



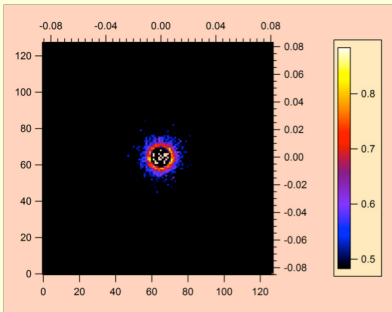
**DR. RONGJIA TAO**   
**CHAIR,**  
**DEPT. OF PHYSICS, TEMPLE**  
**UNIVERSITY, PHILADELPHIA**

STWA, Inc. approached Temple University in 2004 with a new technology that held the potential to change the world.

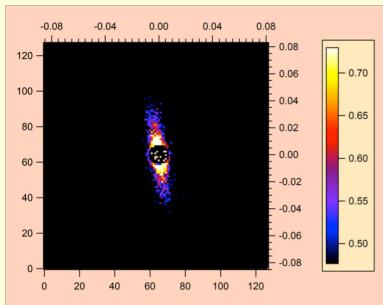
Dr. Tao accepted, and STWA provided a research grant to pursue that challenge.

By 2010, Dr. Tao, armed with a new apparatus, had achieved 322% increase in crude oil flow rates under laboratory conditions at below freezing temperatures.

Dr. Tao and STWA will be testing this new apparatus and technology at full scale to see how close to this number we can get at full scale.



**BEFORE:** With no electric field applied, the scattering pattern was isotropic, indicating that the nanoscale particles in the crude oil were randomly distributed, making viscosity high.



**AFTER:** With electric field applied and gradually increasing the field strength to 2000V/mm.

After the electric field exceeds a critical value, around 750V/mm, the nanoscale particles form short chains along the field direction. From the scattering pattern we can estimate the size of the chains.

These images confirm the technology effect in action, which are the fundamental principals behind the AOT™ and ELEKTRA technologies.

**On August 2 and 3, 2010,** a group led by Dr. Rongjia Tao from Temple University conducted experiments using small-angle neutron scattering at the National Institute of Standards and Technology. (See Sept. Press Release.)

Dr. Tao's team used the best technology available to investigate at a nano-scale level the effects produced by STWA's Technology. The tests captured data and pictures with and without the field, confirming scientific evidence of its effect at a molecular level.

"We have used the most sophisticated technology available to us for watching, in real time, how our technology affects crude oil. The team was able to observe and record images at a nano-scale to examine direct evidence of our technology on the microstructure of crude oil aggregating it into chains, the basis by which our technology operates." Mr. Kyte concluded, "As global reserves continue to shift to heavier, more expensive crudes, our technology's ability to reduce crude oil's viscosity becomes increasingly relevant and valuable in enabling pipelines to operate faster and more efficiently on a global scale."

To do the scientific testing, Dr. Tao's team used the NG7 SANS

(Small Angle Neutron Scattering) beam. The SANS device uses neutron reflectometry, a relatively new technique for investigating the near-surface structure of many materials.

In the first pass, there was no voltage applied to the electrodes, hence no electric field. Then the neutron beam, passing through the quartz window, shined on the crude oil and was scattered out by the crude oil.

We then applied an electric field and gradually increased the field strength to 2000V/mm. After the electric field exceeds a critical value, around 750V/mm, the nanoscale particles form short chains along the field direction. From the scattering pattern we can estimate the size of the chains.

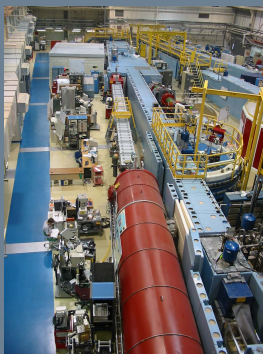
The confirmation at a nano-scale level is truly a groundbreaking scientific discovery, as it means that we now have photographic proof of what AOT™ does to crude oil at a molecular level.

This proof has been of critical importance in the validation and advocacy chain out of the public eye, fueling our development and opening doors.

**ABOUT THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST) NG7 SMALL ANGLE NEUTRON SCATTERING BEAM**

The 30-meter long Small-Angle Neutron Scattering (SANS) instrument on neutron guide NG7 was the first new instrument to go into operation in the NCNR guide hall in May 1991. Jointly developed and sponsored by the NCNR, the ExxonMobil Research and Engineering Co., and the University of Minnesota, the instrument has undergone a number of improvements over the years to remain, along with its near-twin on guide NG3, the best such instruments in the U.S. The improvements, including a higher resolution 2D detector and focusing refractive lenses, have extended the Q-range of the instrument which now goes from 0.008 nm<sup>-1</sup> to 7.0 nm<sup>-1</sup> to enable structural features in materials ranging from roughly 1 nm to over 500 nm to be probed.

(Information from NIST website at: [www.ncnr.nist.gov/instruments/ng7sans/](http://www.ncnr.nist.gov/instruments/ng7sans/))



## AOT™ HARSH ENVIRONMENT TESTING AT U.S. DEPARTMENT OF ENERGY NAVAL PETROLEUM RESERVE NO.3 RMOTC



STWA CEO Cecil Bond Kyte with US Dept. of Energy Field Operations Manager Cecil Foote.

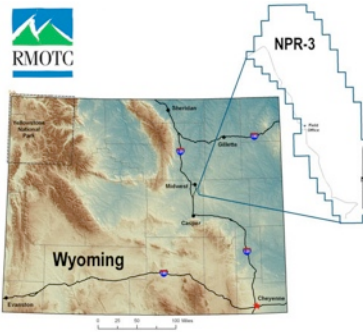


Dr. Rongjia Tao & US Dept. of Energy and Colfax Corporation personnel onsite, running initial calculations for infrastructure requirements.



Dr. Rongjia Tao & US Dept. of Energy personnel viewing one of the bell-housing test sampling points on the Testing Flow Loop.

On September 16, 2010, STWA, Inc. met on site with representatives from the **U.S. Department of Energy (DOE)**, contractor field operations personnel and a source manufacturer for review of the upcoming testing to commence at the DOE's RMOTC facility within the Naval Petroleum Reserve No. 3 (NPR-3) located 35 miles north of Casper, WY. The purpose of this meeting was to review and determine testing logistics, parameters, blueprints, cost estimates and schedules related to all parties involved to ensure parity and successful establishment of timelines and objectives to be achieved.



There is a direct correlation between the time and expense of extracting and transporting crude oil with its viscosity. STWA aims to provide a turnkey solution to make petroleum transport providers and wholesalers more efficient and profitable. The Company will be using a field- scale, multi-phase flow loop at Naval Petroleum Reserve No. 3 (NPR-3), Wyoming managed by the DOE's RMOTC for simulating real world conditions associated with offshore oil production for upcoming testing of its Applied Oil Technology (AOT™). The March 2011 testing at the facility will provide data from which the market value and pricing will be derived.

**January, 2011** - After witnessing STWA achieve several key project development milestones, PRCI initiated contracting with STWA to co-fund the AOT™ field testing at US DOE's RMOTC. [www.prci.org](http://www.prci.org)

**STWA AOT™ Test Objective:**

**Data Gathering**  
The U.S. Department of Energy's Rocky Mountain Oilfield Testing Center (RMOTC) facility for simulated deepwater testing is ideal for controlled testing conditions for STWA's Applied Oil Technology (AOT™) in that, like a laboratory, it enables finite control over testing parameters, but on a scale unachievable in a laboratory.

AOT™ technology has been successfully developed under laboratory conditions and tested in state-of-the-art facilities. The RMOTC test facility is the next natural step in scaling-up this technology for commercial use.

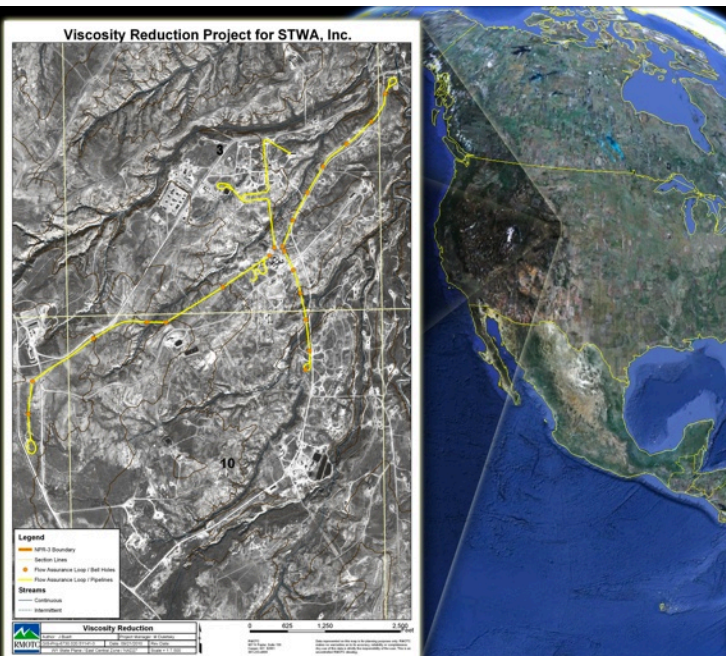
**About the US Department of Energy RMOTC Facility at the US Naval Petroleum Reserve No. 3 "Harsh Environment Deepwater Testing Facility"**

**Characteristics**  
Constructed in 1999 to replicate deepwater conditions on land, the facility offers STWA some distinct advantages and useful attributes, key to AOT™ current development.

The test loop has the following characteristics:

- 1/2" Single Pass Line
- 20°F Temperature Subcooling
- Ambient Temp of ~ 45°F
- 3600psi Max Operating Pressure

The Naval Petroleum Reserve No. 3 (NPR-3) is now used as a test site for emerging and developing technologies to address critical energy issues.



**ABOUT THE RMOTC AT THE US NAVAL PETROLEUM RESERVE NO.3**

RMOTC partners with service companies and equipment manufacturers to test new ideas and products leading to increased recovery or reduced operating costs. Independent oil producers leverage technologies tested at RMOTC by evaluating new recovery processes before application. National laboratories and government organizations field test assumptions in a real-world setting. RMOTC is online at: [www.rmotc.doe.gov](http://www.rmotc.doe.gov)

**Title:  
New Technology to Reduce Oil  
Transportation Costs via  
Viscosity Reduction**

**Abstract/Problem Statement:**

Crude oil and its derivatives are fluids in suspension, meaning they have a base fluid with particulate matter “suspended” within. These suspended particles when rubbing together create drag within the fluid, increasing the overall viscosity and making it more difficult to pump the oil through domestic distribution and export pipeline networks. Using electromagnetism, Dr. Rongjia Tao, Chair, Department of Physics, Temple University expanded on STWA’s legacy technology with an innovative in-line device that introduces short, precise electric pulse bursts within the fluid flow, forcing the particulate matter to align in the field direction. When this happens, the particulate matters’ natural tendency to combine into clusters is enhanced. This enables the total surface area per unit of dissolved particulate matter to decrease. This, in turn, provides more volume within the fluid for the dissolved particles to move, thereby reducing particle rubbing and friction, which reduces the oil’s viscosity.† This results in up to 20% greater efficiency in crude oil pipeline transport.

AOT™ could increase the flow rate of crude oil in pipelines by as much as 20% with ultra-low ongoing energy costs. The product could also deliver cost reductions in pipeline operation by reducing the need for drag reducing agents, diluent and heating to lower crude oil viscosity to move oil through pipelines.

AOT™ FEATURE:	BENEFIT:
Reduces viscosity of crude oil	Crude oil flows faster Pro-rated pipelines transport more oil that creates additional revenue
Reduces the need for flow enhancing additives	No additional tanking, pumping or extraction required No hazardous chemicals
Reduces high-energy consuming viscosity reduction methods	Ultra-low operating costs Carbon Footprint savings
Energy-efficient in-line device	Low energy consumption Carbon footprint savings

This is potentially a high-margin, high-demand product.

Prior to the development of the AOT™ technology, the industry has used a variety of other methods to increase oil flow in pipelines, primarily by reducing the viscosity of the oil.

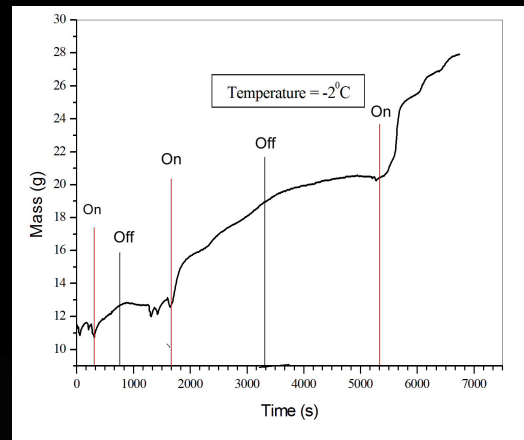
Reducing viscosity improves crude oil flow because it reduces the friction and drag introduced by the crude oil “rubbing” up against itself and the interior of the pipeline. With less friction, crude oil flows faster and requires less energy to pump.

AOT™ technology has competitive advantages versus these existing methods of reducing viscosity. In some cases it can replace existing methods, in most cases it is a complimentary technology that reduces the overall cost of viscosity reduction.

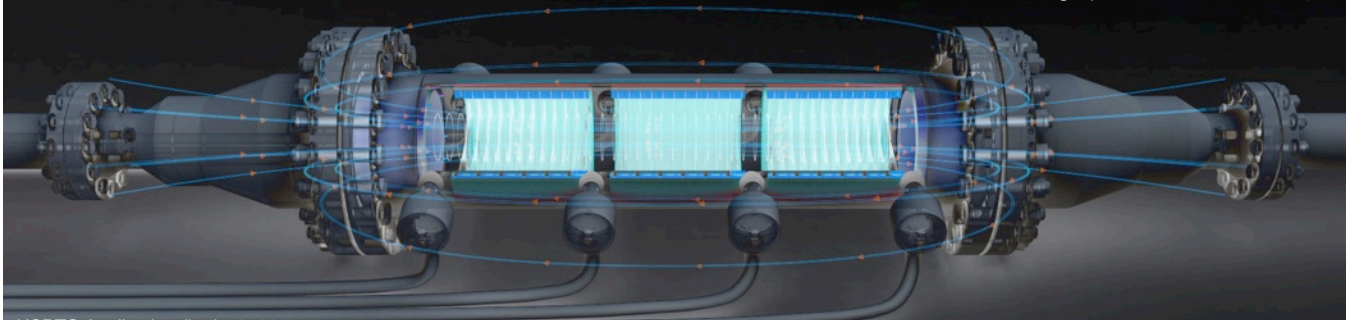
Diluents and Drag Reducing Agents “DRA” are expensive on a per barrel basis. Also, once diluents are added to crude oil, they

usually have to be removed prior to refining. This process of removing the diluents is expensive and reduces the number of refineries that can accept the crude and therefore its marketability.

For example, Venezuelan crude oil is restricted from certain refineries due to its use of diluents, limiting its market potential worldwide. Heating crude oil to reduce viscosity is usually done by burning natural gas, which wastes energy and is very expensive.



(Flow rate measurements from recent laboratory testing by Dr. Tao and his team.)



USPTO Application #11/519168

“Method and Apparatus for Treatment of a Fluid” was filed on May 13, 2005.

We have the exclusive worldwide marketing and distribution rights in perpetuity.

† Recent scientific research on the Company’s technology at the US National Institute of Standards and Technology NIST has confirmed the technology’s effect on crude oil molecules.

The report can be found at the following link:

[http://www.stwa.com/STWA/whitepapers/STWA\\_Crude\\_Oil\\_Electrorheology\\_Neutron\\_Scattering\\_Test\\_at\\_NIST.pdf](http://www.stwa.com/STWA/whitepapers/STWA_Crude_Oil_Electrorheology_Neutron_Scattering_Test_at_NIST.pdf)