Flying into the future

A squadron leader is conducting PhD research on alternative aviation fuels with solid prospects of reducing reliance on fossil fuels, Barrie Bardoe reports

Squadron Leader Ultras Vikram of the Defence Aviation Authority has been working on something quite unusual for an Air Force officer – an Army Combat Badge awarded during a deployment to Afghanistan.

With two other Air Force deployments to the Middle East under his belt, he has considerable operational experience. But it is his PhD research into alternative aviation fuels that may well continue in delivering capability.

In 2012, he was promoted to SQNLDR and was posted to the Joint Fuels and Lubricants Agency as the Petroluem, Oil and Lubricants Engineer, a role that quickly led to an interest in alternative aviation fuels, the beginning of a journey that may prove to be a key contribution to ensuring the way the Air Force flies into the future.

"Due to various organisational changes, I was required to take on the role of Chief Engineer responsible for ADF Petroleum, Oil and Lubricants (POL) at SQNLDR Vikram said."

"This is where I first mentored, seeing I had finished experience in this area."

To fill the knowledge gaps in my new role, I decided to study, in my own time through the Royal Melbourne Institute of Technology, initially I undertook a Master's degree and then moved into a PhD in aerospace engineering.

"I am now the eyes into my mind, which delve into applied chemistry and gas turbine technology, investigating the effects of modern alternative fuels on aircraft gas turbine performance," he said.

"It may seem hard to credit, but there is a lot of variation of fuels, which may affect performance. World jet fuel specifications are based on decades of accumulated experience developed through testing and trials," SQNLDR Vikram said.

"Due to jet fuel's complex nature, rather than defining its composition, jet fuel specifications are based primarily on performance specifications relying on accumulated experience."

"Criteria such as flash point, freeze point, volatility and so forth are established by engine manufacturers to ensure the fuel's performance is consistent with use."

"However it is not known what role many nutrients in jet fuels currently play, if any, in influencing their properties. We have opened up the possibility that fuels derived from alternatives to fossil fuels with fewer nutrients may in fact do the job just as well."

"New generation fuels are produced using different biomass such as algae, wood, and forestry waste, to name a few," SQNLDR Vikram said.

"This creates a situation where the new fuel has much lower hydrogen content than that of hydrocarbons."

"However, the impact of these new fuels and their performance within gas turbines must still be known."

"One possible issue is increased wear and tear on jet engines, and issues with fuel tank leaking to potential fire."

"Normal testing would require extremely large quantities of fuel, and we are trying to speed test, but SQNLDR Vikram is using a small gas turbine engine to replicate use patterns of the real thing."

"The quest for alternative aviation fuels is becoming a high priority with fossil fuels being a finite resource, and demand increasing," he said.

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