit will vary depending on the size of the facility and the scope of the study. Site visits typically range from one to two weeks and require two UCDS personnel. During the site visit UCDS will interview Management, Supervision, Engineering, and Operators. These interviews are typically an hour long and will confirm the data received and search for issues that would impact console operator performance but would not be evident from drawings. We prefer to interview Operators at their duty stations. This puts the operators more at ease and minimizes scheduling issues and overtime costs for the Client. The Client should plan on a significant number of personnel being interviewed during the visit and budget the internal cost appropriately.

After the site visit, UCDS will require a short period to analyze the data and generate a report. This report will contain a full analysis of the Client's console positions ranked across the site and benchmarked against industry. It also will provide suggestions for possible realignments or consolidations. We will include in the study a reasonable number of iterations to examine other possible realignment or consolidation cases of the Client's choice. If desired, UCDS can return to the site to present our findings to Management.

Benefits:

In a typical oil refinery study, it is not unusual to identify Console staffing reductions of 25% or more, translating into a reduction of 3 to 6 positions. At a typical $500,000/duty station, the cost of our services can be recouped in a matter of weeks. In addition, when properly implemented (see below) these staffing reductions can result in improved labor expenses while seeing improvements in normal operation, abnormal situation management, and emergency response.

Related Services:

If the Client identifies a realignment or consolidation case they wish to pursue, we strongly recommend follow-up with a ***Management System Gap Analysis*** and our ***Management of Organizational Change Services.*** These tools provide a strong basis to ensure the proposed changes are safe and achievable and that the entire process is fully compliant with industry standards such as OSHA 1910, the Chemical Manufacturers Association *Management of Safety during Organizational Changes* and overall good Management of Organization Change practices. We can perform the ***Management System Gap Analysis*** at the same time as the ***Console Staffing Assessment*** site visit, thus saving travel and labor expenses. Please refer to the Service Briefs on these offerings for more information.

Field Operator Staffing Assessment and ***Work Team Design Assessment*** Briefs also are available for additional services if the Client desires to extend this type of study to outside operators, or the overall work team make-up.