TELEDYNE

NTCO AGM 2024

Introduction To Teledyne FLIR & Success Stories

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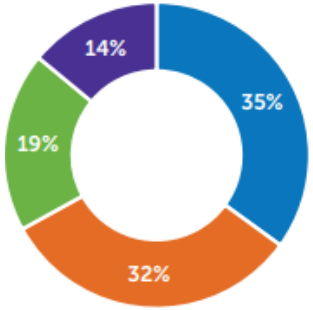
TELEDYNE FLIR OVERVIEW

TELEDYNE TECHNOLOGIES

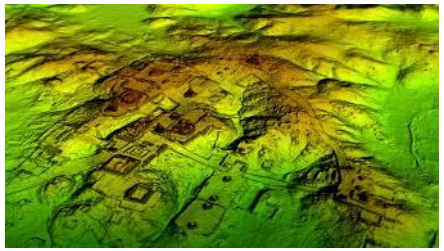
WHO WE ARE

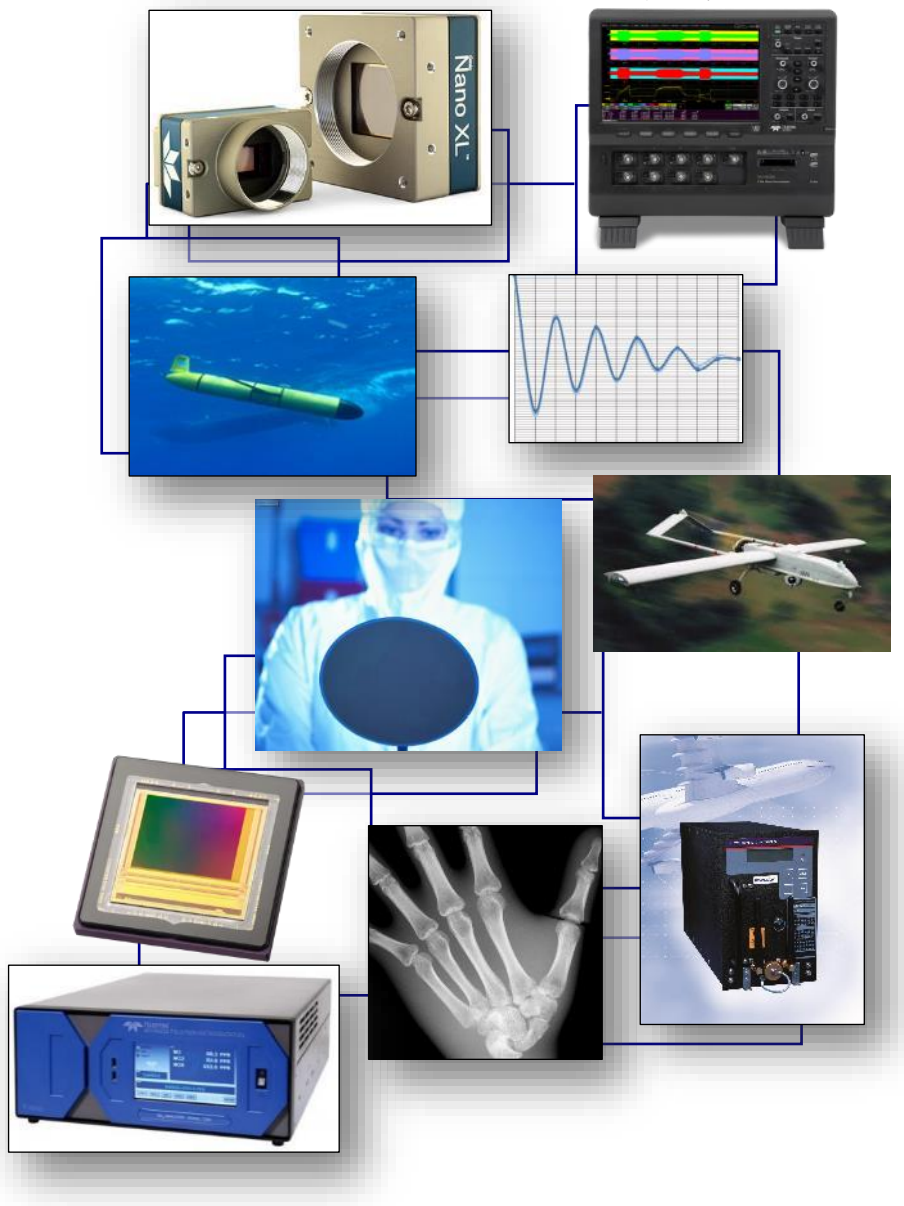
» Teledyne is a leading electronics, instrumentation and engineering focused company with headquarters in Thousand Oaks, CA.

» Publicly traded company, Teledyne had revenue of $4.614B in 2022 and ~ 14,500 employees.



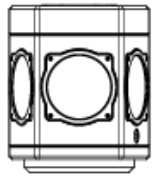
- Instrumentation
- Digital Imaging
- Aerospace and Defense Electronics
- Engineered Systems

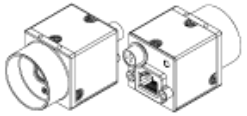


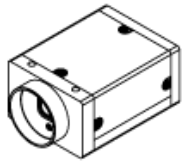


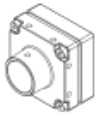
25 YEARS OF MACHINE VISION INNOVATION

Starting out as Point Grey Research in 1997, the Teledyne FLIR machine vision team is a key provider of machine vision, spherical, stereo and people counting cameras around the world.

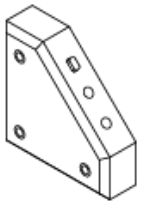








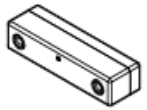
2000
First IEEE 1394 stereo vision camera
Digiclops



2001
First IEEE 1394 imaging camera
Firefly

2002
First spherical vision camera
Ladybug

First binocular stereo vision camera
Bumblebee



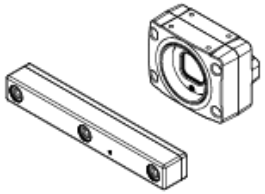
2004
First IEEE 1394b camera
Dragonfly Express

2005
New products
Dragonfly2
Ladybug2

2006
New products
Flea2
Firefly MV
Bumblebee2

2007
New products
Grasshopper
FirePRO

First multi-baseline stereo vision camera
Bumblebee XB3



2008
New product
USB 2.0 camera
Chameleon

New product
Ladybug3

2009
World's first
USB 3.0 Camera

2010
New product
Flea3

New product
GigE camera
Grasshopper2

2011
First
Camera Link camera
Gazelle

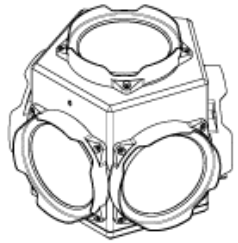
First USB 3.0 camera
Flea3

World's smallest
GigE camera
Flea3

New product
Grasshopper Express

2012
New Product
IP camera
Zebra2

World's Smallest
PoE GigE Camera
Blackfly



2013
New USB3
products
Ladybug5
Grasshopper3

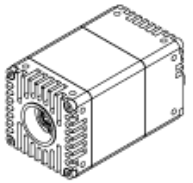
2014
New USB3 product
Blackfly USB 3.0

New GigE product
Grasshopper3

2015
New USB3 product
Chameleon 3

2016
New USB3 and
GigE Vision
product
Blackfly S

2017
10 GigE Camera
Oryx

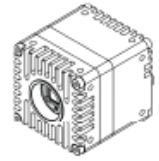


2018
Board-level
Blackfly S

2019
Industry's First
Deep Learning
Camera
Firefly-DL

APS-C Oryx
Oryx

2020
New 10GigE
Form Factor
Oryx



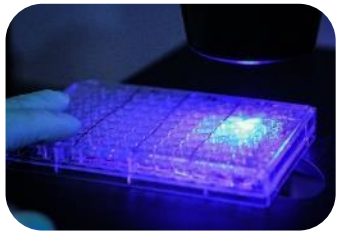
SOME OF OUR CUSTOMERS

Electronics & Semiconductor

Food, Beverage, Pharmaceuticals

Entertainment

Industrial



Medical & Life Science

Metrology

Robotics

Traffic

Logistics

Aerial

Surveillance

Space

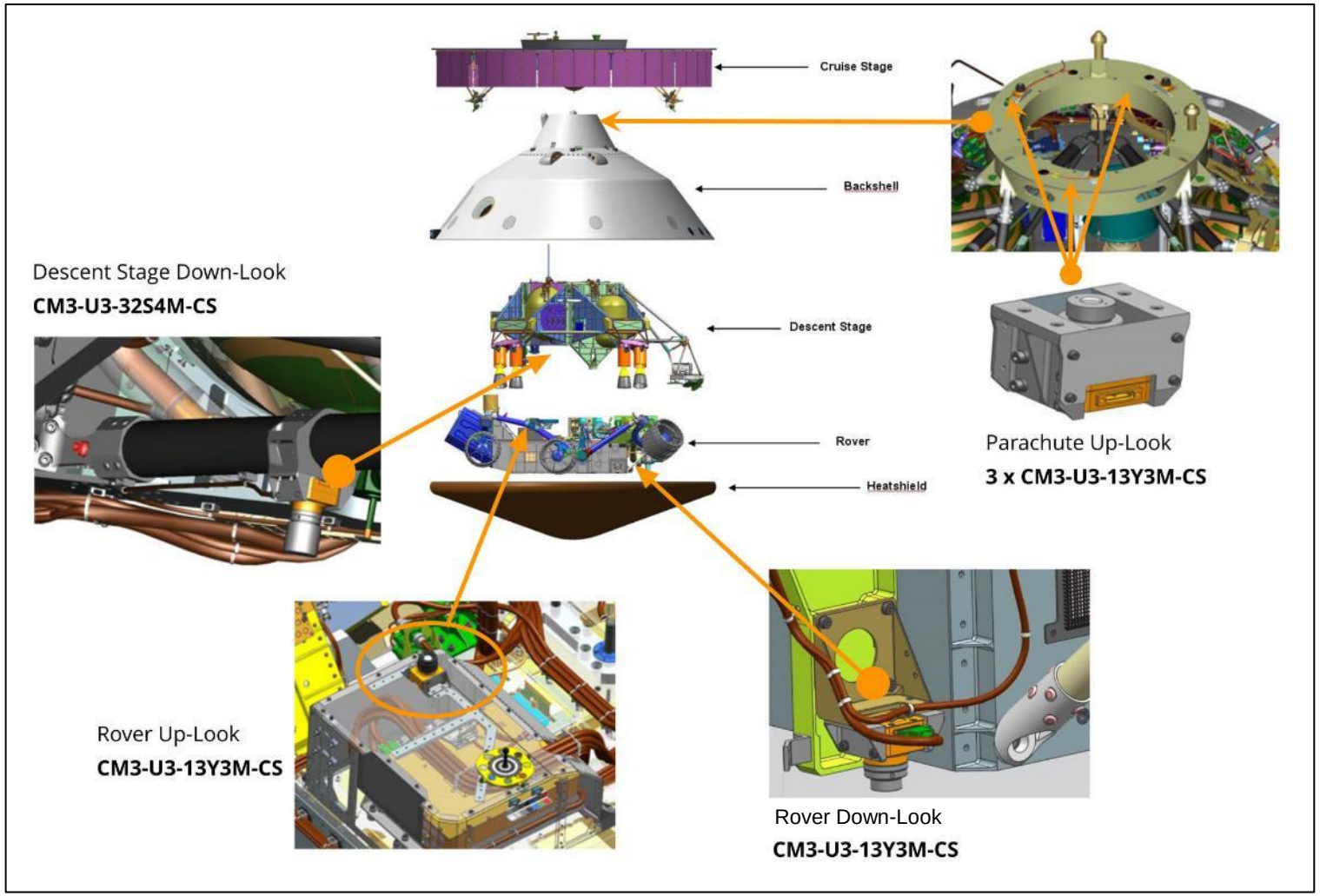
CUSTOMER STORY

TELEDYNE FLIR ON MARS!

- NASA successfully launched their Mars 2020 mission on an Atlas V Rocket
- NASA’s most “camera dense” mission with 23 total cameras
- There were 6 FLIR cameras !
- First time our cameras are subjected to extreme temperature & gravity forces
- Prove our product quality was good and process was robust to ensure consistency

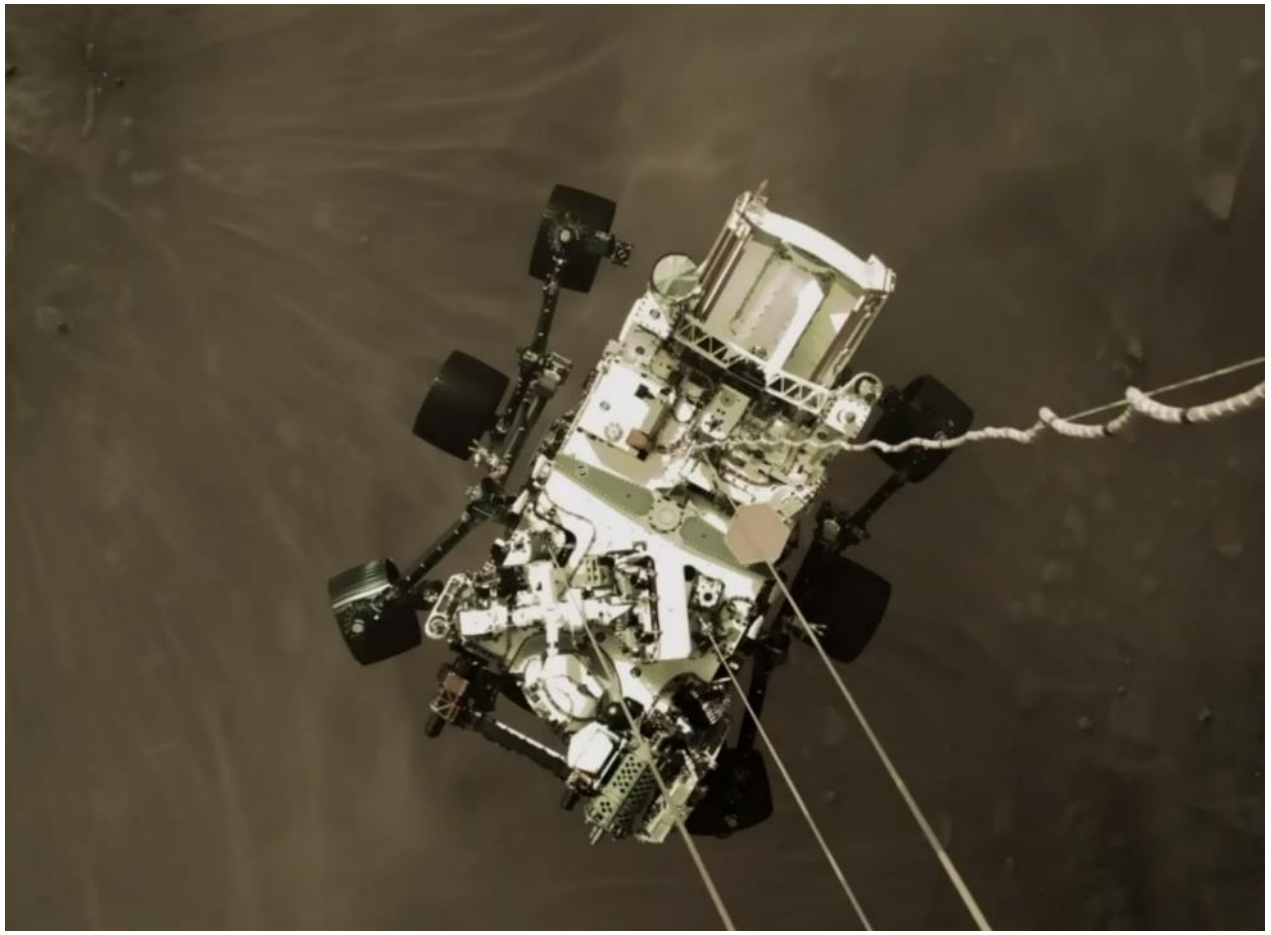
ENTRY, DESCENT & LANDING (EDL) CAMERAS

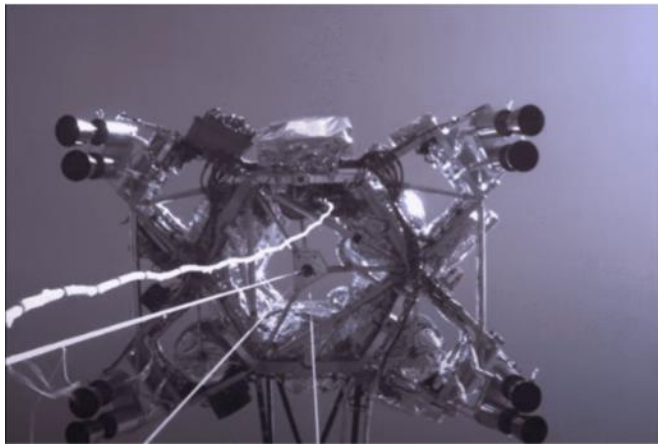
- Looking for COTS cameras – low cost, ease of system integration
- Parachute up-look cameras will watch how the parachutes deploy
- Descent stage down-look cameras will watch how the rover is lowered
- Rover up and down-look cameras will record the rovers progress as it is lowered from the descent stage
- Parachute and descent stage cameras will be jettisoned with the back shell and descent stage



NASA ROVER LANDING ON MARS

NASA successfully landed the Perseverance Rover on Mars on February 18, 2021





NTCO PROGRAM

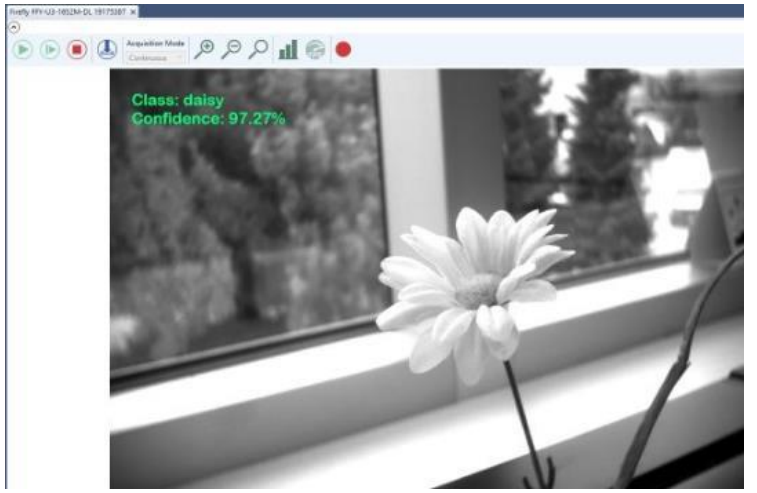
INTERNSHIP TOPICS & TECHNOLOGIES

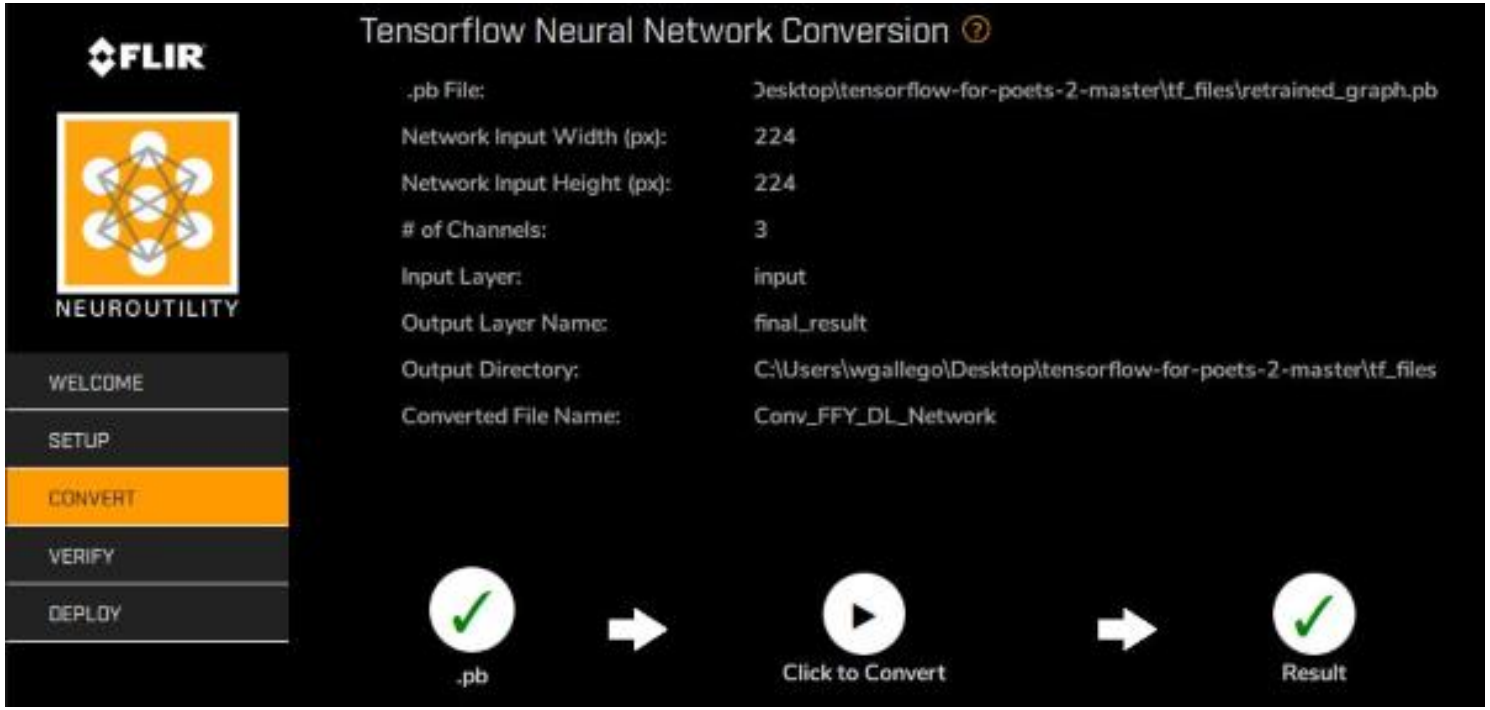
- Topics
  - Optical camera test equipment
  - Software development for new cameras
  - Deep learning network optimization
  - Deep learning use cases
- Technologies
  - Zemax, optical bench design
  - Deep learning, Tensorflow, Caffe
  - C++, Python, ROS

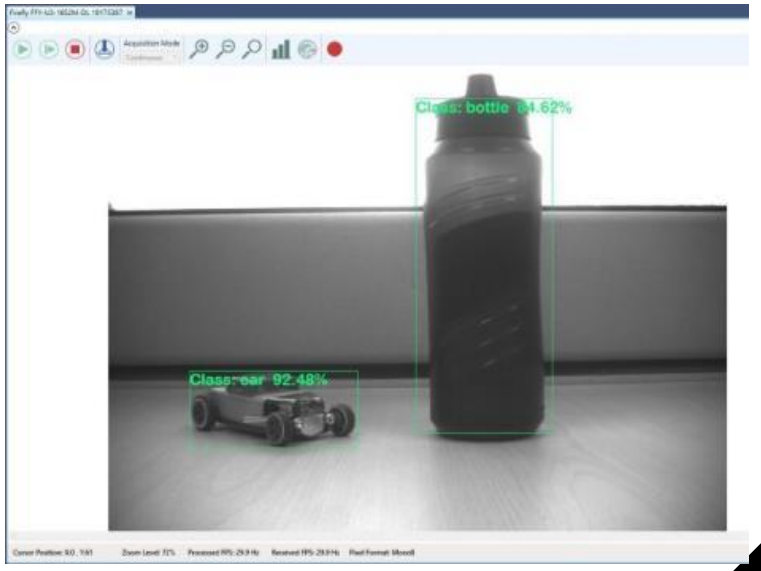
DL MODEL UTILITY

- NeuroUtility tool for Firefly DL camera
  - DL model conversion & upload
  - DL model verification

Firefly DL camera

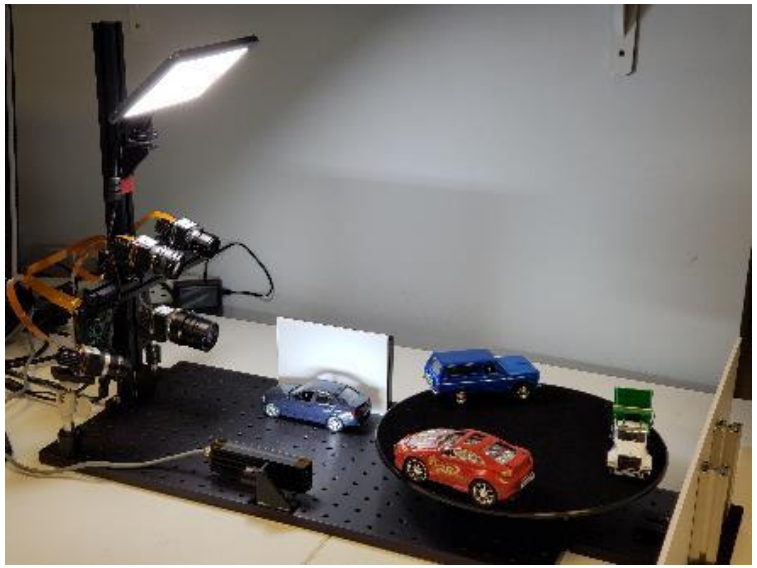


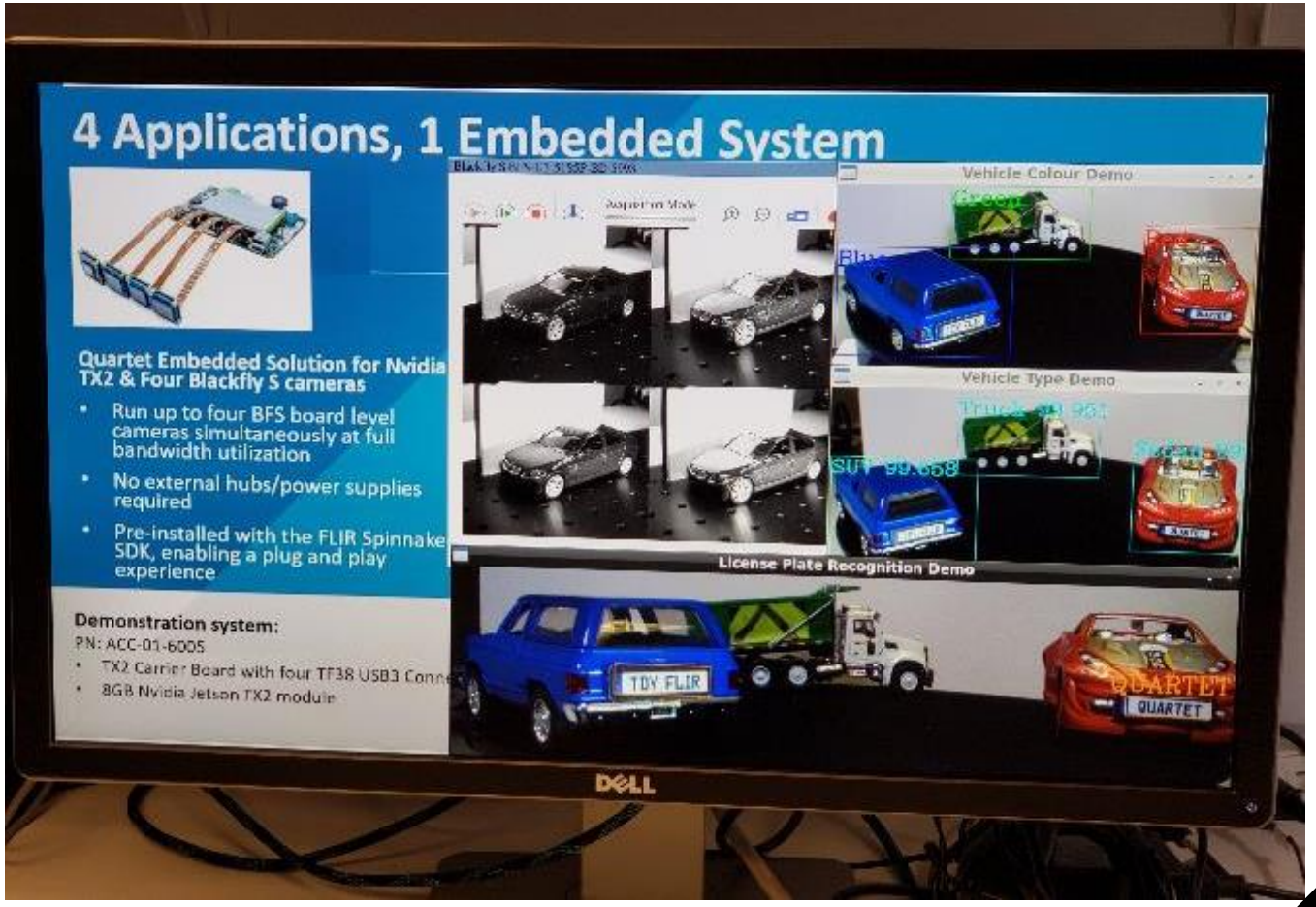




DL MODEL TRAINING

- ITS (Intelligent Transportation System) applications
  - Vehicle type recognition
  - Vehicle colour recognition
  - License plate recognition
- Demo at Vision Stuttgart 2021





NTCO STUDENTS

Student name	University	Program	When	Arrangement
Stephanie Monty	U Vic	B.Sc.	July – August 2018	In-person
Tarun Kumar	U Vic	Ph.D.	May – July 2019	In-person
Nikita Shymberg	U Vic	B.Sc.	May – August 2019	In-person
Kelvin Shao	U Vic	B.S.Eng.	September – December 2019	In-person
Gursewak Singh	U Vic	B.Sc.	January – April 2020	In-person -> remote
Rehan Hafeez	UBC	B.A.Sc.	July – August 2020	Remote
Robert Bickley	U Vic	Ph.D.	September – December 2020	Remote
Viraja Khatu	Western U	Ph.D.	February – April 2021	Remote
Ridhee Gupta	U Waterloo	B.Sc.	May – August 2021	Remote
Jennifer Vlaar	U Vic	B.S.Eng.	June – August 2023	In-person

THANK YOU