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Case Study

IVUS Pullback Sub-System Design



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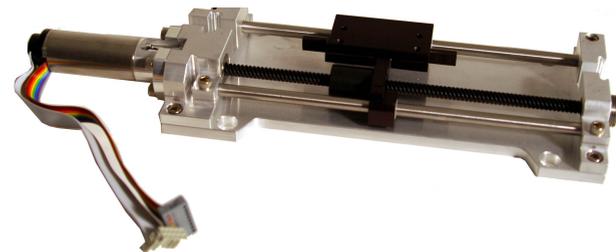


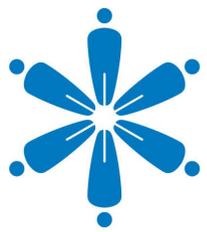
IVUS Pullback System
SVMi / ACIST Medical
Mechanical, Electrical Engineering,
Software and Industrial Design.

Provided concept through pilot
production of this medical device.

Services: Mechanical Engineering of
precision mechanisms, Industrial Design,
Electrical Engineering and Software,
ergonomics, product graphics, color, and
material.

Materials: cast urethane, fabricated and
machined parts, pcb





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Challenge:

Our client, a startup developing High Definition Imaging Intravascular Ultrasound System (IVUS) desired a Pullback System to mate with their Patient Imaging Module, Catheter and Imaging Console. We provided the complete sub-system design, engineering, electrical and software.

Goals:

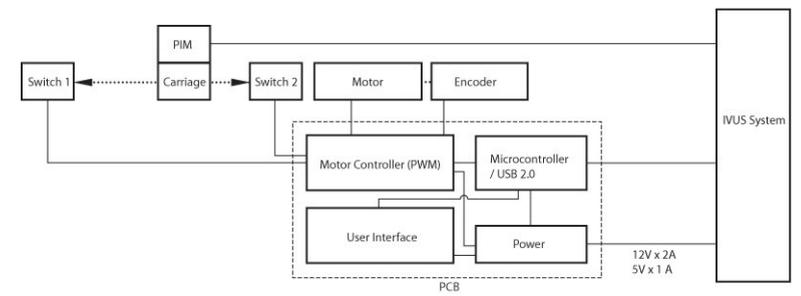
- * Provide Mechanical, Electrical Engineering, Industrial Design for a small footprint IVUS Pullback device
- * Design around existing patents of competitive unit and assist in developing IP for client.
- * Improve performance
- * Provide simple intuitive interface
- * Meet cost goals
- * Pilot build of ~20 units

Result:

- * Back-drivable lead screw mechanism with brushless motor drive, custom electronics and software.
- * Clutchless drive system for remote access and durability.
- * High-torque drive for use at various angles
- * Product brought to pilot production.
- * Company eventually acquired by Acist Medical
- * Device is now OEM'd to a large device manufacturer (Medtronic).

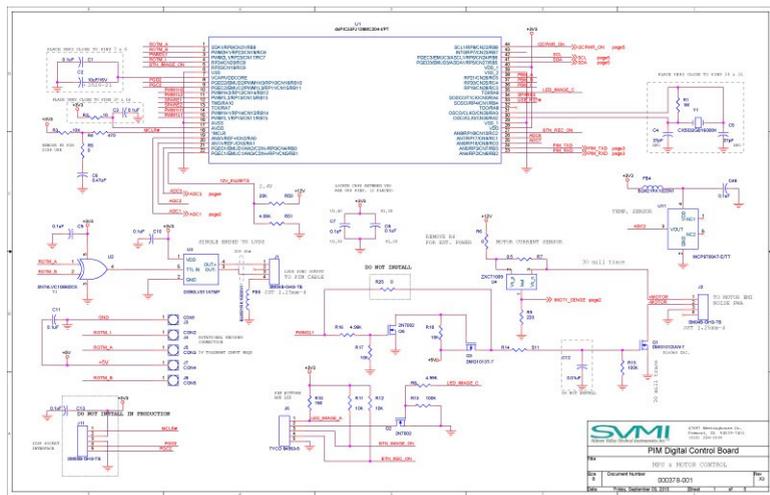


SVMI IVUS Pullback System Block Diagram



Notes:
 Motor: 12W brushless, Maxon EC-max 22 #283840. Commutation is sinusoidal.
 Encoder: Maxon MR_500/1000 x 2/3 ch. 3 channel adds phase pulse for absolute rotation positioning.
 Motor Controller:
 Microcontroller:

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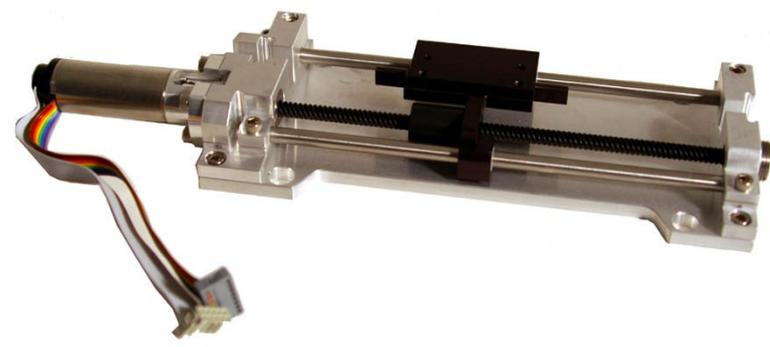


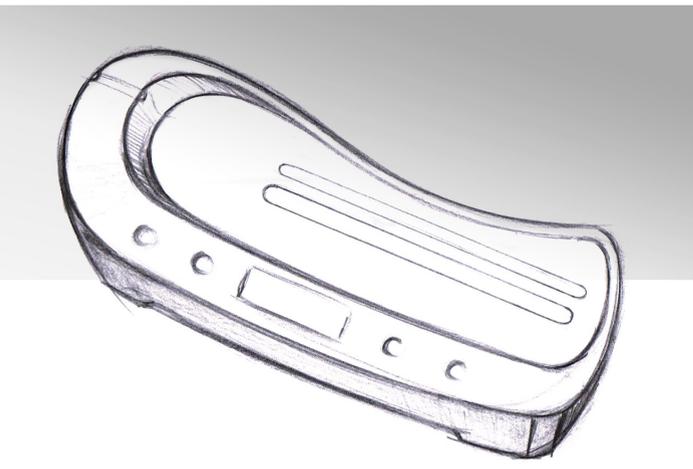
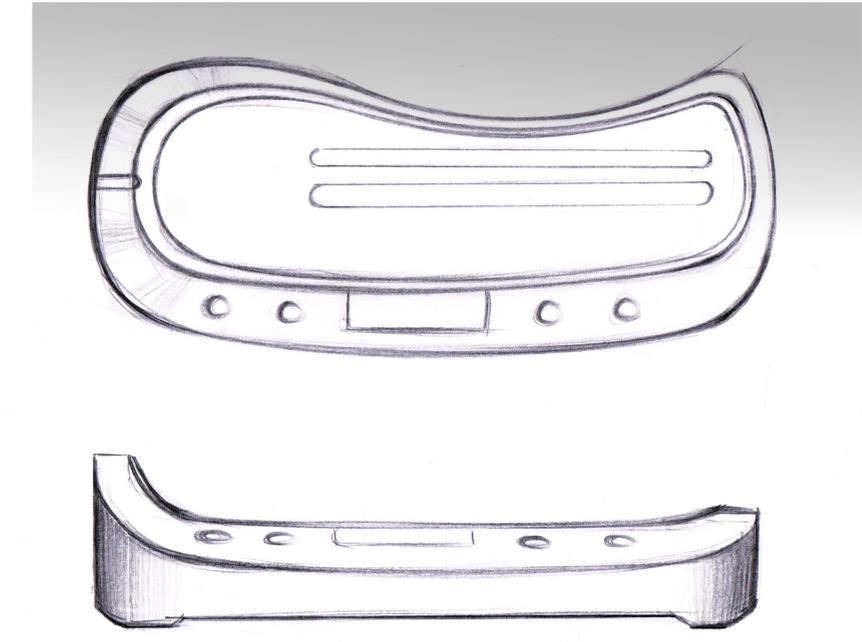
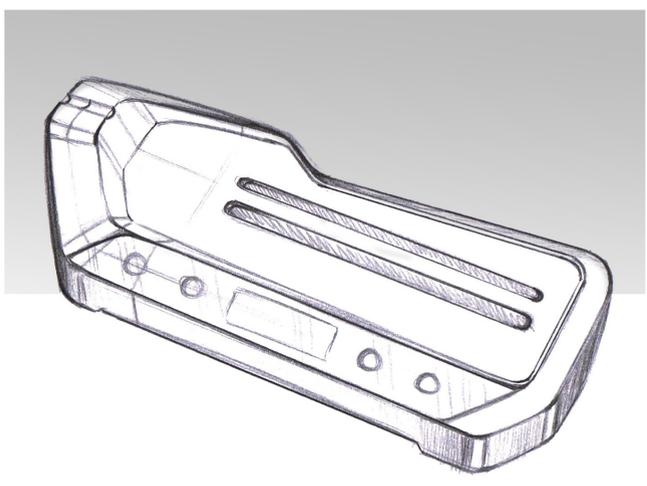
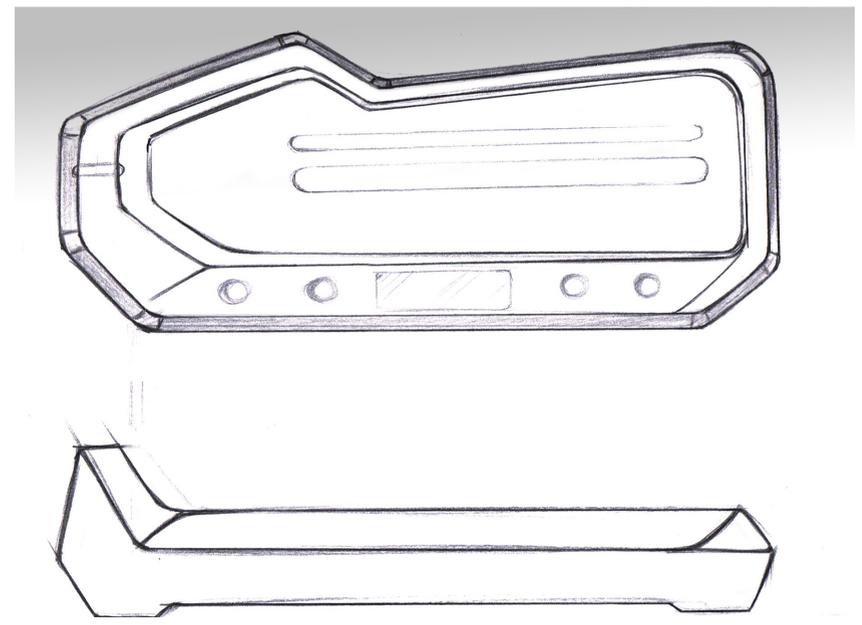
Brief Process:

EnMasse Design investigated various drive systems while reviewing existing IP of competitive systems. A back-driveable lead screw mechanism was chosen to mate with a high performance brushless motor and electronics. Competitive unit used a manual clutch which prevented remote control.

Electronics, motor control and user interface software were developed.

Detailed part and assembly files were created in Solidworks. Concurrently, Industrial Design activities started to address the product form and user interface. Final surface files were developed native in Solidworks and rapid prototypes were produced for initial testing.



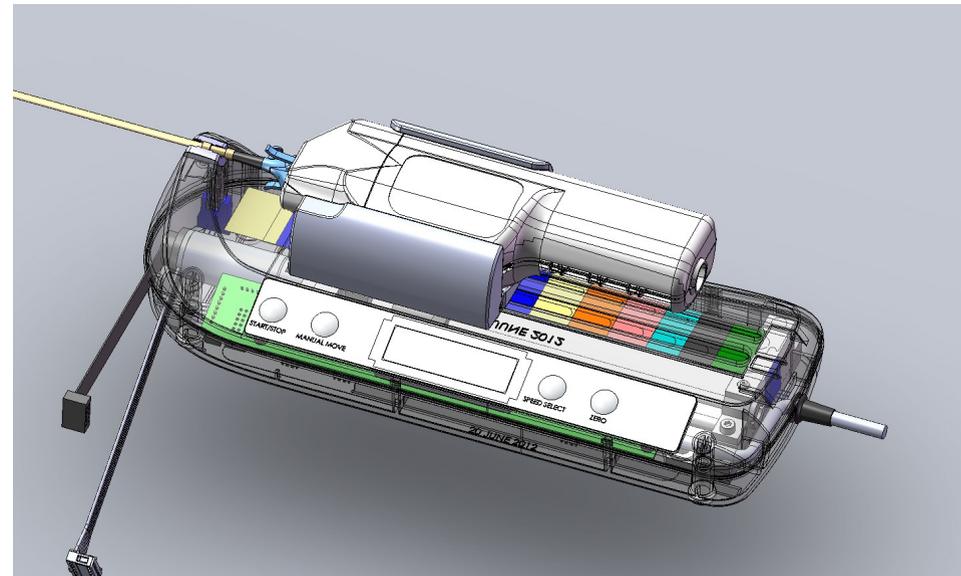
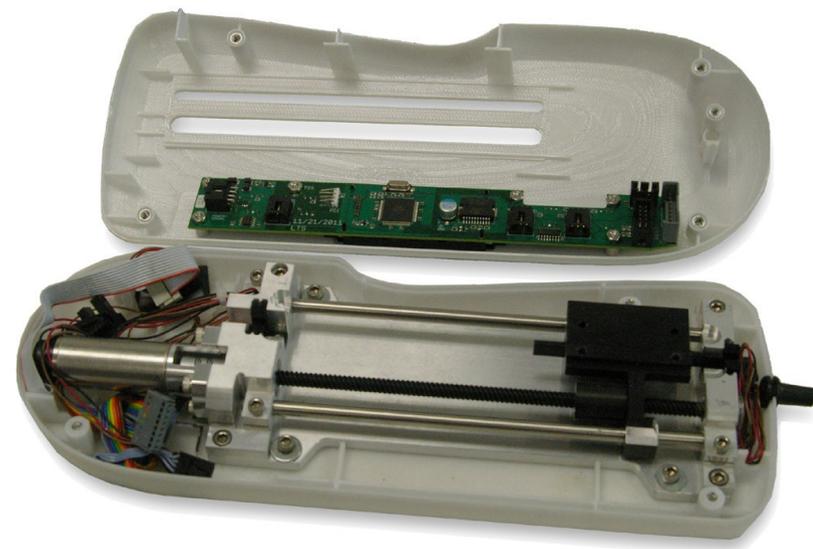
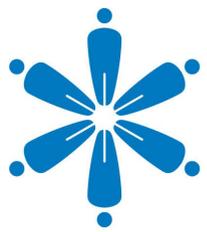


IVUS Pullback System

Industrial Design

Form development chosen for single handed pickup. Device needed to capture existing PIM imaging unit. Easy to use interface.

- * Conceptual sketches
- * Foam model fabrication
- * CAD surface files were developed native in Solidworks
- * 3D printed rapid prototypes produced for initial testing.



IVUS Pullback System

Mechanical Engineering

Provided concept through pilot production of this medical device.

- * Mechanical engineering including proof-of-concept, mechanism design, analysis, DFx : DFm, DFa
- * Precision part design and tolerance stack-up analyses
- * GD&T
- * Electrical Engineering, software and motor control
- * Detailed part design, cast urethane, fabricated metal and and precision machined components.
- * Patent review and IP development
- * Bill of Materials (BOM)
- * Cost reviews
- * Testing



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IVUS Pullback System

Electrical Engineering and software

- * Brushless motor control
- * Speed selection: 0.5 mm – 20 mm/sec
- * User interface controls
- * Serial interface
- * Optical switches
- * Low cost microprocessor
- * Performance testing
- * Software