QubitSolve

Quantum Computational Fluid Dynamics — Co-Design the Future of Engineering Simulation

Dr. Madhava Syamlal | Founder & CEO, QubitSolve Inc. | NSF SBIR Phase II (Grant No. 2450661)

The Computational Bottleneck

High-fidelity CFD — particularly large eddy simulation (LES) and aeroacoustics — is increasingly constrained by **memory and simulation scale**, not just compute throughput. Many mission-relevant flows in aerospace, energy, and defense remain computationally prohibitive at full fidelity, even on today's fastest supercomputers.

Our Approach

QubitSolve is developing **QubitFlux™**, a quantum CFD platform that solves the Navier–Stokes equations through a **Lattice Boltzmann Method (LBM)** formulation.

Quantum CFD changes how simulation results are generated, extracted, and used. For each application, we work with partners to identify the **quantities of interest** that matter most, define efficient and reproducible extraction methods, establish acceptance tests, and ensure compatibility with existing engineering workflows. The goal is not to force an application to fit quantum CFD, but to **shape quantum CFD around the engineering decisions it must support**. That is why we co-design.

> **We are not accelerating classical CFD. We are investigating a fundamentally different computational primitive.**

Technical Status

DEMONSTRATED

- Algorithm feasibility demonstrated
- Prototype circuits executed on real quantum hardware
- Small benchmark verification
- Integrated CFD workflow: OpenFOAM input to quantum circuits to CFD output
- Four-stage validation framework

IN DEVELOPMENT

- Circuit optimization & measurement reduction
- Quantum resource estimation & crossover analysis
- HPC & cloud deployment
- Application-specific benchmarks

We are not claiming quantum advantage today. Present realizations are largely constrained by overhead, but ongoing progress in both algorithms and hardware is anticipated to move the quantum-classical crossover point — where quantum advantage appears — into regimes of practically relevant problem sizes. Our goal is to have engineering workflows ready and available when that moment arrives.

Product Roadmap

Program Opens
Q1 2027
MVP V1: 2D / 3D workflows · Validation · Quantum hardware backends

Co-Design Partnerships
2027 – 2028
Partner cohorts co-develop and validate sector applications

Commercial Workflows
2028
Managed compute · Partner-specific workflows

Launch-Ready Applications
2029 TARGET
Full commercial launch as co-designed applications reach quantum advantage

Dates are targets, not commitments; 2029 readiness is subject to algorithm and hardware progress.

Co-Design Launch-Ready Quantum CFD Applications

The QubitFlux™ Co-Design Partner Program opens in **Q1 2027**. Partners work directly with QubitSolve's R&D team to:

- Define benchmark flows drawn from **your real engineering problems**
- Test algorithmic variants and stress-test workflows, GUI, and APIs
- Inform hardware backend priorities (IBM Quantum, Infleqtion, Atom Computing)

Engage the way that fits you:

- **Apply** — your CFD applications map onto our existing algorithm
- **Extend** — algorithm extensions via sponsored development or joint grant proposals
- **Deploy** — your own CFD or related PDE-solver on QubitFlux platform APIs

What Partners Contribute & Receive

CONTRIBUTE

- One or two high-value flows that are classically memory-, runtime-, or resolution-limited
- Target observables, plus validation data or baseline cases
- Feedback on workflows, integration, and deployment requirements

RECEIVE

- QubitFlux MVP access for your team from program start
- Priority shaping of MVP capabilities and APIs
- Co-authorship potential on publications
- Preferred multi-year terms at full commercial launch

Why Partner Now

Your domain expertise steers the science. Benchmarks defined at your resolution requirements help target the right quantum–classical crossover point for the flows you care about — high-Re turbulence, aeroacoustics, porous media, multi-phase.

Early partners shape the platform. The program runs through **2027–2028** and is not intended to deliver production quantum advantage during that period; it exists to identify, validate, and mature the workflows — and adoption pathways — that could benefit first. Extensions proceed through sponsored development or joint grant programs; early partners receive **preferred multi-year terms** at full commercial launch.

How Co-Design Works

01 Identify a High-Value Engineering Question
A 90-minute working session introduces QubitFlux™ and focuses on your classically limited CFD challenge, the engineering decision you need to support, and the high-value observables that matter most.

02 Define an Observables-First Benchmark
Together, we capture the problem, target observables, validation protocol, and publication terms in a one-page path-to-value memo — which matures into the path-to-value plan appended to a lightweight co-design MOU when you join.

03 Advance Toward Value Generation
Your researchers run the benchmark with QubitSolve support (shared office hours, developer Q&A). Together, we assess progress against the agreed validation criteria and refine the path to practical value.

Team & Advisors · **Madhava Syamlal**, Founder & CEO — former Senior Fellow, DOE national lab; quantum CFD algorithm creator. **Sankaran Sundaresan**, Principal Scientist — Emeritus Professor, Princeton University. Advisors: **Peyman Givi** & **Jeremy Levy** (Univ. of Pittsburgh), **Allan Mink** (former USAF combat pilot & tech leader; angel investor group lead), **S. Subbiah** (former CEO, Zemax; ex-ANSYS & Fluent).

QubitSolve Inc. 781 Chestnut Ridge Rd, Ste 1000, Morgantown, WV 26505-2711 support@qubitsolve.com · qubitsolve.com