OILFIELD TECHNOLOGY CENTER
TEXAS TECH UNIVERSITY

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INTRODUCTION

A unique educational facility has recently been constructed by the Bob L. Herd Department of Petroleum Engineering department at Texas Tech University. The Oilfield Technology Center (OTC) is located on the Texas Tech East Campus on 10 acres of land near the intersection of East Loop 289 and Fourth Street in Lubbock, Texas. The facility is designed to serve as a research and teaching facility to give both undergraduate and graduate petroleum engineering students a hands-on experience in the design and operation of typical oilfield equipment.

The ten acre site sits upon roughly 80 acres of Texas Tech land. Surrounding OTC are Plant and Soil Science experimental crops (cotton, vineyards, grains, peanuts, etc.), irrigation systems, the Electrical Engineering Pulsed Power Lab and the Fiber Research Facility. See Figure 1 for an overview of the East Campus.

Although primarily designed for use with the petroleum engineering curriculum in mind, the OTC can also be utilized for third party workforce development training. Testing of new downhole tools or production treating processes can also be done utilizing the resources available at the OTC.

DESCRIPTION OF THE OTC

The OTC as presently configured consists of a test well, a production battery, a pad with a static display of high pressure gas treating equipment and a combination shop/classroom/office building.

For several years the department had recognized the need to provide visual working models of oilfield equipment so that students could better grasp the fundamentals of petroleum engineering. The construction of the Terry Fuller Petroleum Engineering Research Building in 2014 was a significant step in achieving that goal. However, an existing test well on Texas Tech's East Campus provided the seed for an opportunity to expand the concept further. In early 2016, the decision was made to proceed with construction of a tank battery and building on the 10 acre property where the well was located. This new facility was named the Oilfield Technology Center.

TEST WELL

In 2001, a 4,000 foot deep well was drilled and cased to total depth with 9 5/8" casing on property owned by Texas Tech on the east side of Lubbock. The well is not perforated and was used for a couple of years for research primarily on sucker rod pumping systems. The focus was on research and for various reasons, including vandalism to the electrical power system, the well was only periodically used for instructional purposes. As a result the well has been effectively out of use for about 12 years.

This well has a 5000psi - 9 5/8" dual tubing string wellhead. Currently, pumping equipment on and in the well includes a 456D conventional pumping unit, a single string of 2 7/8" tubing, a combination 7/8"and ¾" sucker rod string and a 1 ½" insert rod pump. The pumping unit motor will be equipped with a pump off controller and a variable speed drive. Rewiring the pumping unit and control system was put on hold until

the wiring for the new building at OTC could be completed. The wiring should be completed by in the first few months of 2018. Figure 2 shows the well as it is presently configured.

The well was pulled and reconditioned in October, 2016. A casing inspection log and a pressure test confirmed that the well integrity is good and ready for service. The pumping unit will be inspected and reconditioned once electrical power is restored to the well. Any fluid introduced in the test well can be pumped out and sent to the tank battery by way of a buried 3" polyethylene line. Since no gas is produced from the well, provisions have been made to inject nitrogen in the flow stream going to the battery. This will provide a two phase fluid at the battery to demonstrate gas-liquid separation. Water and nitrogen have been selected as demonstration fluids for safety purposes and environmental concerns.

This unperforated well provides the capability of supporting research in artificial lift equipment and techniques as well as the development and testing of other cased-hole tools.

TANK BATTERY

In June, 2016 construction began on a full scale tank battery complete with processing equipment. This battery has been completed and can be used in researching better surface production methods and environmental controls. Using the battery in combination with the test well, the effects on production can be demonstrated when changes in well conditions or surface equipment are made. Figure 3 shows the production equipment in the tank battery.

Any fluids introduced at the wellhead can be separated at the battery. Water is pumped back to the annulus of the test well through a 3" buried polyethylene line. Any gases introduced at the well head will be vented. Since nitrogen is being used it can be safely vented with no environmental concerns.

Production processing equipment installed on the 100' X 100' caliche battery pad includes a 30" X 10' two-phase vertical separator, a 6' X 15' free water knock out, a 4' X 20' heater treater, two-300 barrel water tanks and two-300 barrel oil tanks.

A 30" X 10' three-phase horizontal test separator is also located at the battery. Liquid metering is accomplished by use of two-one inch turbine meters, one each for oil and water, and gas is measured with a two inch orifice meter run.

Also connected in the battery piping, but not operational, is a lease automatic custody transfer unit (LACT), a vapor recovery unit (VRU) and a 3' X 37 ' vapory recovery tower (VRT).

GAS TREATING PAD

A second 100' X 100' caliche pad was constructed to hold upstream gas treating equipment. No gas will be introduced in the equipment and all equipment will be for static display only. Equipment currently in place includes a 5,000 psi high pressure wellhead and Christmas tree, a 30" X 10' line heater and a 30" X 10' 2,000 psi three-phase metering separator. Other equipment to be added includes a glycol dehydration unit, a compressor and possibly an amine unit.

SHOP/OFFICE/CLASSROOM BUILDING

Also on-site at the OTC is a 4,800 square foot metal building (Figure 4) that houses a 45 person classroom, office spaces, restrooms and a heated workshop-display area which provides space for exhibits of cut-away models of larger pieces of oilfield equipment. The classroom and offices are heated and air conditioned. Wireless internet access is available in the building and over most of the ten acre site.

Office space is provided primarily for research personnel working at the OTC. The classroom is used for on-site meetings or recitation sessions for various undergraduate classes.

Among the displays in the workshop are one-quarter scale cut away models of a separator, free water knock out, heater treater and gun barrel. Also inside is a forty foot long cut away model of a wellbore showing all of the components of a well from the pumping tee to the bottom hole sucker rod pump including the surface and production casing and the tubing and rod string. Other displays include drill bits and downhole workover tools.

FUTURE PLANS

As shown in Figure 5, a master plan for the OTC was laid out which included all of the existing facility as described above plus an area for a drilling rig, a metering pad and reserved areas for large scale research projects such as flow loops or other drilling production operations that require significant space.

WORKFORCE DEVELOPMENT

Since the OTC will not be used full time for Texas Tech academic purposes, the facility could be used for third party workforce training. Instruction in beam pumping operations and oil, gas and water separation could be done with equipment now in place. With the completion of the gas treating pad, operations of upstream gas treating equipment can be demonstrated.

Since workforce training does not fall within the scope of the University's educational objectives, the OTC would be available to rent out to third parties wishing to conduct training on a time available basis.

The addition of a drilling rig would enable the training of drilling and workover crews. The drilling area may include a 1,000 foot well that could be used to demonstrate running techniques for down-hole equipment.

Classroom space available permits lectures as well as hands-on experience.

RESEARCH

The test well and tank battery may be used for applied research as well as academic research as the case may be. About one third of the acreage at OTC is reserved for purely research purposes. The availability of office space in the building along with internet connectivity make the OTC an ideal site for large scale research projects. We envision large scale flow loops and wellbore configurations to allow scale-up type experiments.

FUNDING

Donations of equipment, labor and financial resources from the oil and gas industry have made the OTC possible. Petroleum engineering alumni have played a significant role in securing these donations and recognizing the vision of the department to provide this one of a kind facility.

Collaborative research opportunities are invited. Inquiries for use of the OTC for equipment testing or third party instruction should be directed to the Bob L. Herd Department of Petroleum Engineering at Texas Tech University at www.pe.ttu.edu.

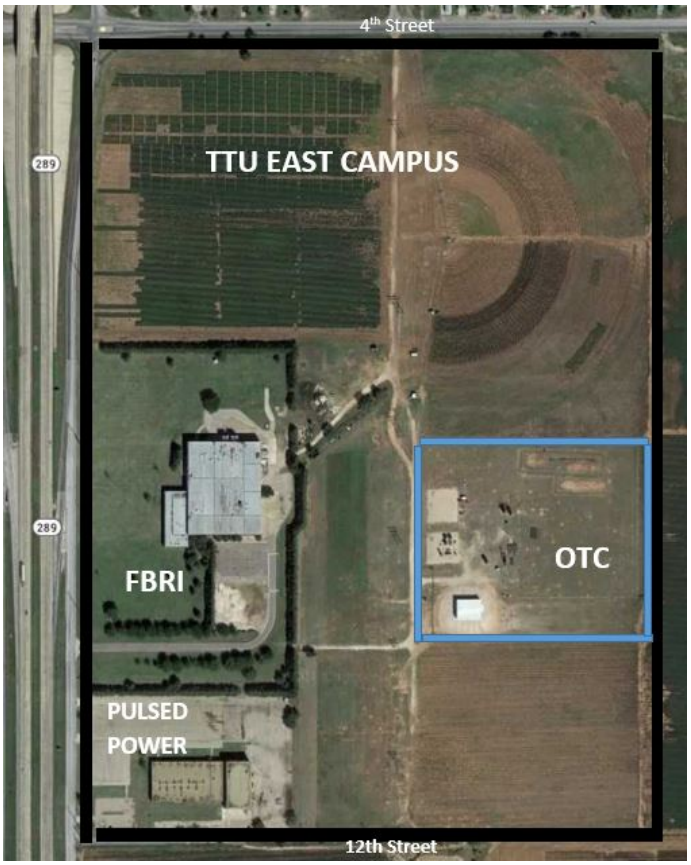

Figure 1 TTU East Campus

Figure 2 Test Well

Figure 3 Tank Battery

Figure 4 OTC Building

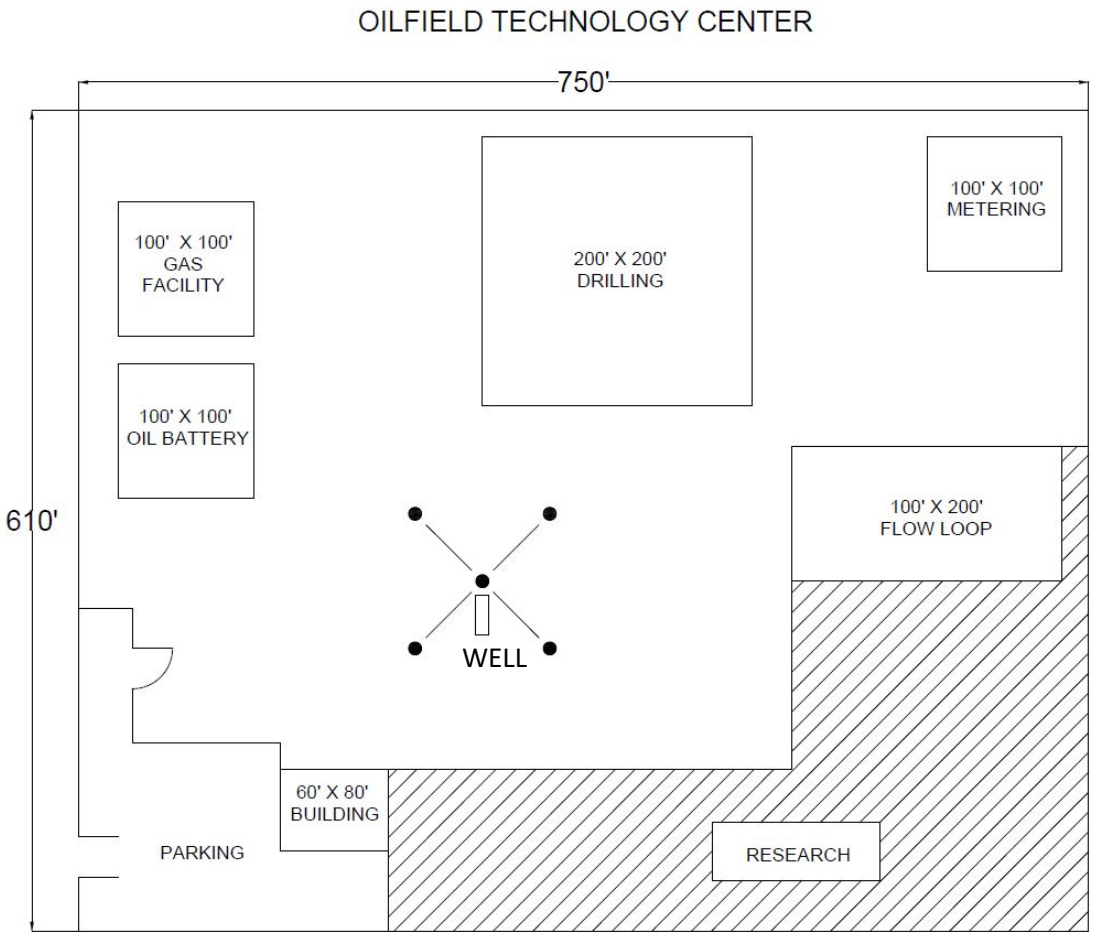

Figure 5 OTC Layout Plan