ARMY'S SMALL ENGINE SEALS ACTIVITY AND INTEREST

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Bob Bill is the director of our activity here in Cleveland, the Army activity, which has about 50 people integrated into the NASA work force. Specifically, I guess two of our people, I think, at least one of them, is working directly with Bruce and Bob in the seals area.

Looking back over the past month, we've had the IHPTET workshop down in Dayton and shortly after that the publication came out and we had ten pages of all the goodness that has been going on in IHPTET over the past year. IHPTET now is ten years old, Integrated High Performance Turbine Engine Technology, and I was realizing we're about as integrated as they come when we start approaching the seals area. The integration comes from the fact that we're trying to work with controlling the secondary airflow, and in addition to that we're impacting the primary airflow stream, and we realize significant benefits like Bruce has mentioned and Bob may mention. We were involved with Bob and Bruce, Bob mainly about 5 years ago, testing on a GE engine, integrating, an advanced brush seal into a location, the CDP area, where we had labyrinth seals in the past. We demonstrated through both a reduction in the secondary airflow and the impact that had on the primary stream that there was about a percent decrease in SFC. That's just by insertion of hardware, not by trying to optimize the cycle in any way.

In addition, we've been involved with Bruce and the folks at what used to be Allison, in that study that they've mentioned. In addition to the AST investigation they looked at the military side, and we are the small military side, the small, 500 to 5000 horse power people. The investigation showed that by strategic utilization of enhanced sealing concepts we could probably benefit about 5 percent in SFC, fuel savings. So again, the studies have shown that the potential is there, and the experimental work has shown that this isn't just some handwaving that people are doing on the computer. It really is there. I imagine you are going to hear as the day goes on that there are more examples that show this is really here.

We are integrated. I was trying to work up a catchy acronym, because the military can't do without it. If I use Analytical and Experimental Integration Of Seals, I almost have the AEIOU. The U wouldn't come.

Back to IHPTET. We are talking with the Phase IIIs and beyond, going to 30:1 pressure ratios, thinking about 50:1 pressure ratios, high shaft speeds, high temperatures where the seals are engaged. The need is there to address the material problems, the tribology problems. And some of that activity is ongoing thanks to the fact that we have been able to get into bed with Bob and Bruce in the seals program, the Army is apt to benefit. Our

application, those small engines, are going to win, because of the work that's going on both with and in our work with NASA and with industries that we've been able to do.

I need to mention also, my comments will be short, the Army, in addition is looking at some advanced concepts beyond IHPTET, or for IHPTET phase III if the normal compression system thoughts don't come through. We've come up and have been working with NASA again on a topping device called a wave rotor. It's actually out of the 40's and 30's and so on. But we are trying to do analytical work to make ourselves better ready to use that device in a less lossy manner. What it's showing is that seals are important in this device. If we approach the pressure ratios we are going to be dealing with and end up with these blades in the last stage of the compressor that are a quarter inch high and we don't know how to manufacture them, and we're dealing with high temperatures, the wave rotor may be a way around this. But the wave rotor won't perform unless we have the seals. Some of our experiments have shown seals will solve some of the component problems.

So whether we are talking IHPTET in our small engine sizes where we know that the benefits are there, or some of the advanced concepts that are really off the wall, we generated cycles too that work. Seals are important and will be important. Materials will not solve those problems. Aerodynamics will not solve those problems. Working on the seals themselves and the work that you are going to see, that not only Bruce or Bob have been doing, but you folks out there will help us through the next ten years. That's about it. Thank you.