## **EYE ON INDUSTRY**



**OTTAWA COMPANY INVENTS** breakthrough device that uses fluorescence spectroscopy to change how equipment maintenance is done.

Gastops is the world's leading provider of intelligent condition monitoring solutions. The company's technology is used in Aerospace, Defence, Energy, and Industrial applications around the world to drive maintenance strategies that optimize the availability, performance, and safety of critical assets.

The company has been working with the Department of National Defence and the Canadian Forces for more than 40 years, developing and commercializing condition sensors and data analysis solutions for some of the most sophisticated, complex aviation and naval platforms in the world including the Eurofighter Typhoon, F22, F35, A320. So, when DND issued the All Systems Go! Challenge—one of many challenges that make up the IDEaS program launched in 2019—Gastops was ready.

## The Best IDEaS

IDEaS is an acronym for *Innovation for Defence Excellence and Security*. The program provides funding to accelerate the development of concepts and solutions, and build a defence innovation ecosystem.



Within this program, "All Systems Go!" is a broad solicitation for innovations in the areas of equipment performance prediction and platform maintenance optimization. Specifically, DND challenged industry to leverage new Health and Usage Maintenance System (HUMS) technologies to facilitate a move away from

ABOVE: A Light Armoured Vehicle (LAV) ABOVE RIGHT: Diesel engine room of a submarine  IT'S ALL SYSTEMS GO! FOR GASTOPS' INNOVATION IN OIL CONDITION AND CONTAMINATION MONITORING

by Brett McAteer



the *schedule-based* maintenance of critical assets and toward *condition-based* maintenance (CBM) and, ultimately, true *predictive* maintenance. The objectives of the move to HUMS are to optimize scarce maintenance resources, reduce the cost of ownership and improve the availability and readiness of military platforms.

# From Schedule-Based to Condition-Based Maintenance

Currently, DND's maintenance strategy tends to rely heavily on schedule-based, preventative maintenance activities like lubricant changes, lubricant top ups, filter changes, visual inspections, and functional inspections at set intervals. It is common for equipment to be subject to an overhaul following a predetermined number of preventative maintenance events. The purpose of an overhaul is to bring equipment to a condition allowing operation for another overhaul period. And the time between overhauls is typically based on either calendar time or operation cycles.

This schedule-based approach works well in that it tends to avoid failures and the very costly and even irreparable damage failures can cause. However, when the scheduled maintenance is actually unnecessary, this approach can still lead to spending that could have been avoided and reduces operational capability while equipment is "in the shop". The preferred approach is Condition-Based Maintenance that is performed only when the objectively observed condition of the equipment indicates that a maintenance event is required to ensure continued operational capability. This approach also avoids spending on unnecessary maintenance and because what's going on inside a piece of equipment is not easily observed, CBM tends to take advantage of the objectively observed condition of equipment *lubricants*. Oil carries the signs and symptoms of compromised equipment and deep analysis of oil condition and contamination can even predict equipment condition in the future.

But here again, the traditional approach to oil condition monitoring involves taking the equipment out of service, extracting oil samples, sending them off to a lab for analysis, and waiting for the results. While the traditional approach to CBM does help prevent major problems by assessing the condition of the oil for indications of the health of critical components, there are serious drawbacks: it still takes the equipment off-line for some period of time, and it cannot provide oil condition information *between* oil tests (and, needless to say, equipment failures don't happen according to schedule).

And that's where Gastops' Oil Condition and Contamination Monitor (OCCM) comes in.

## Oil Condition and Contamination Monitor by Gastops

Even before the All Systems Go! challenge, Gastops had been engaged in research into and development of an OCCM solution that could be installed on operational equipment to provide real-time insights into critical oil condition properties that can indicate equipment condition issues. The company envisaged



ABOVE: Excitation-Emission Matrix Spectroscopy of Lubricating Oil ABOVE RIGHT: Harry DeWolf AOPS ship



OCCM as a stand-alone HUMS and as a "plug and play" addition to existing Equipment Control Module (ECM) solutions.

A proposal to move that R&D effort forward and prove that OCCM was both technically and commercially viable was submitted and funding was awarded to help take OCCM from engineering concept to functional prototype and, in doing so, to demonstrate Gastops vision of a diesel engine HUMS solution.

The project focused on identifying equipment conditions related to failure, sensing (in the lubricating oil) the presence and measuring the severity of those conditions while the equipment is in operation, and using advanced data analysis and Machine Learning (ML) technologies to generate actionable inputs to CBM planning activities.

With Gastops' decades of experience and a full portfolio of oil condition monitoring products and services already in the market, knowing what to measure and why was the easy part. The true challenge lay in engineering a sensor technology that could sense and measure three key critically important oil properties: antioxidant depletion, fuel dilution, and coolant/water contamination, and to do it in real-time, while the diesel engine was running, a status known as *on-condition*.

#### Putting Oil Condition in a New Light

Fortunately, Gastops' research team had already identified the best candidate for that sensor technology: fluorescence spectroscopy.

The company had previously shown that fluorescence spectroscopy can be used to analyze complex mixtures of oil, antioxidants, fuel, coolant and water, each of which "glows" a different colour when exposed to ultra-violet (UV) light.

With the IDEaS/All Systems Go! OCCM project, Gastops packaged fluorescent spectroscopy conducted through an optical fibre probe in a small on-condition OCCM hardware package to detect diesel lubricant antioxidant depletion, quantify fuel dilution in diesel lubricants, and quantify water content in diesel lubricants. Gastops has created an industry first; a state-ofthe-art on-condition sensor and analytics prototype product for evaluating oil condition and oil contamination.

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## A HUMS Solution by Gastops

The success of the OCCM project points to the real potential of a stand-alone or ECM-compatible solution that can monitor oil condition continuously without reducing operational readiness and help equipment owners and operators avoid unnecessary spending on scheduled maintenance. Such a HUMS solution has the potential of shifting oil change activities to an on-condition basis, generating significant cost savings and creating opportunities to optimize maintenance programs—a critical step

# MILITARY WOMAN ... CONTINUED FROM PAGE 19

One request is to immediately find funding options for charities, like Veterans Transition Network, that provide lifesaving supports to the Afghanis awaiting Government of Canada final paperwork processing prior to their ability to leave Afghanistan.

To Carolyn Bennett, Minister of Mental Health and Addictions: Present mental health and addiction prevention and treatment strategies require a radical redesign to become

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#### RECOMMENDATION

NCVA recommends that VAC provide substantial financial funding to bolster the Veterans Emergency Fund to increase the maximum benefits per claim and to prioritize these applications during these challenging times. VAC should consider the utilization of the Veterans Emergency Fund as a stopgap measure for veterans awaiting disability pension claim decisions which have been inordinately held up by the current backlog conundrum. **RECOMMENDATION** 

NCVA proposes that VAC simplify veterans' legislation and

#### BETWEEN THE COVERS ... CONTINUED FROM PAGE 42

Understandably, such an issue might be difficult for Carvin to address without facing criticism.

In September 2020, Carvin proudly revealed on social media that years ago she was the one who had baked a series of controversial cakes celebrating targeted killings by U.S. drones.

The cakes, baked when Carvin was working with the Canadian government in national security, had already attracted significant outrage when they were first revealed online in 2013 but Carvin's role was anonymous at the time.

The U.S. drone program has killed a number of terrorists but has also claimed the lives of thousands of innocent Muslims. Carvin's 2020 admission and her arguably flippant attitude towards such killings prompted an immediate backlash. She was labelled a racist. More than 1,100 people signed a petition condemning Carvin's actions but Carleton University declined to do anything. Carvin eventually apologized.

The controversy soon disappeared and Carvin continues to be sought after by some journalists for her expertise, including on concerns about growing Islamophobia in Canada. For instance, toward the true *predictive* maintenance capability envisioned by the DND's IDEaS program.

"OCCM will build on Gastops advanced monitoring technology coupled with data fusion and modeling techniques to provide new intelligent engine condition insights to operators and maintainers of diesel engines, said Greg Horwich, Gastops' Product Manager for Condition Monitoring Services. "We're excited to be on the leading edge in HUMS solution development and pushing beyond the limits of the current industry capability!" \*

more inter-disciplinary, whole-health, and patient-care centric including for servicemembers and Veterans. Hopes are high that this new portfolio will serve to disrupt the ineffective status quo.

**To all:** Building Canada "back better" this Parliament, will need everyone working together for the well-being of all Canadians, servicemembers and Veterans included.

regulations so as to provide a more "user friendly" process and, in so doing, eliminate the complexities and legalistic provisions currently confronting veterans in making disability/health care claims. **RECOMMENDATION** 

NCVA takes the position that, to ease the transition from DND to VAC, disabled veterans should be fully apprised of benefits and entitlements, rehabilitation options and job alternatives, well before their medical discharge from the Canadian Armed Forces. **\*** 

Part 2 & 3 coming in January & February issues.

she was sought out by the media in the summer of 2021 after a Muslim family was murdered in London, Ontario.

For some, however, that was the height of hypocrisy.

"Some of the very same "national security experts" responsible for legitimising the demonising discourse of "Muslim extremism" are now being treated as authorities on how to fight anti-Muslim extremism," legal academic Azeezah Kanji wrote in an opinion piece published by Al Jazeera in July. "Professor Stephanie Carvin, for instance, was exposed last year for baking cakes that celebrate Muslim drone deaths, yet continues to be quoted in media analyses of the London killings – proving that it is entirely possible to have your Islamophobic cake and eat it too."

Undoubtedly, Carvin's friends in the national security establishment will be more than happy with her new book. And there is no question *Stand on Guard* will be placed on the reading lists at the Royal Military College, the Canadian Forces College as well as in various courses for government employees involved in national security.

But ultimately the book adds little of value and does nothing to advance the examination of the new threats Canada may face in the future. \*