AFT Impulse™ Creative Modeling Technique for Multiple Pump Trip Conditions

CASE STUDY

Crude Oil Terminal

Oil & Gas Industry

Access Pipeline Inc.
Calgary, Alberta, Canada
Platinum Pipe Award Honorable Mention - Software Features and Model Creativity

Jianmin (James) Yang, pipeline engineer at Access Pipeline, used AFT Impulse to model a crude oil terminal consisting of a feed pump, tanks, a delivery booster pump, metering and a delivery shipping pump (see Figure 1). The purpose of the model was to assess the overpressure risk during upset events, particularly pump trips.

The timing of booster pump trips is a key factor that can impact peak surge pressure, and the system's control logic causes the booster pumps to trip when various, independent events occur. These events include a low flow at the booster pump, a high booster pump discharge pressure, and high and low shipping pump suction pressures.

> "(The AFT Impulse sub-model) enables us to closely simulate real process control logic and shutdown conditions."

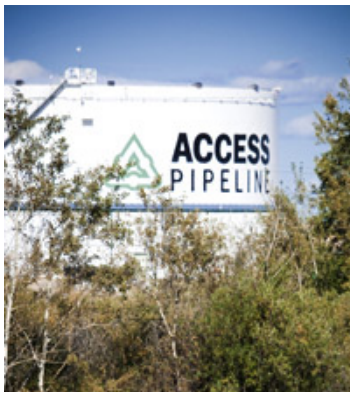
In order to create a model reflective of the actual system, Yang needed to account for the control logic. Previously, the control logic was accounted for by first running the model to see at what time the booster pumps would trip, then entering this time into the transient scenario. However, this method requires two separate runs for every case, making it tedious and time consuming.

To mitigate this, Yang built a sub-model in AFT Impulse (see Figure 2). The sub-model consists of several valve assemblies in parallel with an assigned pressure on both sides. Each valve represents a single booster pump trip condition and, should the system meet any of the trip conditions, a valve will open to allow flow through the logic pipe.

The booster pumps are then programmed to trip if there is flow through the logic pipe, thus eliminating the need for an intermediate run.

"Shutdown events are very common in facilities related to (the) oil industry," Yang said. "(The AFT Impulse sub-model) enables us to closely simulate real process control logic and shutdown conditions."

In addition to the sub-model, Yang also used AFT Impulse's stacked graph capability to analyze multiple system parameters. This helped him gain insight into the behavior of the system as the transients progressed (see Figure 3).



Access Pipeline Inc. is a Canadian based company with pipeline infrastructure located in Alberta. Access Pipeline operates a heavy oil transportation pipeline network servicing facilities in the northeastern region of Alberta. Access Pipeline's head office is located in Calgary, Alberta, with primary field operations and pipeline control centre based at their office in Fort Saskatchewan, Alberta. Access Pipeline also maintains a field office in Conklin, Alberta.

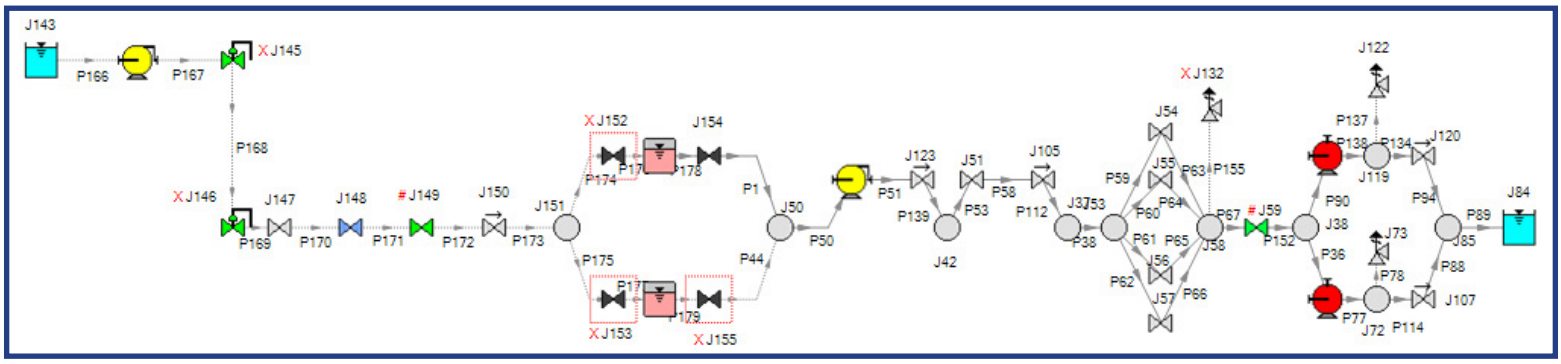


Figure 1 - AFT Impulse model of a crude oil terminal

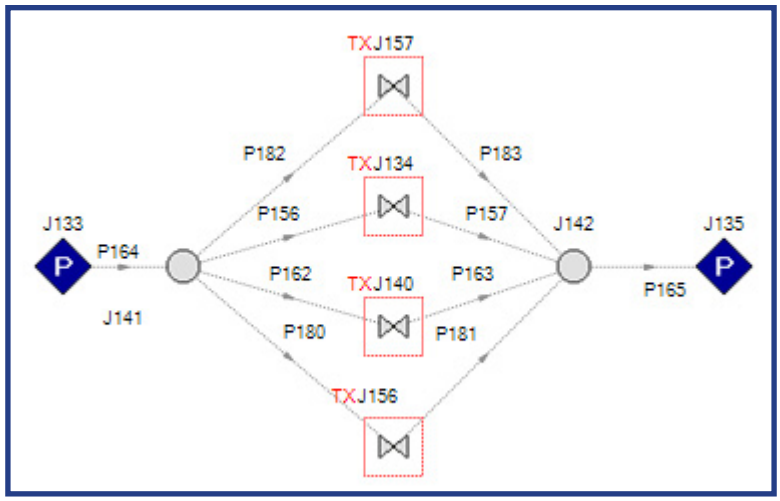


Figure 2 - Logical sub-model representing the pump control logic. This runs on the same workspace as the Figure 1 hydraulic model to simulate the control system

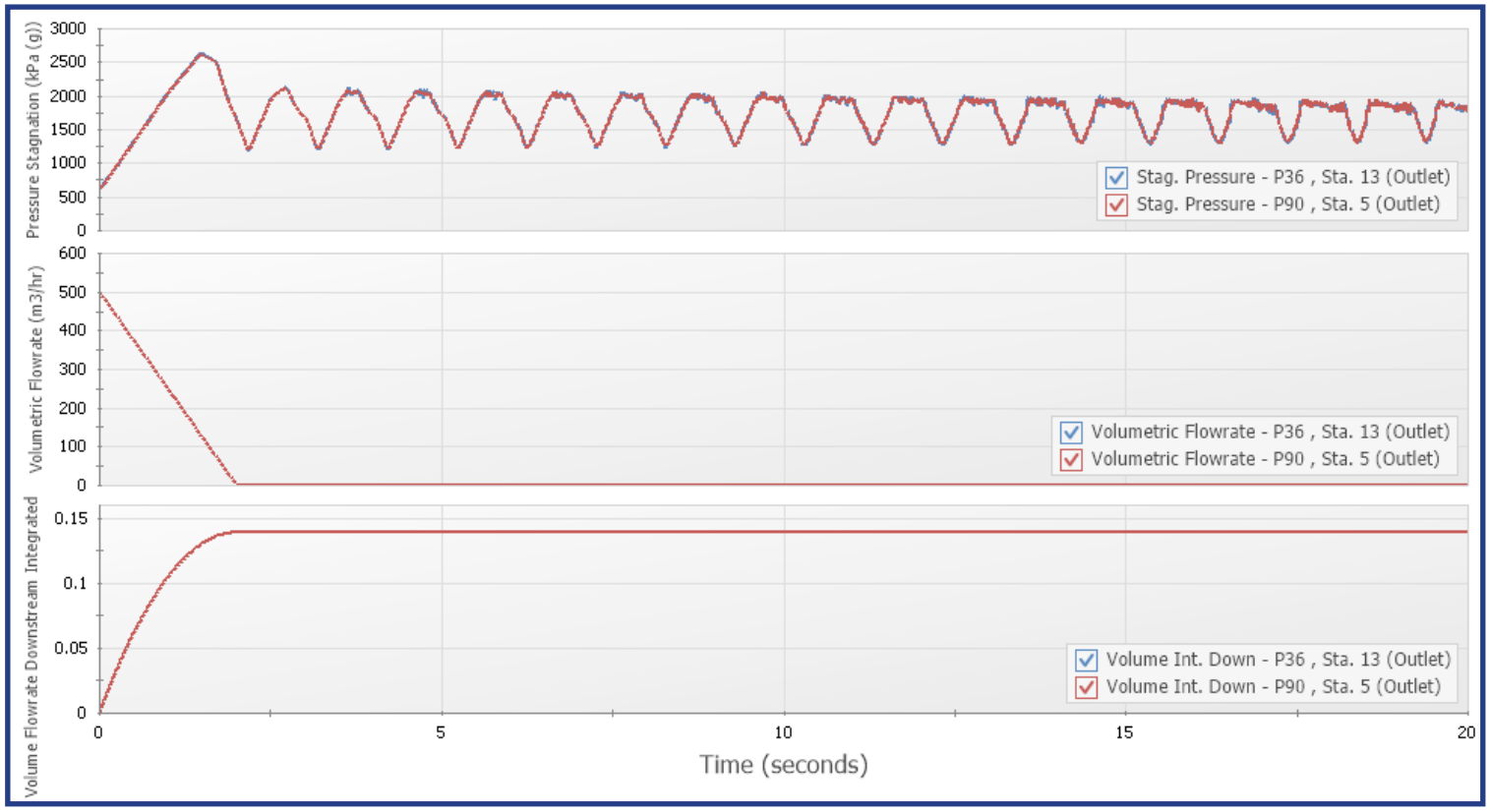


Figure 3 - Yang used AFT Impulse's stacked graph capability to analyze multiple system parameters