THE FIRST FIGHTER PILOT IN THE WORLD TO RETURN TO FLYING AFTER DISC REPLACEMENT SURGERY

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Col. Todd Hofford, 142nd Fighter Wing Vice Commander and newly reinstated F-15 Eagle fighter pilot, prepares for his first official flight since undergoing cervical disc replacement surgery, December 4, 2019, Portland Air National Guard Base, Ore. Col. Hofford recently completed the near three-year process of obtaining a waiver to fly a high G aircraft with a prosthetic disc in his neck, making him the first person in the world to do so. (U.S. Air National Guard photo by Tech. Sgt. Steph Sawyer)

On a rainy December afternoon, pilots are suiting up for their afternoon sorties. Among them is Col. Todd Hofford, a 27-year Air National Guard member and F-15 Eagle fighter pilot with more than 2,500 hours of flying under his belt. Although there have been many such days for Hofford, this one is significant. Three years of unyielding patience and perseverance have led up to this day: Hofford's first official flight since having cervical disc replacement surgery.

Hofford's return to flying status is not only a personal milestone but also one for the U.S. military and the medical community, because Hofford happens to be the first fighter pilot in the world to return to flying a high-G fighter jet after disc-replacement surgery.

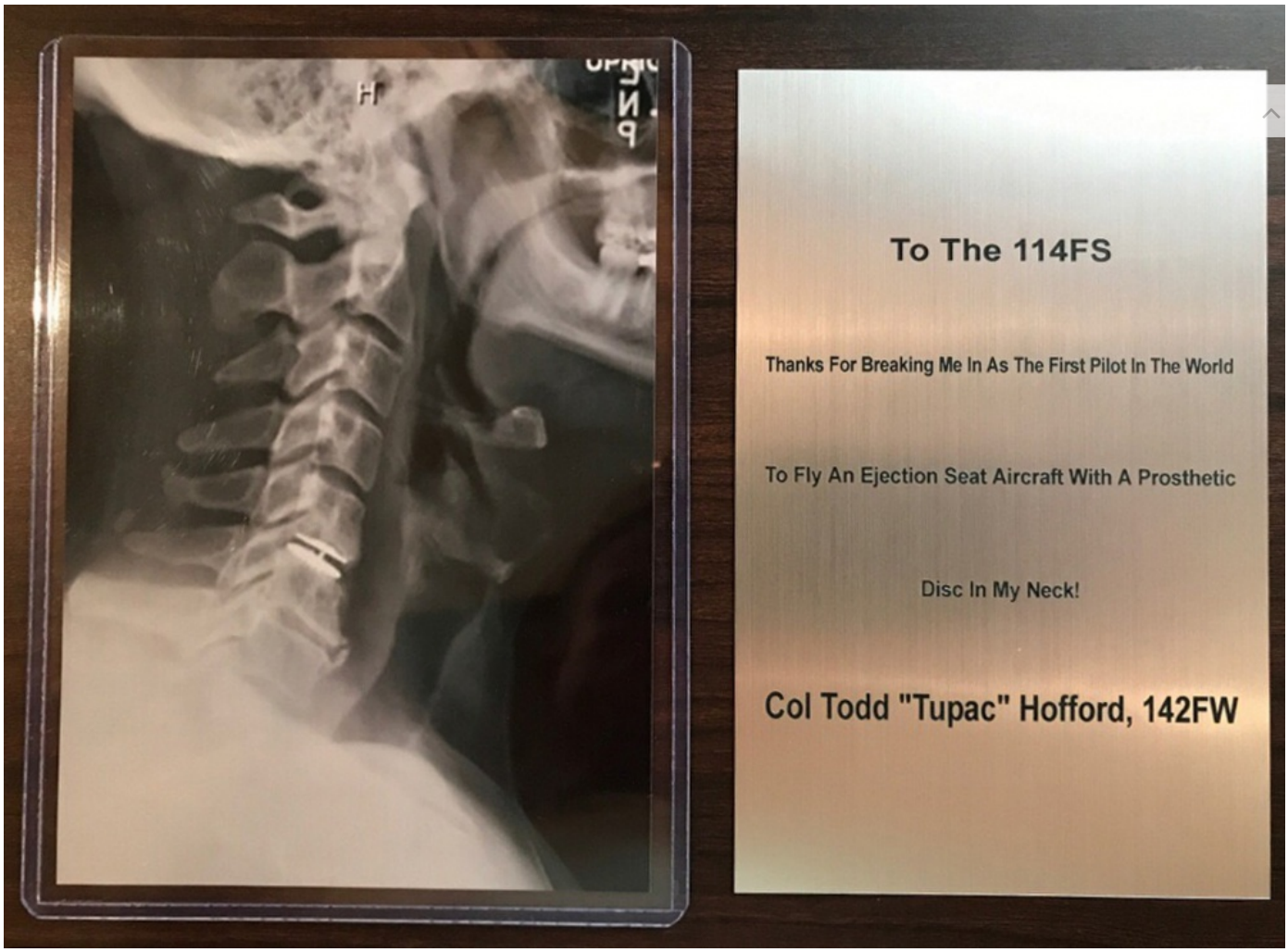
As told by Tech. Sgt. Steph Sawyer, 142nd Fighter Wing Public Affairs, in the article Reinstated pilot first to F-15 Eagle with the cervical prosthetic disc, Cervical injuries are common for fighter-jet pilots. While anyone can suffer degenerative disc disease including herniations, the extreme conditions fighter pilots face significantly increases the rate of occurrence. A 2018 dissertation published by the University of Jyvaskyla in Finland found that 89% to 93% of fighter pilots had spinal disorders over their lifetimes.

The average human head weighs about 12 pounds. The Joint Helmet Mounting Cubing System pilots use adds another 6 pounds. For a pilot pulling 9 Gs, that is a pressure of nine times the force of gravity. A pilot's 18-pound head is now a 162-pound head, which the bones and muscles of the neck must support and maneuver. Over time, this takes a toll on the spine.

For Hofford, the herniation in his cervical spine started in 2014 with a knot in his back where the muscles were trying to compensate for the compromised disc. Then came pain in his arms and tingling in his fingers. Then, in August 2016, he had a complete loss of strength in his right arm. It became clear that surgery was necessary.

Historically, the medical procedure performed to correct a disc herniation is a spinal fusion, where the herniated disc is removed and the bones on either side of the disc are fused together.

With single-level spinal fusion surgery, pilots historically have been able to recover and return to flying. Still, the problem with this procedure is that by taking two vertebrae that are designed to move and fusing them together, some range of motion is lost. This causes more movement in the segments next to the fusion to compensate for lack of motion at the fused section, causing additional wear. As a result, these adjacent segments often go bad, requiring additional surgery.



Col. Todd Hofford, 142nd Fighter Wing Vice Commander, Portland Air National Guard Base, Ore. presented a plaque to the 114th Fighter Squadron at Kingsley Field Air National Guard Base, Ore. where he requalified to fly the F-15 Eagle post cervical disc replacement surgery. The plaque features a post-operative x-ray of Hofford's neck, November 2019. (courtesy photo)

The problem drove medical professionals to try to preserve motion with artificial disc-replacement surgery.

> *"We now have the ability to put a new disc in the neck or the back that actually moves for those patients," says Col. John Hall, Air National Guard assistant to the command surgeon and an orthopedic spine surgeon in a level one trauma center in Flagstaff, Arizona. "It restores normal motion at that level and it reduces the rate of adjacent segment degeneration in the neck by 80%."*

Hall is enthusiastic about what disc replacement could mean for military pilots.

Unlike spinal fusions, a disc replacement doesn't hinder the natural movement of the spine. This lessens the likelihood of more surgeries in the segments next to the prosthetic disc because the body won't have to compensate for lack of mobility.

Disc-replacement surgery is relatively new. It's been practiced in the U.S. for approximately 12 years and in Europe for about 20 years. Because it's new, the Air Force only allows pilots with artificial cervical discs to fly low-G aircraft – not fighter jets.

After learning about the benefits of disc replacement, Hofford underwent surgery in September 2016. He made a full recovery and was cleared by a civilian neurosurgeon to fly, but found out that the military would not clear him to return to flying the F-15.

Hofford knew that if he wanted to fly the F-15 again, he was going to have to make a case for himself and find experts to advocate for him.

> *"I was determined to turn this around," Hofford said. "I knew it was going to take time. I needed to be patient."*

Hofford worked with a physical therapist who developed Fit4Flight, a program to prevent and treat injuries caused by the strain of flying military aircraft. He was also monitored by Hall, who, through his unique experience, believed that getting these devices approved for flight in fighter aircraft stood to benefit both pilots and the military.

"I think I'm the only person in the world who has more than 300 hours in fighters and has put in more than 400 artificial disc replacements," Hall said. "I realized with my experience in tactical aviation and as a spine surgeon, there was a possibility that we would be able to return these people to their full flying duties."

For Hall, the opportunity to work with a pilot who has had the surgery and was willing to go through the arduous process of becoming cleared to fly presented the opportunity to impact the lives and careers of future fliers.

> *"With advances in the field of medicine in general and spine surgery in particular, we found that aviators were getting the gold-standard surgery – artificial disc replacement," Hall said. "But by doing so, it was costing them their careers, and to me that was unacceptable. So, my motivation was to try to evaluate the ability to safely marry this new technology with the demands of fighter aviation."*

In 2016, Hall began a nearly three-year process with Hofford to get him cleared to fly the F-15 with the prosthetic in his neck. Hall researched the worldwide scientific literature regarding the ability of these discs to withstand the rigors of tactical aviation and used computer modeling to analyze crash scenario data, a proxy for the forces that the neck would experience during an ejection sequence.

"I felt that although returning someone to tactical aviation with an artificial disc in their neck was not entirely risk-free, the risk profile was very low," Hall said.

He worked with the Acceleration Branch at the 711th Human Performance Wing at Wright-Patterson Air Force Base, Ohio; the Medical Standards Directorate of the Air Force in Washington, D.C., as well as the Aeromedical Consult Service, the surgeon general of the Air National Guard, and the Air National Guard's chief of aerospace medicine.

After several meetings, PowerPoint presentations, conference calls and reviews of the scientific data, Hofford arrived at Hall's practice in Flagstaff for a full physical exam and X-rays. Next, Hall put him through an F-15 re-evaluation in the centrifuge at Wright-Patterson AFB to see how well his neck would stand up to the forces one would experience in flight. Hofford passed these evaluations with outstanding results.

Based on Hofford's physical performance, Hall and his team elected to grant him an unrestricted waiver to return to flying the F-15. Hofford is now the first member of a study to evaluate his physical condition as he continues to fly.

For Hofford, obtaining this waiver means being able to continue serving his country and the state of Oregon as an F-15 fighter pilot.

> *"It's a privilege and an honor to be able to fly, fight and win in one of our weapon systems," Hofford said. "I'm connected to the mission. I get to be part of protecting the homeland, and that's extremely meaningful."*

Since Hofford's requalification and return to flight, five more pilots have begun the process of being evaluated to return to fighter aviation after disc-replacement surgery.