

# Modular Modeling System

## Newsletter

### MMS for Windows

It's a real challenge today just to keep up with the advances in computer software and hardware technology. It was only last September that we announced our new NDP version of the MMS-B&W and now we are excited about announcing another new version, **MMS for Windows**.

It wasn't easy to make an excellent product better, but we did it! We've been developing **MMS for Windows** for more than a year and, although we're not quite through, we plan to demonstrate it at our MMS User Group meeting in Oct.

The combination of Microsoft FORTRAN version 5.1 and Microsoft Windows allowed us to develop **MMS for Windows** to retain the same advantages of the NDP FORTRAN version yet gain greater ease of use and the additional capabilities featured below.

- Ability to work with multiple worksheets
- Cut, copy, and paste of icons is supported. Graphical information can be pasted to word processing programs for documentation. Blocks of icons can be duplicated on the same worksheet, or copied to a new worksheet.

- Icon place, orient, move, delete, and name are all supported without the need to change modes.

- Pan, zoom, and view-all functions allow the user to move around the worksheet. Windows scroll bars are used for the panning actions. When a file is loaded, the same zoom and view location is restored as when the file was saved.

- On-line help can be easily added to and/or modified without change to the main program. Windows help files provide for hypertext type jumps and search on subject.

- Color control over all the icons via selection from a dialogue box. The full range of Windows colors is available. Users can group objects by color using this feature.

- Worksheet annotations can be placed and edited with the same actions and ease as icons. Complete size, font and color control is provided with the same interface as the icon edit dialogue box uses.

- Works with the **ACSL for Windows** product to allow creation of larger models

- There are essentially no

limitations on worksheet size and number of icons. The total number of icons, connections and annotations can exceed 2000 on machines with 2 megabytes of memory. This configuration is almost a minimum for the Windows operating system. Each object uses about 500 bytes of memory. This means an additional megabyte of memory could provide space for 2000 more objects. Redraw time and other practical considerations are a more important consideration.

- Automatic parameter calculation for all modules

- All modules are available at all times ( without the need for separate libraries )

B&W served as a test site for the Microsoft Windows 3.1 Beta Program.

The new **MMS for Windows** interface provides a more flexible and easy-to-use method for building MMS models. The almost limitless interface provide the ability to build very large models. The Windows cut and paste methods can copy or move blocks in a matter of seconds.

( See newsletter insert )

# Using GTURB Module for Jiangbei Power Plant - a Success

(Note: This is a continuation of the article "Gas Turbine Module in Use by Chongqing" that appeared in the September 1991 MMS newsletter. BWNS has made editorial changes to the article as submitted by Mr. He Zuwei and Mr. Zhan Jincheng. We hope that we did not alter the intent of the article in any way.)

In May of 1991, the gas turbine in the Jiangbei Power Plant was simulated by Chongqing University, using the MMS-B&W GTURB module.

Jiangbei Power Plant is a combined-cycle power plant located on the banks of the Changjiang River. It was installed by Huaneng International Power Development Corporation (HIPDC, China) and John Brown Electricity Engineering Company (JBE, Britain), and began to provide power in 1990. The plant consists of two sets of gas turbines (36.75 MW) and one set of steam turbines (34.75 MW). There are two modes of operation in the plant: a single cycle and a combined cycle. The simulation, discussed herein, is limited to the single cycle system.

The differences between the GTURB module and that of the actual system are:

(1) GTURB contains no fuel oil flow and steam/water injection.

(2) A natural gas compressor is installed in front of the combustors in order to raise

gas pressure at Jiangbei because the pressure loss is large from the gas station to the plant.

(3) There are outlet silencers behind the turbine at the plant.

A simplified diagram of this system is shown in Figure 1.

During the process of parameterization, the difficulties we encountered were that the compressor map data was not supplied by the manufacturer and the performance curve could not be found. As an alternative, we accumulated operational data at various conditions and fitted the performance by a linear regression analysis.

Steady states with and without temperature control were found. The steady state model results of two cases were very close to the design data.

Based on this simulation model, a series of simulation tests were performed. The results showed that the model is reasonable.

The first test was to simulate the startup. The startup program in Jiangbei Plant is different from that in TGTURB.CMD file. In order to proceed with the simulation, we set the natural gas flow during startup with an ACSL TABLE function and edited a command file for the startup simulation.

The model response for this

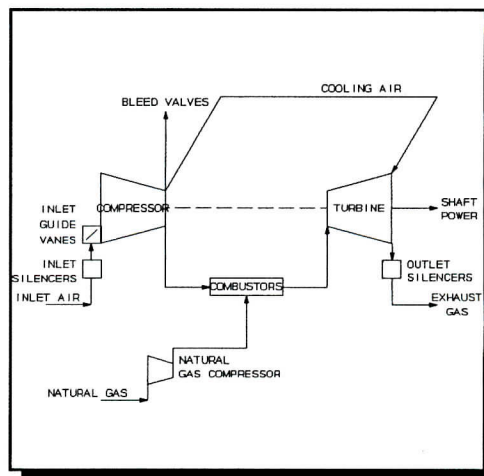


Figure 1

test agreed well with the plant test data. The results are shown in Figure 2. The comparison of the test data with that of the simulation is reasonable.

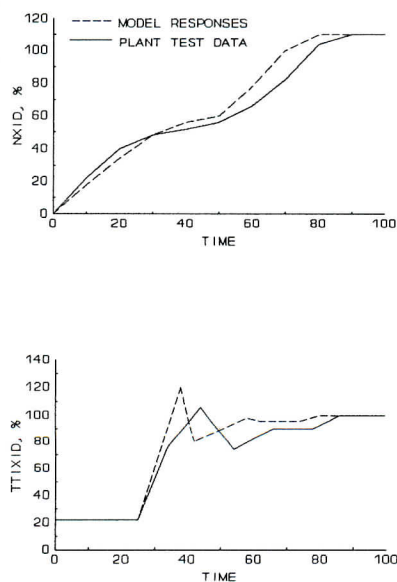


Figure 2

The second test was an attempt to model the



shutdown of the natural gas flow. The machine would coast down to 0.0 rpm and 0.0 mass flows. Figure 3 shows the responses.

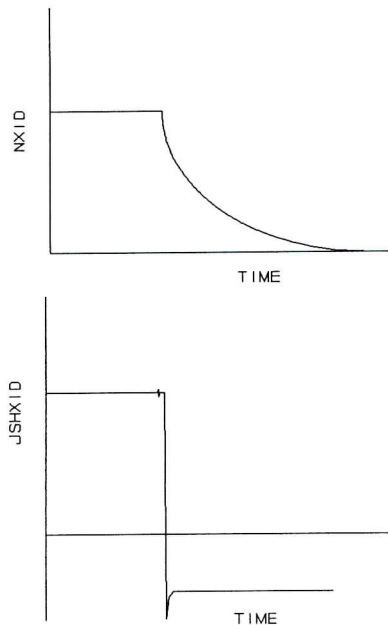


Figure 3

The third test was to model the damaged condition of the natural gas compressor. As shown in Figure 4, suddenly decreasing the pressure and temperature of natural gas, the temperature of combustion in the combustors declines.

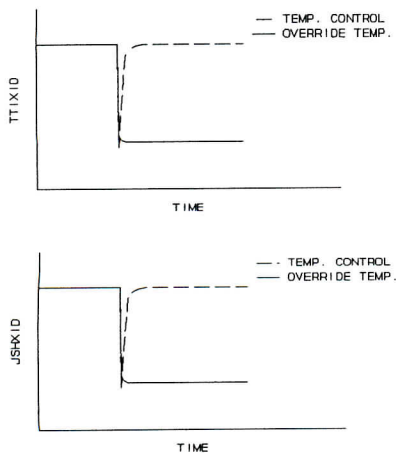


Figure 4

With the gas turbine control system enabled, the natural gas flow will increase and the temperature will rise. Without the turbine control system enabled, the gas flow and temperature will both decrease within the combustion chamber.

It is evident from the analyses discussed above that the GTURB Module achieves a good simulation of the Jiangbei Power Plant. The results of these simulations are helpful for the operation of the gas turbine at Jiangbei Power Plant as well as at similar units.

The following statements in the IGASTB.FOR file contained errors:

```
TSTEAM=TSAT (PGCO, ID, ERRDAT)
EGT=(HGTI-HGTO)/(HGTI-HGTIOI)
WRITE (JJ, 1002) GBV(1), GBVC
```

The above statements should be:

```
TSTEAM=TSAT (PGCS, ID, ERRDAT)
EGT=(HGTI-HGTOC)/(HGTI-HGTIOI)
WRITE (JJ, 1002) GCCB (1), GCCBC
```

*(editor's note: these errors will be corrected in Release 4 of MMS-B&W)*

## MMS User Group Meeting

Because of an April '92 meeting at Delft University in The Netherlands of several MMS users and prospective customers, we thought it best to schedule the next MMS User Group meeting for later in the year - October 26, 27, 28. The meeting will be hosted by BWNS at our offices in Lynchburg.

We selected these dates for several reasons: (1) October is a beautiful time in Virginia and the weather is usually near perfect, (2) the International Joint Power Generation Conference and Exposition (IJPGC) is being held in Atlanta, Georgia on October 19-21 and we thought many of you might want to attend that conference prior to the User Group meeting. Atlanta is only about 400 miles from Lynchburg and airline connections between Atlanta and Lynchburg are easy to make, and (3) by October, we will be ready and anxious to present our new "MMS for Windows" product.

We hope you will attend and bring your spouse with you to enjoy the beauty and hospitality of Lynchburg.

Our preliminary plans for the three-day User Group meeting are to conduct a regular meeting on Oct. 26, a "MMS for Windows" workshop on Oct. 27, and an MMS/ACSL workshop on Oct. 27-28.

We will send you additional information on the User Group meeting and the IJPGC as it becomes final.

*This newsletter is published by*

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## Welcome Ella Carr

We are very pleased to welcome Ms. Ella Carr as our new MMS Software Configuration Administrator. Ella has worked at BWNS for 14 years in various positions, her latest as Administrative Assistant for BWNS' Space & Defense Systems.

As MMS Configuration Administrator, Ella will be responsible for:

**Maintenance of software and documentation records** - This involves keeping track of what software and documentation each MMS user has.

**Assembling and shipping software to new and current customers** - This involves making copies of software and documentation and mailing it to our customers.

**Processing problem reports** - Ella is our designated "point of first contact" for problem reports. While you are welcome to continue reporting problems as you have in the past, we request that, if possible, you should contact Ella first (same fax no.). When she receives a problem report, she immediately enters it into her tracking system and passes the report on to the appropriate engineer

for resolution. Ella will also monitor the status of the report until it is completed.

**Other** - We plan to utilize Ella's many talents and expertise to the fullest.



Ella working on MMS

## MMS SHAKES HANDS WITH FOXBORO

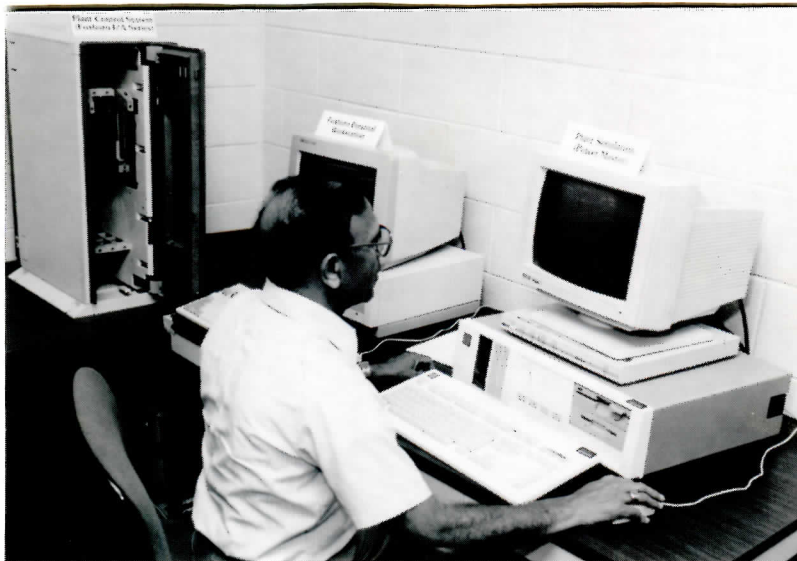
As part of our MMS Engineering Services offerings, BWNS can build interfaces for your MMS models with Bailey Network 90, Infi90, or Foxboro

I/A series control systems. We can then configure the control systems so as to implement your control algorithms.

An example of an interface we built is a MMS model of the B&W-designed PWR used in the development of the Plant Control System (PCS), an

advanced digital control system for the B&W-designed PWR plants implemented in the Foxboro I/A system. Used during the development of control algorithms, this model, with the control algorithms removed, was linked through an RS-232 serial data highway and the Foxboro Foreign Device Gateway (FDG) Module with the Foxboro I/A system configured as the PCS. The algorithms reside in two Foxboro CP30 Modules that communicate with the FDG through the Foxboro Node Bus Module. This real-time model includes a reactor (RX1), pressurizer (PZRB), once-through steam generators (OTSGEM), feedwater train, and the steam system.

If you would like to know more about how we can help you develop an interface for your MMS models, contact H.C. Cheatwood.



Dr. Sadashiva Godbole and the PCS Development System