



SIRA MEDICAL

Improving Surgical Planning
with Augmented Reality

REALITY



PROBLEM: THE UNEXPECTED

Conventional imaging **does not provide robust, clear or realistic representations** of a patient's anatomy.

Patients

- ↑ Morbidity/Mortality
- Longer OR Times
- Need for Re-operations

Surgeons

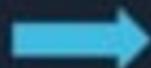
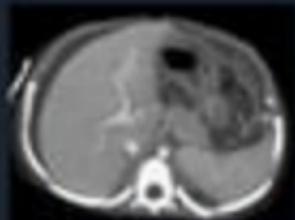
- Lack of confidence in plan
- Inaccurate measurements
- Inefficient image review

Healthcare Systems

- Inefficiencies in Staffing/Resources
- \$19.5B/year in Preventable Adverse Events



HOW IT WORKS



UPLOAD

CT/MRI: Surgeon specifies model needed, uploads to our secure server



SIRAMEDICAL
SEE BEYOND



TRANSFORM

CT/MRI images converted to custom hologram



PLAN

Clinician reviews 3D A.R. model with our software



IT ALL ADDS UP

COST SAVINGS

- ✓ Accurate placement of implants
- ✓ Better patient-prosthesis match
- ✓ Other Efficiencies

Examples:

Pedicle screws \$700MM

Valve replacements \$500MM

Elbow fractures \$100MM

ADDITIONAL REVENUE

- ▶ 21% time reduction
- ▶ Allows more surgeries
- ▶ O.R. time +90min
- ▶ \$27,023 added revenue/OR per day



MARKET
OPPORTUNITY

\$15.1B

U.S. Diagnostic Imaging 2025
Total available market

\$2.7B

**AR in Healthcare
2025**
Serviceable available market



INITIAL TARGET MARKETS

EDUCATION

\$

DEVICE
MANUFACTURERS

\$\$

PRE-SURGICAL
PLANNING

\$\$\$



BUSINESS MODEL

Our Service

Tiered subscription, "basic, premium, enterprise"

For Who?

Initially focused on Orthopedics, Cardiology, Neurology, Pediatrics, Oncology and ENT

Who Buys it?

Healthcare providers, training institutions, device manufacturers



ACCURACY & PRECISION

Title: Assessing Accuracy and Precision of 3D Augmented Reality Holographic Models Derived From DICOM Data

CT Phantom Study:
"Holograms match Gold standard"¹

Evaluating the Performance of Augmented Reality in Displaying MRI-Derived 3D Holographic Models

MRI Phantom Study:
"No difference between Gold Standard and Holographic Measurements"²

Journal of Pediatric Orthopedics
Assessing the Value of Novel Augmented Reality Application for Pre-Surgical Planning in Adolescent Elbow Fractures
--Manuscript Draft--

Elbow Fracture study (60 observations)³:
Models rated "highly accurate"
Major improvement in confidence in surgical plan and hardware fit



INTELLECTUAL: PROPERTY

- **Proprietary method of model creation.**
- Protocols specific to model optimization.
- Advanced hardware visualization.
- 4D Flow, DTI & animation.
- Radiologist-specific detail.
- Gold-standard model accuracy & precision.

- **Curated database of segmented models.**
- Data gathering future best practices.
- Radiologist approved models (Radlex © lexicon).
- Proprietary algorithms for image processing.



RESEARCH SITES

UCSF



UC DAVIS



FOOTHILL COLLEGE

CORPORATE PARTNERS

docomo 5G



Microsoft Partner

TRANSLATIONAL PROGRAMS

UCSF Innovation
Ventures



500
startups



MEET THE TEAM



Jesse Courtier, MD
Founder

UCSF Associate
Professor of Radiology

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Co-Founder

Digital Health Expert,
Venture Capitalist,
Entrepreneur

Ben Laguna, MD
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Co-Founder

AR/VR expert, UCSF
Radiology Fellow, Penn
Med, Princeton

Dustin Boyle
Developer

VR/AR developer,
Previously at Sony



OUR ADVISORS



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Advisor

Expert in Augmented Reality
and Computer Vision

Author of "Beginning Windows
Mixed Reality Programming"





AWARD WINNING TECHNOLOGY

WINNER

Two time Catalyst Award in Digital Health

FINALIST

2018 SXSW Interactive Innovation Awards

FINALIST

2019 ACC.19 Innovation Challenge

FINALIST

Medical Capital Innovation Competition

FINALIST

Health 2.0 VentureConnect Competition



OPERATION PLANNING

SURGEON:

- Clearer and Relevant Imaging
- More Efficient Image Review
- ↑ Confidence In Plan
- Accurate Measurements
- Better Hardware Sizing
- No Change to Workflow

SCHEDULING & SETUP

HOSPITAL:

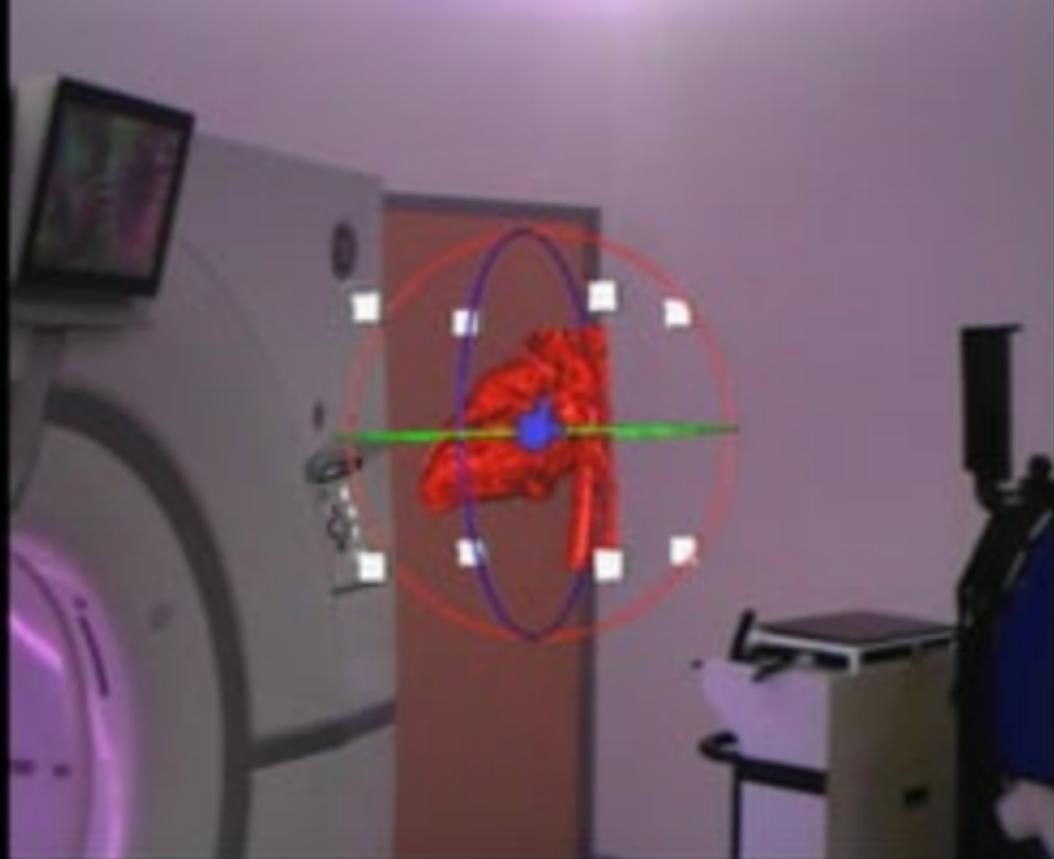
- ↑ Throughput
- ↓ Instrument Variability
- Better Use of Surgical Supplies
- Efficiencies in OR Staffing

OPERATION PERFORMANCE

SURGEON + HOSPITAL:

- ↓ Unanticipated anatomy variants
- ↓ Complications
- Data Library For Future Cases
- Higher Quality Scores





ANIMATION





ANNOTATION / LABELING



... AND **MORE**

- Object manipulation
- Measurement toolsets
- Haptic feedback elements



OUR DEVELOPMENT TIMELINE



PILOT STUDY : UCSF

- Retrospective study – complex elbow fractures – 60 observations
- Impact on:
 - Confidence in surgical planning (high)
 - Hardware selection and fit (increased)
 - Intra-operative time saving (projected at 20%)
 - Quality of models (high)

"Would change how I'd approach; looking at this makes it more likely I'd have recognized need for bone grafting"

"Improves confidence in treatment plan"

"Based on CT would have done CT and gone posterior; based on model would have gone anterior and used some absorbable fixation"

"Complex intra-articular with a bad CT, [this] gives you more info on how it will fit together, relationships of fragments"

"Know what to look for for retractor positioning, incision location"



CUSTOMER VALIDATION

- What makes for a successful surgery?
 - ✓ "Having the expected outcome, having the surgery go as planned"
- How do you think imaging can be improved?
 - ✓ "Challenges with 2D image conversion to real patient; current preop imaging gives me a sense, but different when I'm in the OR"
- What are some of the factors that lead to longer surgery time?
 - ✓ "Unclear anatomy is #1" "Unexpected findings" "Surgery is different from what you expected"
- What's the biggest challenge with respect to pre-surgical planning?
 - ✓ "Time to review imaging in depth" "It is time intensive"



REGULATORY PATHWAY

- Standard: 510 (k) Class II medical device
- Level of concern: Minor, tool claim
- Pathway: Substantial Equivalence, predicate devices identified
- Initial assessments undertaken by USC and Battelle
- Software verification currently underway by Battelle
- Software validation to commence
- Assessments by USC Regulatory Science and Battelle available for review



PLATFORM DEVELOPMENT

Product Development	Target Specialties	Market Development
Animation	Orthopedics	Pre-surgical planning
ML Pipeline	Cardiology	Education
Virtual cuts	Neurology	Medical device
Annotation	Pediatrics	OR decision support/analytics
Haptics	ENT	Administrative planning
Predictive outcomes	Transplant	Remote consultation
Custom toolsets	Oncology	Reference



OUR PACKAGES

BASIC



\$/Month

- 5 seats
- 20 models per month

PREMIUM



\$\$/Month

- 7 seats
- 30 models per month

ENTERPRISE



\$\$\$ /Month

- 10 seats
- 40 models per month





WHY AUGMENTED REALITY?

- Augmented Reality

- Collaborative
(read each other's faces)
- Real-world background
- Interact with real objects

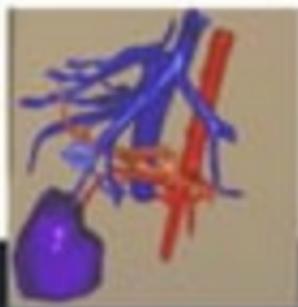
VS

- Virtual Reality

- "Digital blindfold",
limited interaction
- Simulated background
- Simulated objects
- Nausea



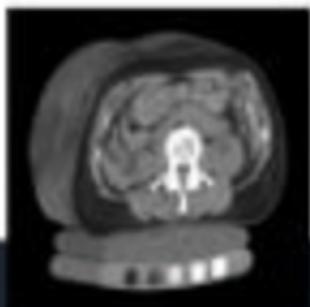
ADVANTAGES OF SURFACE RECONSTRUCTION



Surface Based Reconstruction

- Layers can be segmented separately and tailored to end user needs.
- Less-computationally demanding
- Easier to obtain 3D measurements, including angles, volumes, and manipulate objects in relation to each other

VS



Volume Based Reconstruction

- Computationally demanding
- Only slabs of information are visualized, without segmented information, limiting utility.
- Relevant anatomy difficult to distinguish



ECONOMIC & OTHER ADVANTAGES

PRE-OPERATIVE

No hidden anatomy

Advance plan

Optimal staffing determined in advance

Optimal supply needs determined in advance

Surgery time determined in advance

Implant size determined in advance

Model segmentation in advance

Much higher image resolution

No change to workflow / lower barriers

INTRA-OPERATIVE

Hidden anatomy discovered w/patient under anesthesia

Plan on the fly

Optimal staffing estimated

Optimal supply needs estimated

Surgery time estimated

Implant size determined on the fly

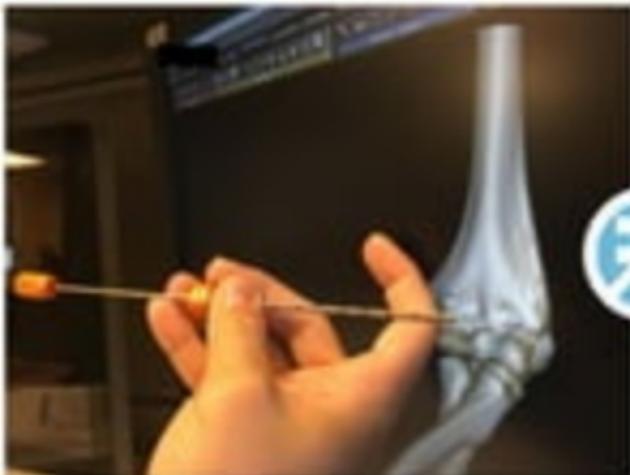
Model segmentation during surgery

Lower resolution

Change to workflow / high barriers



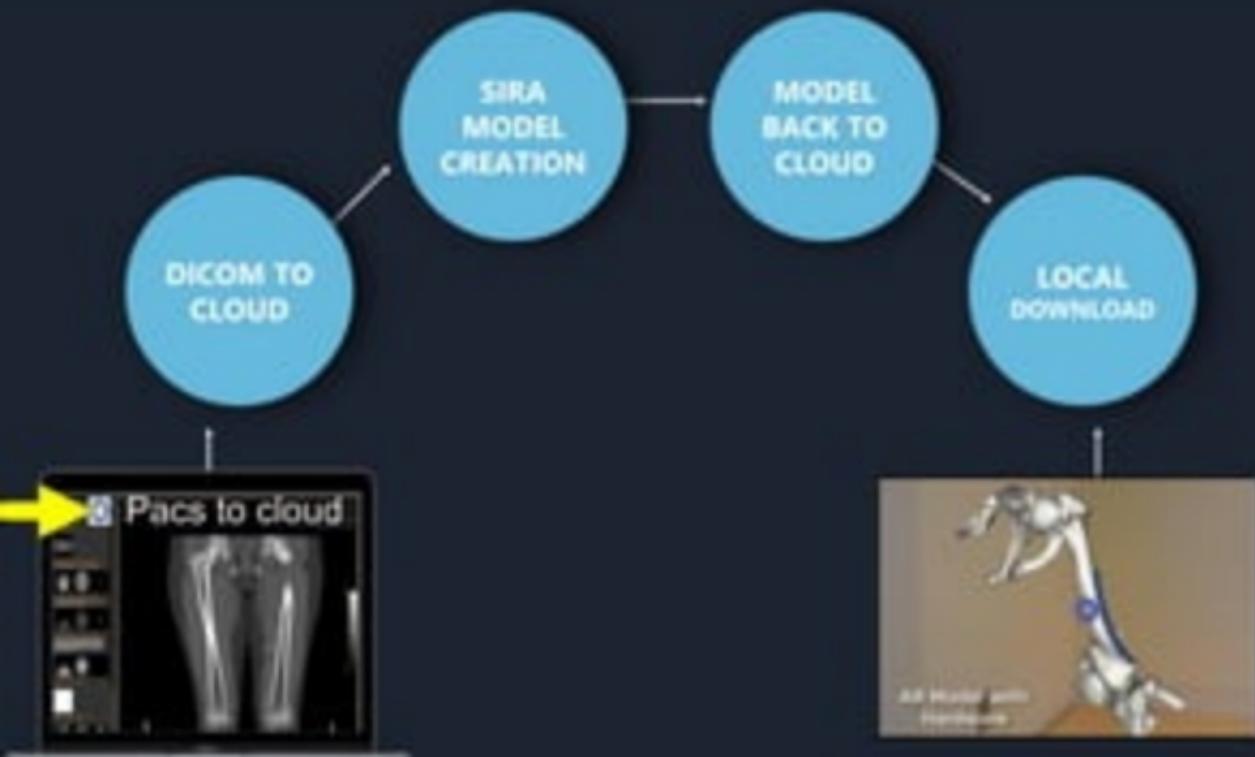
"3D" ON A 2D MONITOR: NO REAL WORLD INTERACTION



SIRA MEDICAL
TESTING ACTUAL HARDWARE FIT



WORKFLOW

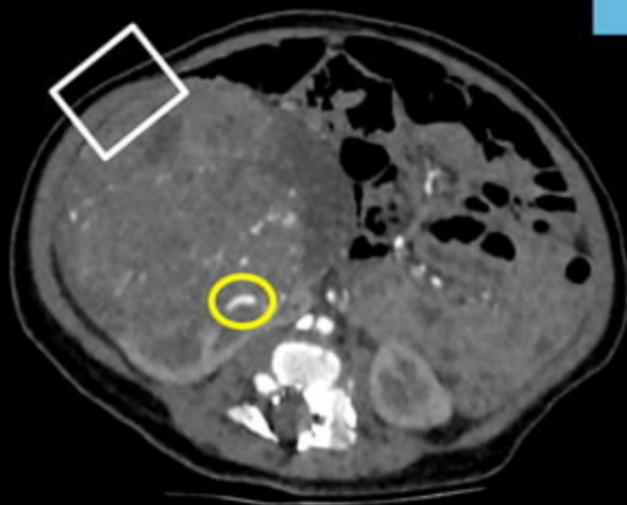




SIRAMEDICAL

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CT SCAN



- ▶ Critical anatomy often hidden



REALITY



Did You Know?

>50% of Technical Errors in Surgery are
Related to "Unexpected" Anatomy

