

## Case study

# Sage Cheshire Aerospace

## HP Z Workstations analyze data from record-breaking jump



### Industry

Aerospace

### Objective

Enable skydivers and astronauts to safely egress from high altitude by gathering scientific data and studying human physiology for future space missions

### Approach

Use HP Z Workstations with NVIDIA Quadro K4000 graphics and SolidWorks software for rapid-iteration design, fabrication and testing

### IT matters

- Unleash creativity with realistically rendered 3D design
- Rapidly iterate the design, fabrication and testing cycle
- Intensive analysis yields lifesaving accurate results

### Business matters

- Compete with larger firms
- Safety first
- Gather, simulate, and rapidly analyze scientifically valuable data



**“The compute power of the HP Z Workstations lets us go back and forth between design, fabrication and testing in rapid iterative cycles.”**

– Art Thompson, CEO, Sage Cheshire Aerospace



### Aerospace pioneers analyze data using HP Z Workstations

On October 14, 2012, Felix Baumgartner became the first human to break the sound barrier without the use of a vehicle, the first to jump from so high in the stratosphere, and the first to free-fall at Mach 1.25. The data he generated extends scientific understanding of human physiology in egress, and will benefit space programs for years to come. The aerospace company undertaking the project was Sage Cheshire of Lancaster, Calif. Key tools for analyzing all this data and improving human physiology safety for egress from high altitude are HP Z Workstations powered by NVIDIA graphics and SolidWorks 3D modeling software. They provide the computational power to compress development and testing cycles for speed, lower cost and unleashed creativity.

## HP recommends Windows.

Sage Cheshire is a small aerospace company in Lancaster, California, approximately 30 miles from Edwards Air Force Base. Its CEO, Art Thompson, started his career in the 1970s working for Northrup on an aircraft that became the Stealth Bomber. Today he prefers to run a small, nimble company that can take on interesting challenges and solve them fast, through parallel-process teamwork. Sage Cheshire engineers and composite-fabrication specialists work on highly advanced design, research and development, prototype, and production of commercial and military aircraft. Many of them have held high-level security clearances. One day in 2005, a friend of Thompson's, former military parachutist Felix Baumgartner, called to ask if Thompson had any ideas how to break a world record that had stood for half a century. In 1960, U.S. Air Force Col. Joe Kittinger had jumped 20 miles above the earth's surface into the fastest free-fall in history. People had died trying to best that record. Could Baumgartner succeed, and in the process generate valuable data for future space missions? That's how project Red Bull Stratos began—and how HP Z Workstations became part of aerospace history.

On October 14, 2012, Felix Baumgartner stood in the doorway of a capsule 24 miles above the earth's surface, stuck his foot out, and jumped. Over the next nine minutes he became the first human to break the sound barrier without the use of a vehicle, the first to jump from so high in the stratosphere, and the first to free-fall at 843.6 miles per hour and hit Mach 1.25. The data he generated on the way extends scientific understanding of human physiology in egress, and will benefit space programs for years to come.

**“We were taking Felix into a very hostile environment and had to make sure we brought him down safely. Not only did we have someone's life in our hands, we had an opportunity to advance scientific knowledge for the future.”**

— Art Thompson, CEO, Sage Cheshire Aerospace

Every detail of the project had been designed, tested and retested by an extraordinary assemblage of aerospace engineers, a Space Shuttle commander, and even record holder Kittinger himself as a consultant. The experts

in turn relied on the power and reliability of HP PCs to support their creative process, and now use HP Z Workstations to analyze the data generated during Baumgartner's jump. How the Sage Cheshire team leverages these resources provides a rare glimpse behind the scenes at advances in aerospace engineering.

Their first challenge was to win the bid. Funded by the Austrian energy drink company Red Bull, the project received proposals from several firms.

“The Stratos project was looked at by many companies,” recalls Jonathan Wells, the Sage Cheshire mechanical engineer who served as capsule crew chief for Red Bull Stratos. “We were informed that competing bids came in at more money and time to complete the project. Sage Cheshire—had the ability to compress the program length, cost and iterations, and do it safely to guarantee Felix would not be harmed.”

### **HP Z Workstations blaze through complex calculations**

Once they won the bid, the Sage Cheshire team went to work. They had to design the capsule, decide how to launch it, adapt a spacesuit, create life support systems, rig sensor electronics, and nail a thousand and one details flawlessly. Thompson envisioned Baumgartner stepping through a 4-foot capsule opening. He and his team designed ergonomic models and drew them up in SolidWorks on HP PCs. Once they figured out general shapes—how the hingeless door would rotate, how Baumgartner would clear his head as he stepped out—they addressed the electronics and how everything would fit together. Having 3D printing capabilities in-house enables Sage Cheshire to fabricate parts for testing, then go back to the modeling software to refine designs. Today Sage Cheshire uses the HP Z230 Workstation in computer numerical control (CNC) functions for automated machine tooling.

HP Z Workstation speed and power—the ability to quickly render data into 3D visual imagery—keeps the creative flow alive. “In the old days you might do a drawing, and it's so math-intensive that as you rotate the object, you might wait several minutes,” Thompson says. “The HP Z Workstation allows us to quickly manipulate the models and understand what's going on with the 3D images, without breaking our thought process.”

## Customer at a glance

### Application

SolidWorks 2014

### Hardware

- HP Z420 Workstation
- HP Z230 Workstation
- HP ZBook Mobile Workstation
- NVIDIA Quadro K4000

### Software

- SolidWorks 2014 from Dassault Systemes

## HP recommends Windows.

The team decided to launch the capsule with a helium balloon, as Kittinger had, and adapted a spacesuit from David Clark Company, which has pioneered flight suits since 1941. To modify the suit for free-fall, they conducted testing scanning it down to the millimeter then using the data for Computational Fluid Dynamics (CFD) analysis in SolidWorks. They needed to understand the effects of turbulent forces all the way from near space down to where the parachute would open at 5,000 feet, so the suit could function in an arrow-like delta position as opposed the standard seated pilot posture. Airflow and current analysis renders visible how speed and wind impact moving objects.

“Simulations like this going forward will really help us be able to design and prepare reentry vehicles, recovery systems, and safety systems for people who have to rely on parachutes to get to the ground safely, to know that they’re not going to tumble or go into a flat spin,” Wells says.

After Baumgartner landed safely, the Sage Cheshire team checked the data gathered during the jump against their predictive calculations—and found them to be very close. “We went from a computer theorizing what would happen to real life data, and found very little deviation,” Wells says. “With the new NVIDIA Kepler architecture, SolidWorks 2014 and our HP Z Workstations, we can now simulate much faster and more accurate results for any of our projects.”

“Sage Cheshire leverages HP solutions to compress project length, cost and iterations, while maintaining the high safety standards of the aerospace industry.”

– Jonathan Wells, capsule crew chief for Red Bull Stratos, Sage Cheshire Aerospace

For Sage Cheshire, the sky’s no limit—it’s an invitation to fly. With the power of the HP Z Workstations, the small firm undertakes big projects previously accessible only to large organizations. “Having the right tools and technology unleashes creativity,” Wells says. “You’re not thinking about what you’re lacking; you’re thinking about what you want to build, what you want to do next.”

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