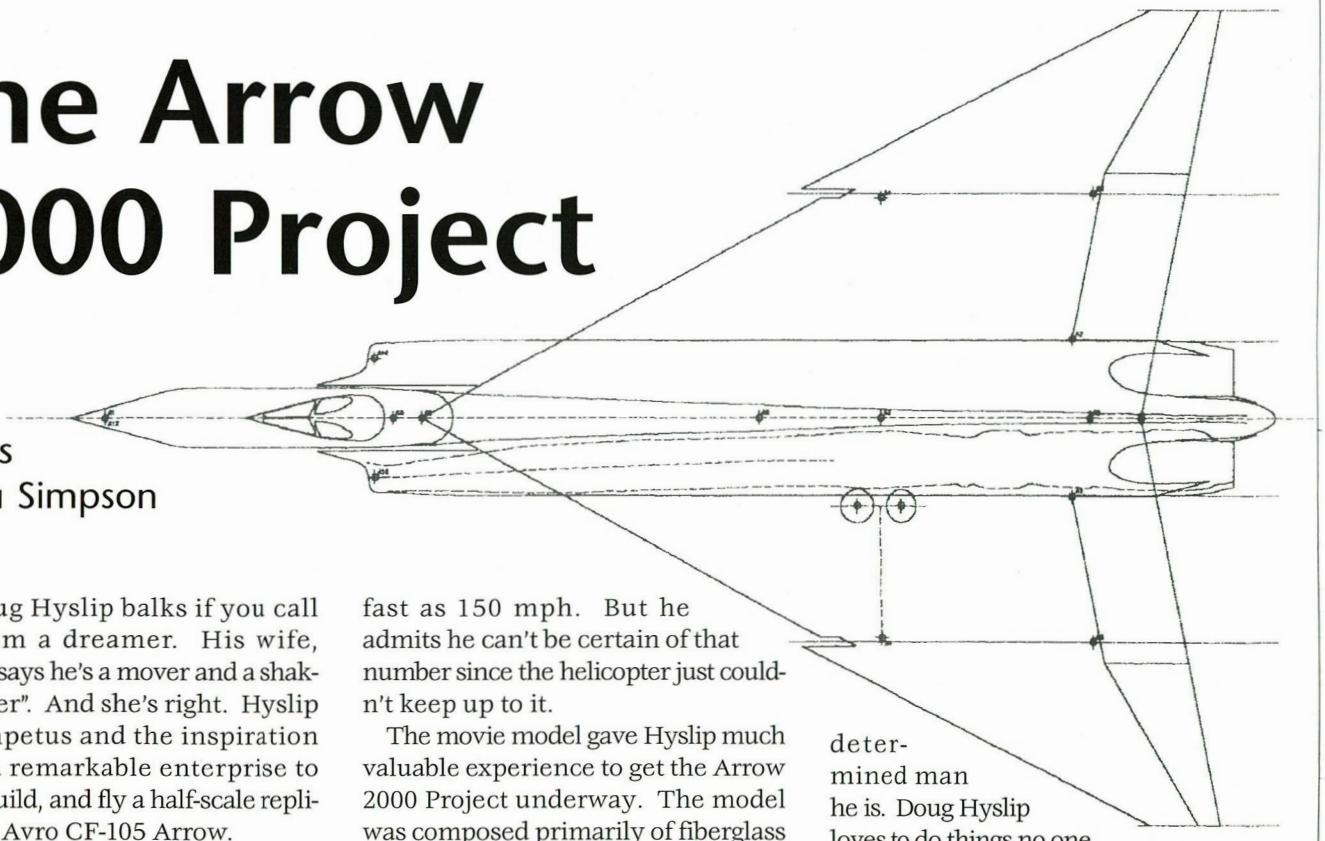
The Arrow 2000 Project



story
&
photos
by Stu Simpson

Doug Hyslip balks if you call him a dreamer. His wife, Donette, says he's a mover and a shaker, a "do-er". And she's right. Hyslip is the impetus and the inspiration behind a remarkable enterprise to design, build, and fly a half-scale replica of the Avro CF-105 Arrow.

Creating a manned version of Avro's most controversial aircraft seems to be a natural course of events for Hyslip. He's already built one flying model of the Arrow, and most readers have likely seen it. He produced a 1/8 scale radio- controlled model of the CF-105 for CBC's presentation of 'The Arrow', which aired on television earlier this year. Hyslip took actual Arrow drawings and scaled them down to make the model.

Most of the flying scenes in 'The Arrow' depicted the jet in majestic solo flight over the Canadian Shield. In truth, Hyslip was controlling the miniature from the seat of a movie helicopter above the prairie near Calgary while a camera operator got the required footage. Hyslip estimates his mini-Arrow travelled as fast as 150 mph. But he admits he can't be certain of that number since the helicopter just couldn't keep up to it.

The movie model gave Hyslip much valuable experience to get the Arrow 2000 Project underway. The model was composed primarily of fiberglass and was powered by a pair of ducted fans, which are very popular in the RC model world. As we'll see, the remotely controlled miniature has a lot in common with its incubating big brother.

"I've Always Been Intrigued By This Airplane"

I interviewed Hyslip in his well-kept RC-model supply store in east Calgary. His shop isn't exactly what one might expect for the headquarters of a project that's sure to eventually attract world-wide attention. Hyslip seems to be the epitomy of easy-going; calm and soft-spoken. Until you get to know him, you don't really notice what a truly driven and determined man he is. Doug Hyslip loves to do things no one else has done. "If it isn't a challenge, I don't get involved," he says.

As we talked about the Arrow 2000, Hyslip became increasingly excited. His eyes lit up as he proudly displayed the reams of research data acquired so far. It became abundantly clear that Hyslip loves the Arrow. "I've always been intrigued by this airplane," he stated.

Much as he loves a challenge, Hyslip is smart enough to know that he can't undertake something like the Arrow 2000 on his own. So he's formed a charitable non-profit society and has assembled a band of talented volunteers to manage the various specialty areas the project requires.

Twelve people are currently active and working on the project. Each is an established professional in his or her specialty. There are design engineers, as well as advisers for things like insurance, legal issues, and accounting. Hyslip also has about 60 resume's on hand for other volunteers who want to get onboard. The entire enterprise carries

an air of well-planned professionalism all about it.

Where Do You Start?

So, where would someone start gathering material for something like this? Hyslip answered that question by leading me to a stack of duotangs and binders more than a foot high. Each was a photocopy of an Avro technical report on some aspect of the original Arrow's perfomance or specs. Flipping through the stack, I saw titles such as, "CF-105 Flying Control System, Volume 1", and "CF-105 Structural Integrity Flight Test Program". Some of the reports were so large as to require two volumes.

Hyslip and his volunteers have accessed the original service manual, as well as the research and engineering data for the Arrow, including structural drawings. There's certainly no shortage of research material, all of which has been incredibly helpful to the engineering staff.

"According to our design people," Hyslip says, "this stuff is exceptional." He refers to both the quality of the reports, as well as the quality of the data. "In fact," he adds, "the original Arrow's navigation system would still be acceptable today." It's amazing to think that Avro's people achieved so much with the primitive computers of the 1950's.

Technical Difficulties

Like any endeavour of this type, there are hordes of engineering problems to overcome. The first one Hyslip encountered was the design constraints that he'd be forced to work within. See, when you boil it all down, the Arrow 2000, despite it's unique nature, will still be a homebuilt aircraft. And that means it has to conform to the requirements of Chapter 549.

Chapter 549 of the air regs lays out the limits, the standards, the minimums, and the maximums for amateur-built planes in Canada. Most homebuilders can recite it chapter (pun intended) and verse.

Upon studying Chapter 549 Hyslip realized two things right off the bat.

Doug Hyslip, the man behind the Arrow 2000 project.

First, the Arrow 2000 would have to weigh less than 3968 lbs at gross. That rule immediately limited the plane to about 1/2 scale. Secondly, the powerplant had to be of a displacement type. In other words, Hyslip's Arrow must have piston engines, no jets allowed. Right away he started thinking ducted fans (simply put, a ducted fan is an engine and small-diameter propeller buried inside a plane. The fan ingests air through ducting similar to a jet's intake, then blows it through an outlet at the rear of the plane, similar to a jet exhaust, thereby providing forward thrust).

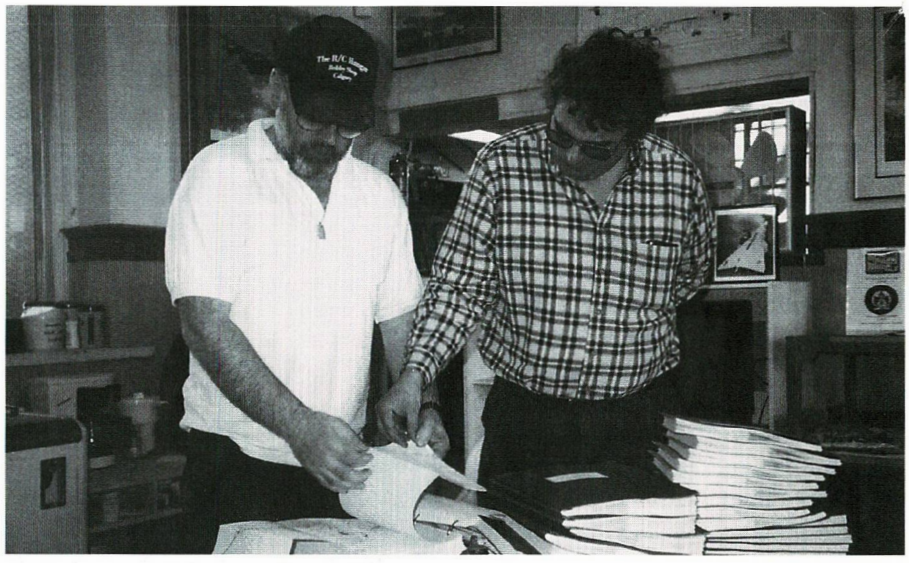
There were other things to consider, too. For instance, the wing loading had to be less than 13.3 pounds per square foot. And how could he fit a full size pilot into a half-scale airplane?

Fortunately, technology came to the rescue. Hyslip's engineers tell him that the Arrow 2000 will come in at around three thousand pounds gross, which gives nearly a thousand-pound margin for error. The secret here is that the designers will use composite materials for the airplane's primary structure (remember the movie model?).

Composites offer the best strength-to-weight-ratio. "We'll be researching a lot of the Rutan technologies," Hyslip adds. One has to wonder what Avro's engineers could have done with such materials.

Composites will help keep the weight down, but things will still be tight with the wing loading. It's projected to be just shy of thirteen pounds per square foot at gross weight. As for the cockpit, Hyslip concedes it'll have to be a bit larger than 1/2 scale if anyone other than a midget is to fly his Arrow.

Without a doubt the single biggest challenge Hyslip and his team face is finding a suitable set of engines. Initially the design team looked at



Doug Hyslip, Paul Gies and some of the technical reports they've acquired on the Arrow. Gies is responsible for engineering on the project.

installing a pair of 280 hp Mazda rotaries in a ducted fan configuration. Then Hyslip heard Pratt & Whitney has had a ducted fan engine in development for quite a while. He's currently investigating this angle.

If engineering estimates are anything to go on the Arrow 2000 could post some sparkling performance figures. The project's technical staff expect the the home-made Arrow to challenge Chapter 549's 250 mph speed limit. Limit load factors will be in the neighborhood of +6/-3.5 Gs. And if the designers can come up with something like 500 horsepower, it ought to climb like a homesick angel. "The airframe will certainly be capable of it," says Hyslip. "Our biggest limitation will be the powerplants."

Hyslip's group is planning, at this stage anyway, for an endurance of only about two hours. That's because the replica will only be flown during airshows. Right now, Hyslip can't see a need for any more fuel.

Putting It To The Test

The research and testing phases of the project sound particularly interesting. For example, project personnel are planning to build yet another radio-controlled model of the Arrow. This one will be twice the size of the movie version, or about 1/4-scale. That means it'll be twenty feet long with a span of thirteen feet. The model will carry a sophisticated telemetry system to transmit flight test data to ground crews.

Then the designers want to build a full scale structural mock-up of the plane. They'll test that one to destruction to see if the numbers add up like they should.

With the data gleaned from the first two test programs, they'll finally be able to build the real thing, hopefully beginning in the year 2000. Hyslip says project staff have allowed themselves a total of eleven years to complete their task. "It took 30,000 people five years to build the first Arrow," he adds, "it'll take us a bit longer to build this one."

Why Bother?

With more than ten years of hard, hard work ahead of him, I just had to ask Hyslip why he was doing this. One of the reasons is that he and his group of volunteers want to collect and preserve any and all artifacts relating to the CF-105.

"But mostly," he said, "we want to acknowledge and honor the incredible achievements of the people who designed and built Canada's Avro Arrow."

If you can think of a better reason, let Doug Hyslip know.