*Personal recollections*

# Vehicle Platforms in the Office of Research and Development

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The day Sputnik went into orbit in 1957, I was interviewing with Melpar, Inc., primarily an electronics firm, in Falls Church, Virginia. They needed a physicist to work on a contract [redacted] This led to a published article in the early 1960s and several contracts with the Agency's newly formed Office of Research and Development (ORD), located in the Ames Building in Rosslyn, Virginia.

In 1966 I joined ORD to work on the Aquiline project. This was to be a small unmanned vehicle, shaped like a bird, that would augment the U-2 as a reconnaissance platform. Its major asset supposedly was its low cost. As a contractor, I had briefed Bud Wheelon, the Deputy Director for Science and Technology, on several occasions, and I asked him how the U-2 was developed. He said, "It was very simple, we found the best aerodynamicist in the business, Kelly Johnson, and told him to build the most reliable vehicle that would get our sensors over the target and home again." Unfortunately, this was not to be the strategy for developing Aquiline.

ORD was an ad hoc group with no official charter. Its primary assets were a few dynamic individuals with vivid imaginations. Two such people were Dave Christ, the division chief and driving force behind Aquiline, and Don Reiser, his deputy. Many were new employees like Frank Briglia, hired as project manager for Aquiline, and C. V. Noyes, who, as a potential contractor, wrote such a good proposal that Dave decided it would be cheaper to hire him.

Dave Christ was good at identifying advanced concepts and a master at selling to upper management. Don Reiser could milk the most from technical people and contractors. His efforts in low-voltage transistors and micropower electronics were among the first significant successes in ORD.

The third important member of this team was a consultant named [redacted] A mathematician by nature and an electronics engineer by trade, [redacted]

My addition to this team was to fill the gap in aerodynamics and to feed Dave's dream of a family of vehicle platforms that would span the next 20 years. The first two were Aquiline and its little-known successor, Axillary.

## The Aquiline Project

Dave Christ delighted in describing his first meeting with Douglas Aircraft: "I told them we wanted an unmanned aircraft that would fly over 1,000 miles, have an autopilot with complete on-board navigation, a payload of a few pounds for taking pictures or collecting intelligence of one kind or another, a wing span of only 10 feet or so, and look like a bird."

The first challenge was to construct an initial operational capability (IOC) vehicle that looked like a large model airplane. The first attempts to fly the IOC ended in crashes, and I mentioned to Frank Briglia that the

Douglas team knew nothing of the sport of making and flying radio control (RC) aircraft and that perhaps they needed such a person on the team.

Douglas did try to fly model airplanes, but their test pilots had little skill in RC flying and more crashes followed. Frank concluded that the solution was to forego further RC tests and to push ahead on the autopilot development that he felt would avert further problems of human error. He wanted the next flight to be fully automatic.

As the flight test grew near, Don [redacted] and I left for the test site at China Lake, California. The facilities, the flight planning, and the previous test results were impressive, and the Douglas team was confident that a successful flight would vindicate the past failures and large costs that had plagued the project.

The countdown the next day seemed to take forever. Finally, the engine was started, and the vehicle's umbilical cable was disconnected from the site trailer. Once the vehicle was launched, it passed over the edge of a cliff, rotated 90°, nose down, and disappeared from view. Those who walked to the cliff's edge knew what they would see on the rocks below.

Back at Ames, we received the call from Douglas explaining that the longitudinal accelerometer had experienced high acceleration as the vehicle traveled down the launcher. This caused the autopilot to believe the nose was pointed up, and the control surfaces were in the nose down position as it passed over the edge of the cliff.

Don Reiser obtained all test data and autopilot schematics from Douglas and told me and [redacted] to complete a full stability and control analysis as soon as possible. I told Frank Briglia that the analysis showed no stability margin at all and that, in all probability, the vehicle would have crashed in the last test even if the accelerometer had been properly locked out during launch. This analysis was soon confirmed by Douglas, saying they overlooked the necessity of giving the latest autopilot parameters to their control system analyst.

A running battle soon developed with Dave Christ and Don Reiser putting great pressure on Frank to take a firmer hand with Douglas. Eventually, Frank elevated himself to unsupervised director of the project. I lost contact at this point, but I was not surprised some years later when Aquiline was "mothballed" with a price tag of $30 million.