



FLIR's Success with UCSB

Richard Bornfreund
Chief Scientist

APRIL 24, 2019

About FLIR



FLIR Vision:

We are the World's Sixth Sense, revolutionizing human perception

FLIR Mission:

Innovate technologies that increase awareness and insight
so that professionals can make more informed decisions
that save lives and livelihoods


Our Present At a Glance

Revenue: \$1.8B

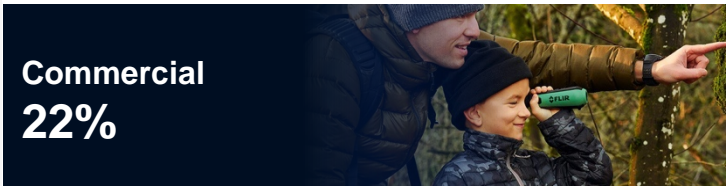
**Industrial
40%**




**Government and Defense
38%**




**Commercial
22%**



**Thermal
59%**



**Non-Thermal
41%**

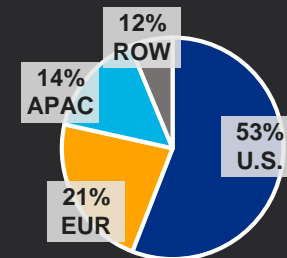


Did You Know?

- FLIR ITS sensors analyze over 250,000 road intersections worldwide
- Raymarine instruments were selected to outfit all U.S. Coast Guard craft
- FLIR is 1 of only 3 companies in the U.S. that produces military-grade laser crystals
- FLIR security solutions will be core to the Safe City initiative of a major city in the U.S. Northeast
- FLIR gained #1 market share in Firefighting thermal cameras within two years of entering market

FLIR Metrics

Geographic Revenue



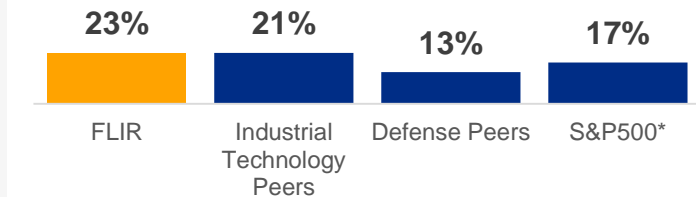
52% Adj. Gross Margin

\$343M Free Cash Flow

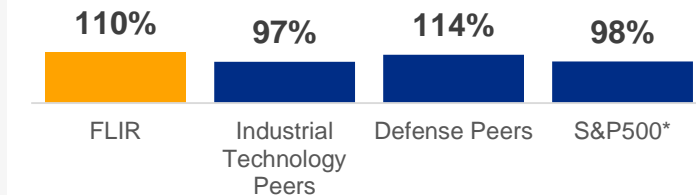
18% ROIC

FLIR vs. Peers

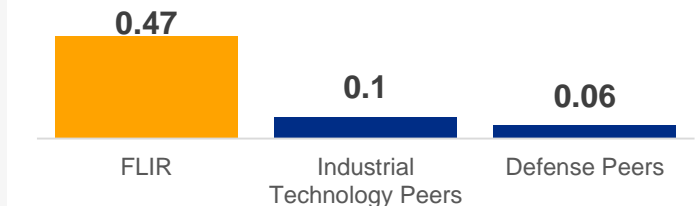
Adj Operating Margins



Free Cash Flow Conversion



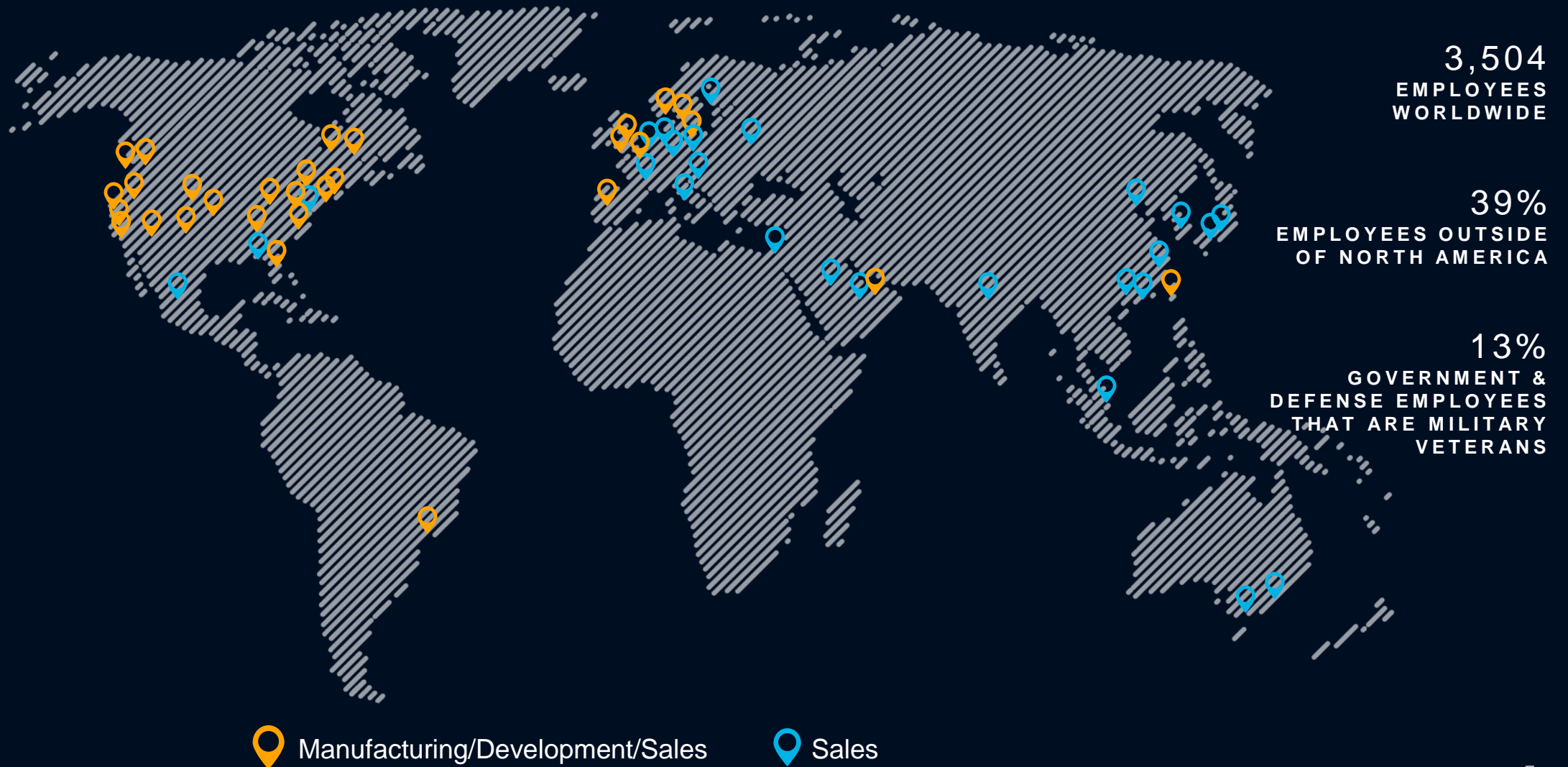
Patents per Employee



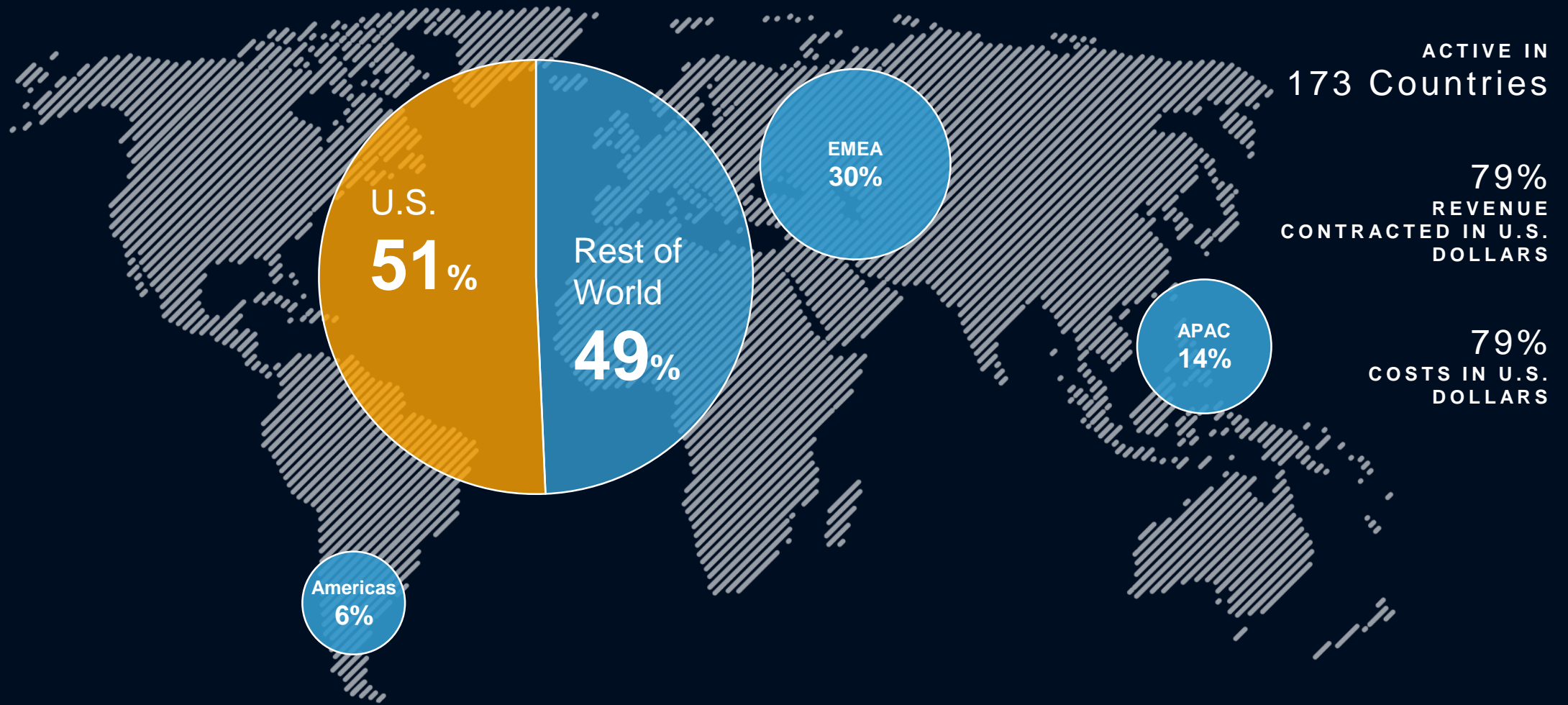
• Adjusted Operating Margins and Free Cash Flow Conversion amounts above represent 5 year historical medians
 • Industrial Tech peers: FTV, GRMN, MKSI, MTD, NATI, PKI, ROP, TRMB, WAT.
 • Defense peers: AVAV, GS, HRS, LLL, LMT, MRCY, NOC, RTN.
 • * S&P500 excludes Financials, Real Estate, and Utilities companies.

Note: FLIR metrics are based on last 12 months data as of December 2018 and exclude results from the divested Security businesses.

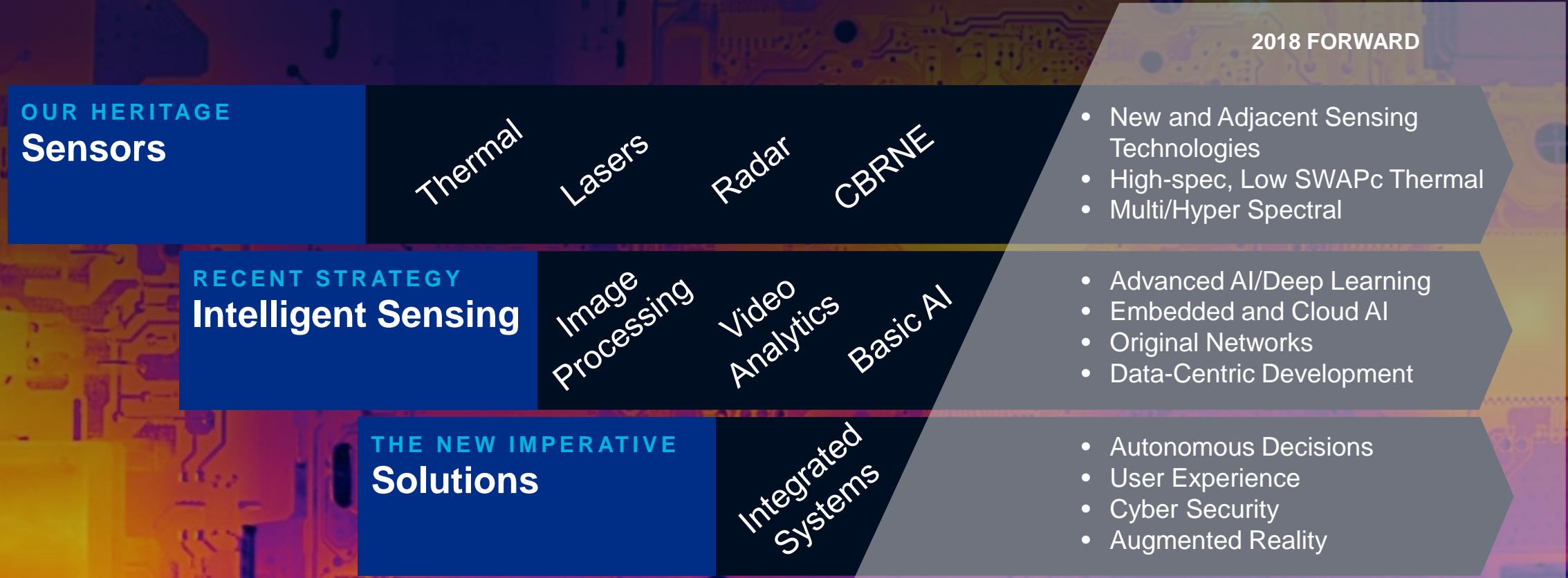
Geographic Reach – Locations



Geographic Reach – Global Revenue Sources



Further Evolution of Technology



Fostering A Relentless Innovation Engine
 Enhance R&D Portfolio Management | Focus on Workforce Alignment | Strategic Use of M&A and Alternative Business Models

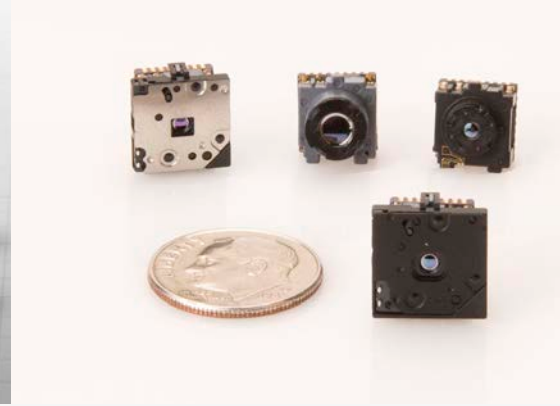
FLIR Production Facility located in Goleta, CA



- Industrial Division Headquarters
- Two major buildings with 170,000 ft²
- Five consolidated cleanrooms totaling 30,000 ft²
 - 1 - Class 1000 Cleanroom
 - 4 - Class 10,000 Cleanrooms
- Provides integrated facility to manufacture:
 - III-V based sensors (InSb, SLS and InGaAs)
 - VOx bolometers
 - High volume packaging of IR sensors.

Industry Leading Customer and Technology Innovations

**Cutting
Edge
Imaging**



**Focus on
User
Experience**



Innovation in Sensing and Thoughtfulness in Design

Thermal by FLIR™

Program created to support OEMs and product innovators interested in using the FLIR thermal imaging sensors to provide the World's Sixth Sense

Program ensures that OEMs and entrepreneurs can carry the Thermal by FLIR™ brand and receive additional product development and marketing support from FLIR to build and market their respective products

THERMAL BY  FLIR™

CASIO®

Panasonic®

dji®

CAT®

ARSENZ™
Wearable Computing Solutions

TF TinkerForge™

FLIR – UCSB Interactions

Student Interactions: Internships/Alumni

- FLIR hires between 5 and 10 interns per year into engineering department
- Includes diverse disciplines
 - Electrical Engineering
 - Mechanical Engineering
 - Computer Science/Engineering
- Great method of identifying excellent students
- Approximately ½ of USCB interns employed by FLIR are hired as regular employees
- Significant number of engineering group are UCSB alumni

Student Interactions: CAPStone Projects

- The UCSB Engineering Capstone Program is a year-long, project-based course offered to fourth-year engineering students. The program focuses on the development of our students into professionals by pairing students with experts from industry and/or experts from academia to create an engineered solution for real and meaningful problems.
- FLIR has sponsored 9 CAPStone projects since 2011; projects included both single discipline and multi-disciplinary approaches
- Benefits to FLIR
 - Creating a good reputation among the students as being a good sponsor/mentor allows us to get the best students year after year.
 - Get to know who are the best students (interview)
 - Create a good relationship with professors/UCSB
 - Get something done at low cost
 - Create prototype to enable new customers

Student Interactions: CAPStone Projects that turned into products

Thermal imager for firefighters

Problem
Firefighters have a tough job. The smoke they breathe obscures their vision during firefighting activities, and even together, the combined heat and smoke is so intense that it is often referred to as the "fourth enemy" of the firefighter.

Our Solution
A hands-free thermal camera that attaches to the brim of a firefighter's helmet. When a firefighter looks to a display, inside of the helmet, giving the firefighter unparalleled thermal vision.

Hardware
FLIR A700
- 3.6MP 120° FOV
- 800mW max power
- 30-3000K sensitivity
- 30-3000K sensitivity
- 30-3000K sensitivity

System Block Diagram

FLIR
The World's Sixth Sense™

Hands-free

HOME / PRODUCTS / THERMAL IMAGING

Scott Sight

Finally, a truly hands-free thermal imager. Scott Sight provides unmatched situational intelligence without the need to stop searching a room or put down your hose line.

https://www.3m-scott.com/product_categories/hands-free/

Quark Self-Stabilizing Gimbal

Hummingbird: The Self-Stabilizing Gimbal
Nicholas Perler, Adam Silver, Patrick Clark, Phuong Nguyen, Nicholas Cincos
June 5, 2018

Abstract
FLIR Systems is a manufacturer of the thermal imaging camera. The Hummingbird is a self-stabilizing gimbal that can be used to hold a camera steady while in motion. It is designed to be used with the Quark and Quark 2, but can be designed to hold any camera. It is designed to be used in a variety of applications, including aerial photography, surveillance, and security.

Design Requirements
1. The gimbal must be able to hold a camera with a weight of up to 1.5kg.
2. The gimbal must be able to hold a camera with a weight of up to 1.5kg.
3. The gimbal must be able to hold a camera with a weight of up to 1.5kg.

Design Simulation
The simulation was used to verify the design of the gimbal. It was used to verify the design of the gimbal. It was used to verify the design of the gimbal.

Conclusions
The gimbal was designed to be used with the Quark and Quark 2. It was designed to be used with the Quark and Quark 2. It was designed to be used with the Quark and Quark 2.

FLIR
The World's Sixth Sense™

ZENMUSE XT2
DUAL VISION. SUPERIOR INTELLIGENCE.

Join the next generation of commercial drone solutions with the XT2. Pairing the FLIR Tau 2 thermal sensor and 4K visual camera with DJI's leading stabilization and machine intelligence technology, the XT2 quickly transforms aerial data into powerful insights that save time, money—and lives.

Watch Video

<https://www.dji.com/zenmuse-xt2>

Student Interactions – GRAD SLAM Program

Launched in 2013, **Grad Slam** is an [award-winning](#) campus-wide competition for the best three-minute talk by a graduate student. Students present the central points of their project in a clear, direct, and interesting manner for a diverse audience comprised of students, faculty, and community members.

- FLIR is a sponsor of the GRAD SLAM program and competitions
- FLIR invites the students to present their talks at FLIR



Student Interactions: Technical Masters Program

The Technology Management Program at UC Santa Barbara is dedicated to the development of business and innovation in an increasingly technology-based global economy. TMP offers a Ph.D. in Technology Management, a professional Master of Technology Management degree, as well as UC-recognized certificates to current undergraduate and graduate students.

- Project Support
 - FLIR has funded a TMP project every year since program started
 - FLIR is currently funding one project
- Two FLIR Employees were hired from TMP program
- 1 FLIR employee went through TMP program and returned to FLIR

UCSB Facilities - NanoLab

UCSB Nanofabrication Facilities

- Wafer fabrication equipment in a Class 100/1000 cleanroom facility

Facility provides FLIR with:

- Evaluation of Equipment of Interest
- Material Development
- Process Development on Equipment unavailable in FLIR facilities



UCSB Facilities – Microscopy Lab



UCSB Microscopy Facilities

- Microscopy and Microanalysis Facility instruments managed by UCSB Materials Department

MRL provides:

- High End FIB/SEM and TEM Capabilities
- Equipment used in Failure Analysis
- Equipment Used in Process Development and Analysis



Summary

- FLIR Goleta's facilities' proximity to UCSB has been very beneficial
- FLIR – UCSB Interactions have included
 - Student internships and hiring of alumni
 - Access to technical facilities complementing FLIR facilities
 - UCSB faculty interactions
 - New product developments
- FLIR is fortunate to be located in a place with the sun, the beach and UCSB



The World's **Sixth Sense**®