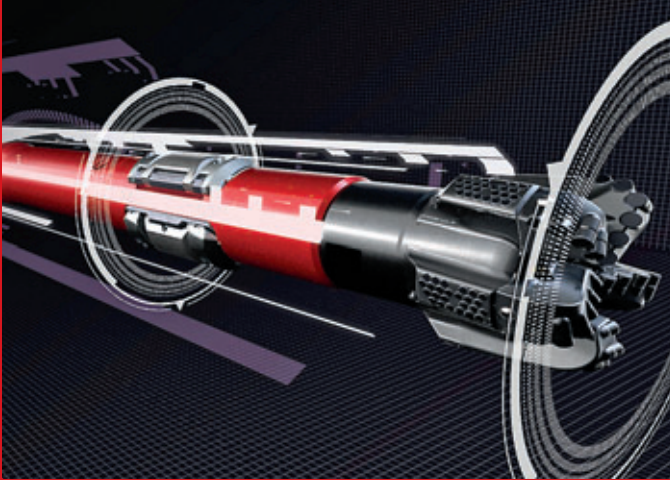


Technology & Innovation



1,116

U.S. patents granted in 2019

34th

Ranked in largest number of U.S. patent grants

Our reported number of patents granted in 2018 and 2019 includes Halliburton acquisitions, divestitures and grants that potentially were not reflected in public databases at year's end.

25%

Increase in patents granted

1st

Oil and gas industry leader in the number of U.S. patents granted

Increase in research and development (R&D) spend since 2018

3.6%



3.4

U.S. patents

for every

\$1^M_{USD}

R&D investment

Technology & Innovation *continued*

World Oil Technology Awards 2019

- Best Drilling Technology Award – EarthStar® 3D Inversions
- Best Exploration Technology Award – T1T2IFMI for Unconventionals with Halliburton XMR™ Service
- Best Health, Safety, Environment/ Sustainable Development – Onshore Award – Tuned® Prime™ Cement Spacer
- Best Well Intervention Technology Award – SPECTRUM® 360

Technology Management

Halliburton is at the forefront of developing innovative solutions for our customers' business challenges in the midst of an energy and digital revolution. We are focused on the future and the exciting evolving energy transition, providing products, services and solutions to the oil and gas industry that support our customers in their low-carbon future. This development focus is continuously enhanced by our customer collaboration, advanced technology, continuous improvement, safety and service quality.

Technological innovations are fundamentally altering the dynamics of business, economics, education, governance and even our sense of community. In our industry, digital technologies are redrawing the map of exploration and production in ways unimaginable not long ago. Halliburton digital initiatives are integral to our business strategy and are targeted at solving business challenges. From big data analytics that drive operational efficiency and accelerate cycle times, to the use of machine learning and artificial intelligence to provide real-time insights and enable automation across all stages of the well life cycle, Halliburton is able to automate both mechanical systems and processes – enabling people to focus on more advanced, value-adding tasks.

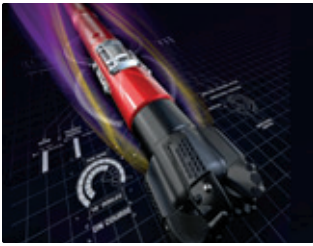
Innovation management at Halliburton begins with identifying the global priorities of our customers through the relationships forged by our 14 product services lines. Those priorities are distilled into potential innovations that are analyzed for business objectives, specific customer needs, Health, Safety and Environment (HSE) impacts and opportunities, and regulatory compliance. Our focus is on continuous improvement; therefore, our innovation objectives are modified regularly to mitigate design risks from the product or service.

Halliburton thrives on technical challenges; designing appropriate solutions are what we are renowned for achieving. The challenges of the global move to a low-carbon economy provide us a novel and exciting opportunity – to produce oil and gas as efficiently as possible with negligible material usage and zero emissions. As a result, sustainability principles and requirements such as emissions, water use, waste management, health and safety, increased production potential, and cost reduction are addressed as part of our technology development process.



2019 Highlights

This year, Halliburton engaged our global teams to develop innovative approaches to reduce the environmental footprint of our products and services. Whether it was hazardous waste reductions, water recovery, recycling initiatives or carbon dioxide (CO₂) reduction efforts, each of these projects created a more efficient and sustainable way to operate.



Our iCruise® intelligent rotary steerable system (RSS) has enabled the completion of jobs six days ahead of schedule, while keeping 100 percent accuracy in each respective zone. This technology helped save 7,200 gallons of diesel, which equates to 74 metric tons of carbon dioxide equivalent (CO₂e) over an equivalent job drilled with traditional methods. This technology also eliminated the need to use lithium batteries, thus removing any adverse environmental impacts of lithium battery production, storage, and recycling or disposal.



In the United Kingdom, our Wireline electro-mechanical downhole cutting tools and tubing punches can achieve single blade cuts in less than two minutes with real-time downhole data. This decreases time on site and eliminates the need for the transportation, storage and usage of explosive charges and chemicals. On a recent campaign in the North Sea, an operator utilized the electro-mechanical downhole cutting service for a well abandonment program. The technology successfully saved one-and-a-half days of rig time per well – a substantial reduction from the initial plan.



In Bolivia, all waste resulting from water-based mud operations were processed through a dewatering system and then processed through a reverse osmosis unit. The resulting water met strict environmental limits for disposal and had excellent properties to enable the reuse of 18,800 barrels of water on a well. In addition, this reduced the need for wastewater disposal, thus saving money on vessel rentals required for water disposal.



The Sperry Drilling QuickPulse™ automated directional gamma service enables a 70 percent faster rig-up time and results in a smaller surface footprint for the drilling equipment.



Our Tuned® Prime™ cement spacer has resulted in a greater than 93 percent reduction in crystalline silica content, which significantly improves the safety for personnel using cement spacers.



The Commander™ full-bore cement head has advanced our wireless functionality, resulting in an average rig-up time of 30 minutes. This saves a significant amount of time over a traditional job, which results in less time spent by personnel in the red zone.

Technology & Innovation

continued

2019 Products

	REDUCTION/ELIMINATION										IMPROVEMENT							
	DURATION OF JOB / NUMBER OF PEOPLE ON SITE	POTENTIAL FOR SAFETY INCIDENTS	EMISSIONS TO AIR / FUGITIVE EMISSIONS / GHG	FOSSIL FUEL USE	VOLUME OF WATER USED OR PRODUCED	VOLUME OF HAZARDOUS OR HARMFUL MATERIALS / CHEMICALS	SPACE / FOOTPRINT REQUIRED	NUISANCE: NOISE / ODORS / VISUAL INTRUSION	SPILLS OR LEAKS	VOLUME OF NON-HAZARDOUS WASTE PRODUCED	VOLUME OF HAZARDOUS WASTE PRODUCED	USES ELECTRICITY INSTEAD OF FOSSIL FUEL	HAS A LONGER LIFE SPAN / HIGHER DURABILITY	CONTAINS RECYCLED MATERIAL	INCREASES ABILITY TO REUSE / RECYCLE PRODUCT AT END OF LIFE	IMPROVES WELL INTEGRITY	ENABLES BETTER POSITIONING OF WELLS	IMPROVES RESERVOIR UNDERSTANDING
BAROID																		
BaraShale™ Lite 2															•	•		
Single-sack Drilling Fluid							•									•		•
CoFlo for Brine Treatment					•	•	•			•								
DRILL BITS & SERVICES																		
Bottomhole Assembly (BHA) Interaction Venus														•				•
SPERRY DRILLING																		
iCruise® intelligent RSS – 6.75 in., 4.75 in., 8 in., 9.5 in.	•		•	•		•				•								
PixStar™ High-Resolution Ultrasonic Imaging Service	•																	
QuickPulse™ Automated Directional Gamma Service	•	•						•										
GasFact™ 2.0	•							•				•				•		•
Radian® 6.75																•	•	•
TESTING & SUBSEA																		
Flex™ Managed Pressure Drilling (MPD)	•							•										•
Total High-Angle Disconnect Testing	•													•				•
WIRELINE & PERFORATING																		
RELAY™ Digital Stickline System – Downhole Power Unit (DPU®)	•			•		•	•			•		•		•		•		
RELAY™ Digital Stickline System – Elite Control Unit	•			•		•	•			•		•		•		•		
CEMENTING																		
Tuned® Defense™ cement spacer														•				•
Tuned® Prime™ cement spacer		•				•				•								•
HALADVANCE™ 344 cement additive	•									•								•
Commander™ Full Bore cement head	•	•																•
LiquiLite™ cement additive	•						•			•								•
PRODUCTION ENHANCEMENT																		
First-generation electric fracturing system (Zeus 1.0)			•									•						
Next-generation blending system (Janus)	•							•	•									
ExpressSand™ MAX	•																	
DryFR								•		•								
ExpressKinect™ Quick Latch system	•									•								
Project Gala – CECS/J 1939 controls and Allison 9832 transmission														•				
COMPLETION TOOLS																		
LinX® 200™ monitoring system						•												•
DataSphere® Opsis™ permanent downhole gauge						•							•					•
SmartWell® hydraulic disconnect tool		•																•
PRODUCTION SOLUTION																		
SafeGrip™	•																	

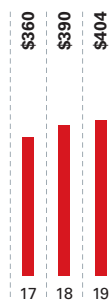
Many of the products and solutions released in 2019 provide our customers with the means to reduce or eliminate environmental and social impacts, and to improve the efficiency of accessing their assets.

REDUCTION/ELIMINATION

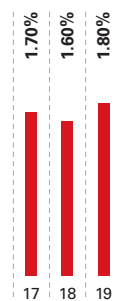
2019 Services/Projects

	DURATION OF JOB / NUMBER OF PEOPLE ON SITE	POTENTIAL FOR SAFETY INCIDENTS	EMISSIONS TO AIR / FUGITIVE EMISSIONS / GHG	FOSSIL FUEL USE	VOLUME OF WATER USED OR PRODUCED	VOLUME OF HAZARDOUS OR HARMFUL MATERIALS / CHEMICALS	SPACE/FOOTPRINT REQUIRED	NUISANCE: NOISE / ODORS / VISUAL INTRUSION	SPILLS OR LEAKS	VOLUME OF NON-HAZARDOUS WASTE PRODUCED	VOLUME OF HAZARDOUS WASTE PRODUCED
BAROID											
Baroid – Polymeric product					•						
Baroid – Water-based mud						•					
Non-damaging drill-in fluid for the drilling of the reservoir section of the KS formation and the aquifer, which has been selected as an injection reservoir to capture supercritical CO ₂ for long-term storage			•								
Use of highly refined mineral and synthetic Group III base fluids to replace diesel and Group 1 fluid						•					
Reinjection of cuttings											•
Dewatering and reverse osmosis for water treatment					•						•
Fluid recycling strategy						•					

Total Research & Development Spend
million USD



R&D Spend as a Percent of Revenue
percent

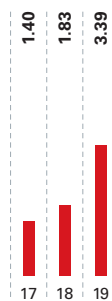


In Huyapari, Venezuela, Halliburton Baroid led a fluid recycling strategy, using 40 percent reused well fluid to reduce the total volume of processed fluid and to minimize waste. All the fluids' properties for reuse were verified in the Fluids Lab prior to use for the next well.

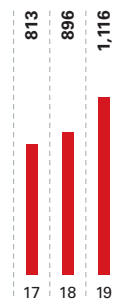


In Southeast Asia, Baroid used magnesium oxide whenever possible to decrease the amount of caustic soda used for pH control in water-based mud drilling fluids, which has helped decrease the amount of hazardous waste produced.

Patent Efficiency
U.S. Patents per USD 1M of R&D Spend



Patents Granted Per Year
U.S.



Technology & Innovation *continued*



In response to our purpose to assist in the reduction of the industry's environmental footprint as a component of being responsible stewards of the environment, Halliburton is testing new initiatives using electric pumps. This innovative service directly addresses ecological concerns by significantly reducing operational noise pollution, diesel emissions and atmospheric contaminants. The resulting benefits will empower our customers to improve their eco-footprints and to support sustainability easily, efficiently and cost-effectively, while also enabling us to deliver the same level of service that they have come to expect from Halliburton.

We have accomplished this vision by heavily investing in the research and development of a new way to power our already proven Q10™ pump. Our approach is a non-conventional, high-power density, natural-gas-turbine-driven mobile power plant. This is coupled with high duty-cycle-rated electrical systems and components to drive our world-class Q10 hydraulic fracturing pump. Our modular approach allows for minimized truck moves and right-sized power utilization for the most efficient power delivery. The continuous-duty components allow for higher asset utilization and an overall leaner operation.

The Halliburton electric solution can be run using highly abundant, 100 percent North American produced natural gas, or with flare gas harvested by third parties. This will deliver significantly lower combustion, resulting in a reduction in nitrogen oxides (NOx), carbon monoxide (CO), unburned hydrocarbon (UHC), particulate matter (PM) emissions and noise emissions than from our already ultra-low emissions North American Tier 4 fleet, which is the largest such fleet in the world.