

**On-Chip Transport of Biological Fluids in MEMS Devices**

# Advanced Simulations for Field Screening of Chemical and Biological Agents

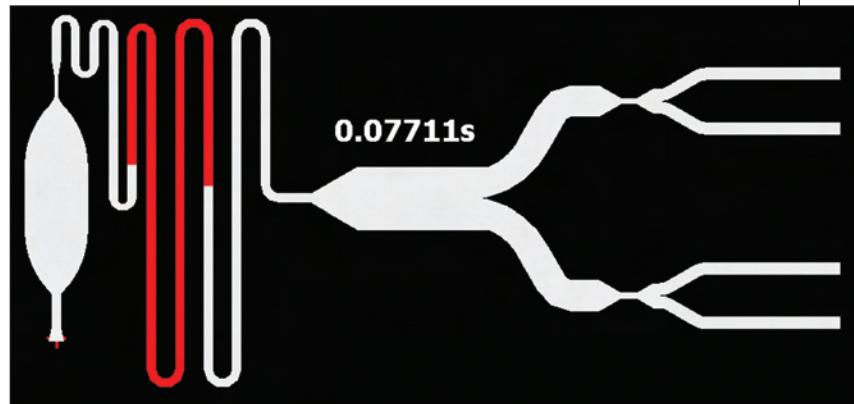


## Technology and Innovation

In this DARPA SBIR project, CFD Research Corporation (CFDRC) developed novel simulation methods and software for the design of microfluidics and BioMEMS (Biological MicroElectroMechanical Systems) that miniaturize and automate complex laboratory procedures. The end results include the ability to deploy sophisticated bioanalytical tests in the field for purposes ranging from sensing chemical and biological agents to monitoring soldier health and performance.

CFDRC's simulations provide a cost-effective approach for screening competing concepts for different BioMEMS applications, and then optimizing selected designs. These advanced physical models for novel microscale phenomena—particularly in a general-use format—were not readily available prior to this SBIR project.

Primary end users include researchers in government laboratories focused on developing miniaturized automated detection systems for chemical and biological defense (including Los Alamos National Laboratory and Sandia National Laboratories). Additional end users include the life sciences instrumentation sector specializing in the development of new devices for genomic and proteomic applications in drug discovery and diagnostics (including Applied Biosystems, Becton Dickinson, Caliper Life Sciences, and others), and government prime contractors (such as



Lockheed Martin, Honeywell, Motorola, and others).

Dispensing of a liquid plug under the action of on-chip pneumatic actuation (Experimental data from Prof. Chong Ahn, U. Cincinnati)

## Joint Collaborations

CFDRC's SBIR work has led to a number of collaborations, providing the company with an introduction to a broader community focused on developing MEMS-based Microsystems to address various government and commercial needs. These collaborations aided CFDRC's overall effort in two key ways: (1) relationships with academic investigators (such as U.C. Berkeley, Stanford, and CalTech) allowed the company to tap into the investigators' fundamental knowledge in the quest to develop general purpose models and (2) contact with lead organizations such as Motorola, Honeywell, Science Applications International Corporation (SAIC), and others helped prioritize the company's various model development efforts.

## Lessons Learned

- Focus on user convenience and workflow integration. These are

frequently more important than technological features. In the company's experience, simple features such as databases and the import of CAD geometry were as important to the end-user point of view as were advanced physical models.

- Prioritize technology efforts based on end-user value creation rather than on technological desires. Be sure that end users serve on advisory panels that set requirements and assess performance.
- If planning to submit a proposal for a DARPA SBIR, be sure to take time to understand DARPA's needs as specifically as possible by talking to the SBIR topic author during the pre-solicitation period.

### Economic Impact

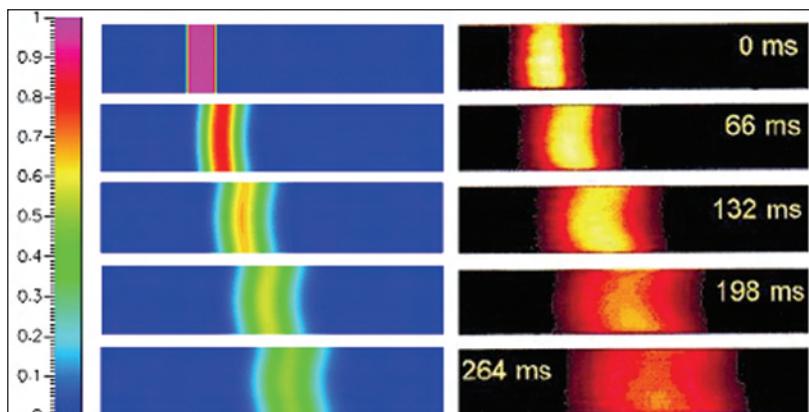
The foundation laid by the DARPA SBIR was instrumental in developing CFDRC's expertise and software products, and enabling subsequent revenue generation via a variety of sources. These sources included government Broad Agency Announcements, National Institute of Standards and Technology's Advanced Technology Program contracts, and commercial software licensing and application contracts.

SBIRs have been a significant source of funding for new technology development for the company. These new technologies—which each have taken several years and several million dollars from non-SBIR sources to further develop—are vital to the company's future.

### About the Company

CFD Research Corporation—founded in 1987, and located in Huntsville, Alabama—specializes in innovative engineering simulations and designs. CFDRC offers unique capabilities for multiphysics, multiscale, coupled simulations of fluid, thermal, chemical, biological, electrical, and mechanical phenomena for real-world applications.

The company has grown steadily and profitably since its founding, and its software products and services are used by more than 500 organizations, including over fifty Fortune 500 companies. CFDRC currently has 85 employees at its Huntsville offices and—in recognition of its successes in commercializing its products—the company received the Tibbetts Award by the U.S. Small Business Administration. ■



Sample dispersion in an electrophoretic chip (Experimental data from Prof. J. Santiago, Stanford University)

### Company Information

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Founded: 1987  
Number of employees: >85