

RAPID: RIG AUTOMATION & PERFORMANCE IMPROVEMENT IN DRILLING

A DRILLING RESEARCH CONSORTIUM at the
UNIVERSITY of TEXAS AT AUSTIN

Vision & Mission

RAPID is a research consortium group led by researchers from multiple engineering disciplines whose **objective is to deliver automation solutions for any and every aspect of well construction**. The goal is to reduce the drilling/completion time/cost *and* the number of individuals at the rig site by >50%. To do so, RAPID will

Educate the “automation generation” of drilling engineers with an emphasis on automation;

Perform applied basic research (emphasis is on applied);

Recruit outstanding and diverse talent to advance automation using the lessons learned both inside and outside the oil industry;

Provide new technologies developed by outstanding researcher and students with interdisciplinary training;

Provide a new and necessary arena for members to come together to facilitate adoption, standardization and integration;

Members prioritize RAPID research activity that accounts for the advancing capabilities from industry itself.

Thus RAPID effectively drives the adoption of advanced automation capabilities generated by the university, its members and member affiliates.

Value Creation & Benefits

The oil industry has embraced decentralized automation for other phases of production but comprehensive adoption of automation for drilling and completions has progressed slowly. For many companies, it is too risky to invest in automation solutions unless the end solutions will impact a sufficient number of tasks to reduce costs, improve safety, and improve drilling efficiency. *The consortium approach is sensible*. The development of automation solutions necessarily requires cooperation across industry and consortiums have proven to be good forums for cooperation. This approach creates multiple avenues to deliver **value** with minimal risk.



RAPID's Real-Time Operations Center (RTOC) for remote operations monitoring and data pattern analysis.

RAPID will train the “automation generation” of well engineers. Members have priority access to undergraduate, graduate and other funded participants.

RAPID supports multiple undergraduate programs. Members have priority access to undergraduate students from multiple departments who all have exposure to drilling activities.

Develop a unified downhole physics model. Members have access to the developed software and algorithms.

Emphasizes the transfer of developed technologies developed from applied and experimental research.

Empower rapid commercialization and member utilization of developed technologies. UT Austin has a proven record of transitioning promising technologies to industry.

UT Austin's RTOC provides opportunities to analyze real-time and historical well-data using industrially accepted and UT in-house software. The results are exclusively provided to the member who supplied the data.

All research will be presented to consortium members at annual symposiums where members have the opportunity to interact with RAPID members and funded participants. Software and research results are made available via a members-only website.

RAPID Research Focus Areas

Automated drilling control

Intelligent mechanization/automation

Downhole Modeling, simulation, and empirical validation

Monitoring, data analytics and “Big Data”

A complete description of our research approach is on our web site in RAPID Guidance Document. Areas of interest and activity include – but are not limited to:

- Remote, directional drilling control and geo-steering
- Automated control for adverse conditions (i.e. stick-slip, whirl, bit-bounce, etc.)
- Automated control for wellbore stability and preventing lost circulation
- Automating managed pressure and dual gradient drilling
- Automating completion, stimulation, fracturing, and intervention tasks
- Surface automation and mechanization (pipe handling, BHA assembly, drilling while circulating, etc.)
- Mechanization for rig move/transport, mob/demob, and skidding/rig walking
- Automation and optimal control for tripping
- Rig design for automation
- Novel sensor design, new sensor integration, data quality, data analytics and sensor standards
- High-frequency downhole and surface sensor analysis

Scalable “Big Data” information models and communication protocols

Decision support software for data monitoring, event recognition, and process control

Hardware-In-the-Loop simulation for prototyping and testing

Case-based teaching and training using HIL Simulator and UT Austin’s RTOC

Improved surface and downhole models (hydraulics, rock mechanics, hole-cleaning, drillstring dynamics, etc.)



UT Austin’s hardware-in-the-loop (HIL) Simulator.

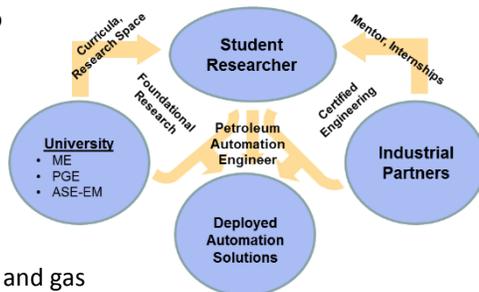
Recruitment & Education

RAPID’s main goal is to develop future engineering researchers with the requisite background and experience to bring advanced, flexible automation technologies to the oil and gas industry. To meet this objective, we emphasize:

- **Customized interdisciplinary curriculum** in the Petroleum & Geosystems, Aerospace & Engineering Mechanics and Mechanical Engineering Departments. Students develop a solid foundation drilling fundamentals as well as automation.
- **Engineering-based research projects** that address the fundamental technological challenges of remote, unmanned drilling.
- **Continual collaboration** with industry. Students complete mentored internships in relevant application areas.
- **Actively recruit women and underrepresented minorities.** Industry looks to develop an internal demographic that aligns with the community(s) they serve which then improves community relations and broadens the recruitment base.

The RAPID **graduate curriculum** draws on courses from multiple departments. Individuals recruited will have varied industrial experience and undergraduate degrees, but all students will graduate with core competencies in drilling and automation. Both Masters and Ph.D. students will be recruited as members have shown interest in graduates at both levels.

RAPID supports multiple **programs for undergraduates** as they constitute a large majority of industry workforce. Students in multiple departments are exposed to drilling automation via multiple efforts.



- **Sponsored senior design projects in drilling automation** – 3-5 projects/year involving 12-20 undergraduates.
- **Undergraduate staff for RAPID’s RTOC** - Students perform the bulk of RAPID’s data analysis under close supervision. This provides the opportunity to gain firsthand experience using both UT’s and popular data acquisition and analysis software.
- **Undergraduate Research Program** - RAPID also hires outstanding students to perform independent research with the guidance of industrial partners providing a link between graduate research and undergraduate accessibility.
- **Case-based drilling course using HIL Simulator** - The simulator provides a unique opportunity to validate automation and downhole models in a way that excites young engineers about the challenges and rewards of a career in drilling engineering.
- **Participate in Mechanical Engineering’s “35 in 5” Program** – This program aims to improve the enrollment of women in ME to 35% in 5 years by actively engaging first-year students in research. RAPID fully supports this program and will provide multiple slots to involve (and retain) participating students.

RAPID Research Team/Facilities

RAPID’s Director is Dr. Eric van Oort, a Professor in UT Austin’s Petroleum & Geosystems Engineering Department who has 25 years of industry experience. He leads a diverse team of researchers with extensive experience in robotics, control, mechanization, data analytics, and decision making. The senior research team includes:

- Dr. Eric van Oort (Professor, PGE)** Automated Well Construction, Fluid Automation, Remote Command & Control
- Dr. Mitch Pryor (Research Scientist, ME)** Automation, Mechanization and System Control
- Dr. Pradeep Ashok (Research Scientist, PGE)** Sensor Fusion, Automated Data Analysis and Decision-Making
- Dr. Dongmei “Maggie” Chen (Associate Professor, ME)** Control-Oriented Modeling and Data Analysis
- Dr. Mark Reis (Research Fellow)** Fit for Purpose Rig Design
- Dr. Behcet Acikmese (Assistant Professor, ASE-EM)** Advanced Control for Drilling and Vibration Mitigation
- Dr. Ali Karimi (Research Associate)** Drilling Fluid Automation and Multiphase Flow Modeling

RAPID has access to numerous facilities to support this effort including the picture HIL simulator and RTOC. RAPID also has a state-of-the-art drilling fluids automation lab, multiple industrial robots, motion capture capability, etc. More detail on these capabilities can be found on the RAPID website.

RAPID Participation/Contact Info.

- Terms and conditions of the RAPID Industry Participation Agreement (IAP) available upon request
- RAPID membership fee: \$75,000/year

Visit the RAPID website: <http://drilling.utexas.edu>