Full turbulent: Re = 24,000

\[ Q = \frac{A_1}{L_1} = 100 \text{ m}^3/s \]

\[ V = \frac{Q}{A_1} = \frac{Q}{100} \]

\[ Re = \frac{4QPD}{N_m} = \frac{4\times100}{100} \]

\[ D = \frac{4Q^2}{10000\pi} = \frac{0.01(1000)}{100\pi} \]

\[ D = 3.8 \text{ m} \]

\[ V = \frac{Q}{N_m} = \frac{4\times100}{1000} \]

\[ Re = \frac{400}{N_m} \]

\[ D = \frac{400}{N_m} \text{ m} \]
There will always be a what, a where, a when, a why...
SYNAPSE IS THE HOW
Synapse solves the most difficult product development challenges from concept through manufacturing, delivering solutions for the leading brands and experience-minded companies in the world.

- Biomedical and Life Sciences
- Connected Devices
- Consumer Electronics
- Entertainment
- Health and Fitness
- Renewable Energy

GET DESIRED RESULTS

- Reduce risk
- Scale resources
- Get it done faster (designed, approved, built, tested, and shipped)
- Adapt swiftly to changing needs
- Provide a deep bench of world class technical resources
- Innovate and implement cutting edge technology
- Develop your product from concept to reality

100% RATE OF RETURN FROM EVERY CLIENT WHO HAS EVER WORKED WITH US
ENGINEERING NIRVANA
Synapsters say ‘yes’ when conventional wisdom says ‘no.’ That means achieving the impossible within extraordinary timeframes by building, testing, learning, building again, and having fun while doing the unthinkable.

“SYNAPSE DID IN 10 WEEKS WITH 3 ENGINEERS WHAT OUR COMPANY WOULD HAVE TAKEN 14 MONTHS AND 20 PEOPLE TO DO.”
– Fortune 500 Engineering Manager

BEST JOB EVER
Synapse believes that an entrepreneurially empowered culture inspires creative breakthroughs to solve the most difficult problems. Synapsters rigorously honor their commitment to make this “the best job they’ve ever had.”

THE WAY WE DO THINGS IS THE KEY. IT IS WHAT DIFFERENTIATES US. THE MAGIC LIES IN THE METHODS WE USE.”
– Synapster
**PROOF-OF-CONCEPT**
You have an idea. Is it feasible? What are the risks? How much will it cost? How long will it take? Synapse delivers solutions, from technical white papers to rapid prototypes, quickly and cost-effectively.

**END-TO-END**
You’ve developed a prototype, first-gen design, or a new breakthrough technology. Now you need a reliable, practical plan focused on taking your idea from concept to market. Synapse’s product development and project management expertise provides the collaborative teams you need to accelerate time to market through supply chain, logistics, design for excellence, quality, manufacturing, and test services with best-in-class partnerships.

**SWAT TEAM**
Anything can happen, from surprise technical hurdles to a delay in your product’s shipment. For those obstacles, Synapse has a highly responsive and specialized team whose sole mission is to keep things running smoothly. Consider it your company’s back-up plan.

**CUSTOMIZED PROGRAMS**

**PROOF-OF-CONCEPT**

**END-TO-END**

**SWAT TEAM**

**PROCESS**

**POC**

**E2E**

**SWAT**
AFFORDABLE CLEAN ENERGY
CLIENT: Simpa Networks
Synapse designed and built the Simpa Regulator™ prototypes currently being tested with customers in Bangalore, India. The Simpa Regulator™ hardware platform enables the Progressive Purchase® pricing model by metering and adjusting electricity availability in response to the entry of payment codes by customers. The result is a secure, low-cost, intuitive, rugged, and tamper proof device that allows Simpa to test and prove their new pricing model with real customers, giving them valuable new information about customer needs and desires.

MORE EFFICIENT AIR CONDITIONING
CLIENT: National Renewable Energy Laboratory
NREL, the only federal laboratory dedicated to the research, development, commercialization, and deployment of renewable energy and energy efficiency technologies, selected Synapse to develop functional 1/10th and full scale proof of concept prototypes to demonstrate physically what theoretical modeling and simulations have shown. The NREL DEVAP Air Conditioning concept uses desiccant materials which remove moisture from the air by using heat and advanced evaporative technologies. The result is a cooling unit that uses 90% less electricity and up to 80% less total energy than traditional air conditioning.
AIRFLOSS
CLIENT: Philips Oral Healthcare, Inc
The Sonicare Airfloss uses breakthrough microburst technology to deliver microdroplets of air and water to remove plaque biofilm between teeth. Adhering to the Philips Sonicare standards of performance and safety requirements, the Airfloss quickly cleans the entire mouth in just 60 seconds. Synapse was involved in the Sonicare Airfloss from idea to real-life product, joining forces with Philips to overcome complex form factor and electromechanical power constraints to create a revolutionary approach to inter-denial cleaning.

WIRELESS AND NEAR FIELD COMMUNICATIONS
CLIENT: Viableware
Synapse Product Development partnered with Viableware, a Kirkland, WA based startup, to develop Rail™, an innovative payment platform that enables restaurants to put their point-of-sale system in the hands of their guests. Synapse engineers worked closely with Viableware in the design and production of the wireless digital payment folio that communicates securely with existing point-of-sale systems and Viableware’s datacenter to protect consumers from credit card information theft, while also enabling restaurants to streamline payment processes and generate new advertising revenues.

ARCHERFISH SOLO
CLIENT: Cernium Corporation
When Cernium Corporation decided to take its proven automated technology to the consumer market, they turned to Synapse for leadership in consumer product design and offshore volume manufacturing support. In tandem with input from key component suppliers and OEM assembly partners Synapse developed a path for expediting the design and manufacturing to meet Cernium’s goal of introducing the product at CES 2010, where the product was an Innovations Design and Engineering Award Honoree.

END TO END
POC
SWAT
WEARABLE FITNESS ELECTRONICS
CLIENT: Nike
Nike has partnered with Synapse to bring revolutionary digital consumer products to both casual and core athletes around the world. Nike, the global leader in athletic footwear and apparel, looks to Synapse for engineering expertise in realizing highly aspirational product design requirements that push the envelope in complexity, interaction, and functionality. Continually engaging with Nike, Synapse showcases E2E capabilities to help Nike realize its goal of bringing athletes closer together through the marriage of digital technology and sport.

PHOTONIC AND ELECTROCHEMICAL DETECTION
CLIENT: Combimatrix Corp
Synapse has partnered with Combimatrix, a nano-molecular and genetic analysis company, for nearly a decade contributing to their IP portfolio and developing automated processing instrumentation with precision optics, machine vision, fluidic chemical processing, and electro-chemical analysis. Synapse developed the ElectraSense® product for array-based analysis, which measures up to 12,000 probes on an array in less than 25 seconds and today dominates the commercial market.
**SUSTAINABLE BOTTLE**

**CLIENT:** Bamboo Bottle Company

The Bamboo Bottle Company initially approached Synapse for industrial design services to integrate their individual components and assembly concepts into an elegant, tasteful, and ‘cool’ solution. As follow up to that initial work, BBC approached Synapse again to incorporate not only ID services but mechanical engineering support all the way through contract manufacturing selection and release for their new “Coffee Top” and “Sport Top” product line.

---

**REVOLUTIONARY CONNECTED DEVICE**

**CLIENT:** Fortune 100 Entertainment and Experience Company

When one of the world’s largest family entertainment companies wanted to implement next generation business processes, they turned to the Synapse team. We tackled a connectivity issue plaguing the system for three years by designing an alternate technology prototype in one month which allowed the $1 billion initiative to live on and put the client back on track.

---

**SWAT TEAM**

---

**POCKET LINUX TEXT SCANNER**

**CLIENT:** Exbiblio

When Exbiblio set out to build tools for connecting the worlds of online and print media, they built a dream list of features that would need to be included in a device no larger than an iPod shuffle. Synapse engineers pushed the technology boundaries of manufacturable design to new limits of density and met these ambitious goals for a successful initial product launch.
EXPERTISE

PROGRAM MANAGEMENT
PROJECT LEADERSHIP
Multi-Disciplinary Project Management
Flexible Project Plan Approaches
Complex Scoping & Planning

PROJECT EXECUTION & RISK ASSESSMENT
Strategic Risk Identification
Proactive Mitigation & Contingency Planning
Resource, Schedule, & Scope Coordination
Configuration & Prototyping Build Management

BUSINESS RESULTS
On Time & On Budget Delivery
Highly Agile Project Teams
Reliable Communication & Collaboration
Problem Facilitation & Roadblock Removal

SOFTWARE DEVELOPMENT
FIRMWARE
Microprocessors
FPGA + CPLD Programming
DSP Code Development
Device & Display Drivers
Field Upgradeability
Safe Error & Failure Handling

EMBEDDED SYSTEMS
Micro Power Requirements
Custom Linux Solutions
Fully Integrated Multi-Device & Real Time Systems
MultiProcessor Integration
Device to Desktop to Web Integration

APPLICATIONS
GUI Design
Cross/Multi-Platform Apps
Mobile Apps
Control Systems
Automation interfaces

SYSTEM ARCHITECTURE
SW Specification
Algorithm Development
Software Roadmaps

PROTOCOL DESIGN
Wired & Wireless Networks
Mesh & Point to Point
High Speed & Low Power
Interchip Communications

ELECTRICAL ENGINEERING
SYSTEM ARCHITECTURE
Large Systems to Self-Contained Devices
Technology Selection & Roadmaps
RF/Wireless Protocols
Price/Performance Analysis
Volumetric Optimization

EMBEDDED SYSTEMS
8 to 32 Bit Microcontrollers
Memories & Peripherals
Hardware/Software Partitioning & Tradeoffs

CIRCUIT DESIGN
Digital, Analog, & Mixed Signal
Sensors, Actuators, & Control Systems
Displays, Indicators, & User Interfaces
Programmable Logic
Power Supplies
Ultra-Low Power

PRINTED CIRCUIT BOARDS / ASSEMBLIES
Schematic Capture
PCB Layout
Rigid & Flexible PCBs
PCBA Fabrication & Testing

RF / WIRELESS COMMUNICATIONS
Bluetooth / BLE, ZigBee, WiFi, ISM
GPS
RFID, NFC
Cellular Protocols
Custom Antenna Design

PRODUCT EXPERTISE
High Volume Consumer
Industrial & Medical
Ultra-Low Power, Portable, Battery Powered
Wireless (Fixed & Portable / Wearable)
Concept to Production
Rapid Prototypes

MECHANICAL ENGINEERING
PRODUCT ENGINEERING
Electronics Packaging
Complex Injection Molded Part Design

DESIGN FOR MANUFACTURABILITY
Product Miniaturization
Waterproof Enclosure Design
Complex Surface Modeling

ANALYSIS & MODELING
Computational Fluid & Thermal Modeling
Thermal System Design
Structural Analysis & Modeling
Fluidics System Design & Simulation
Optical System Design & Modeling

AUTOMATION & ROBOTICS
Mechanism Design
System Kinematics
Motors & Actuators

PRODUCT TESTING
Halt Chamber Testing
Performance & Reliability Testing
Safety Compliance

HUBWORKS INTERACTIVE
DRINKHUB 2011

SYNTRIX BIOSYSTEMS
PHOTOLITHOGRAPHIC
CELLULAR DISSECTION SYSTEM 2006

ASTHMAPOLIS GPS-ENABLED
ASTHMA INHALER 2011
EXPERTISE

INDUSTRIAL DESIGN
FORM DEVELOPMENT
- Architecture Exploration
- Design Language Development
- Materials Research
- Color & Texture Studies

INTEGRATED APPROACH
- Concurrent Multi-Phased Development
- Multidisciplinary Problem Solving

ERGONOMICS STUDIES
- User Research
- Usability Exploration

PROTOTYPING & TESTING
PRE-PRODUCTION PROTOTYPING
- Rapid Prototyping
- Functional Prototypes
- Formfactor Compliant
- Prototype Testing
- Design Verification
- Preproduction Verification
- Parametric Testing

PROOF OF CONCEPT
- Technology Demo
- Functional Mockup
- Rapid Design Validation

FORM MOCKUP
- Appearance Models
- Weighted Mockups

TEST & REGULATORY
- Test Plan & Spec
- Agency Prescan & Approvals
- Global Regulatory Certification

MANUFACTURING & NEW PRODUCT INTRODUCTION
PRODUCT DOCUMENTATION
- Component Specifications
- Part & Assembly Drawings
- Acceptance Criteria
- Bill of Materials
- Validation Test Plan
- Service & User Manual

MANUFACTURER LIASON
- CM & Supply Sourcing
- Tooling Development
- Assembly Instructions & Training
- BOM Management
- CM Selection

DESIGN FOR X
- Manufacturability
- Assembly
- Test
- Service
- Cost Reduction

“WE WERE PLEASED TO COLLABORATE WITH A PARTNER ORGANIZATION THAT SHARED THE SAME COMMITMENT TOWARDS PRODUCT DESIGN AND ENGINEERING EXCELLENCE. THE SYNAPSE TEAM WORKED AS AN EXTENSION OF OUR TEAM, ENABLING US TO RAPIDLY BRING OUR PRODUCT TO MARKET.”

— VP of Engineering and CTO of Leading Consumer Security Products Company