

# Phoenix Maintenance & Development

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NIROPS Closeout, NIFC, Boise

# Phoenix Operators

🌀 Big Thanks!

- Kelli Gammons
- Jill Kuenzi
- Brian Teats
- Rob Navarro

# Development Goals / End Game

- “Phoenix NexGen” expected fire season 2022
- Improved Operational Efficiencies
  - Improved system versatility and usage
  - Extended operational life
- Improved System Performance
  - Enhanced orthorectification
  - Improved image collection/resolution
  - Reduced unwanted images artifacts

## System Versatility

### Ekinox INS/GNSS

- Repeatability/streamlined calibration
- Upgraded Multiband GPS Antenna
- Comparable to Applanix INS performance

### Cryocooler

- Replace Phoenix liquid nitrogen (LN2) cooling system.
- Reduce height of scanner
- Eliminates need for in mission scanner access

# Operational Efficiencies

## ● Ekinox INS/GNSS

- Installed & ready to be implemented

## ● Cryocooler

- Delivered by end of 2021

## ● New Mirrors

- Static set - Delivered 12-31-2020
- Rotating Mirror - Delivered by end of April 2021

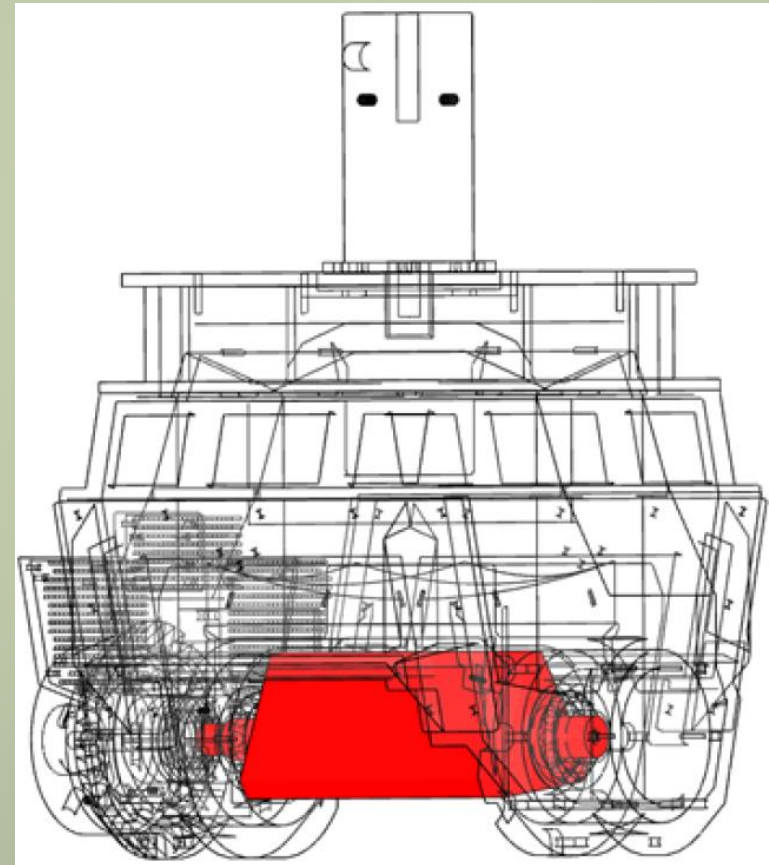
## Engineering Stress Analysis

### ● FEA - Lifetime 20 - 25 years

- Daily use for 8 months/year (April-November) = 244 days
- Max Spin-up/Spin-down per day: 3
- Max Flight Hours per day: 6

### ● Lifecycle Calculations

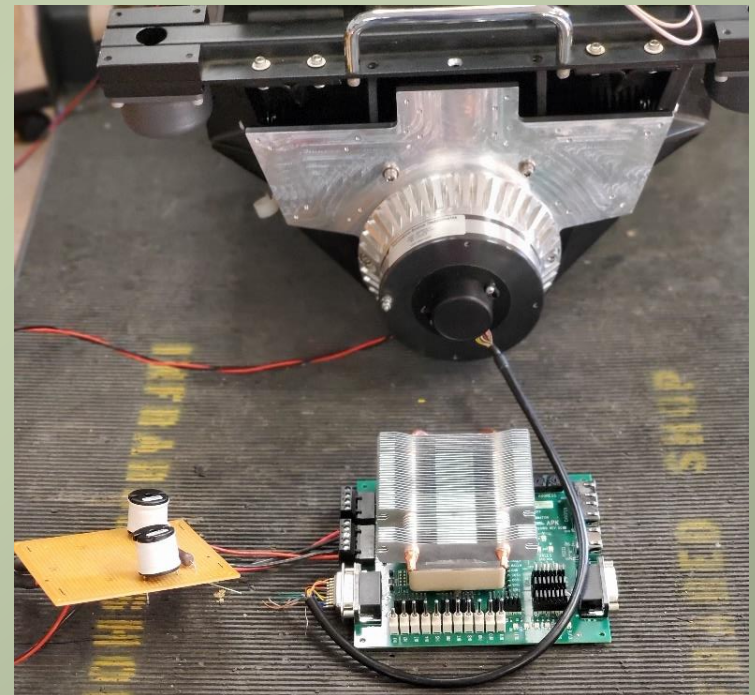
- Spin-up/Spin-down Cycles
- Aircraft Vibration Cycles
  - Jet and Propeller
- Surface Crack Growth



*Figure 1: Rotating Mirror placement in scan head*

## Improved Image Collection

- New Motor & Controller
  - Generated sync pulse
- New ADC/DSP
  - Upgrade from 32-bit to 64-bit
  - Faster data pipe - Quadruple scan speed
- New pre-amp and signal conditioning
  - Allow addition of SWIR bands to system



*Figure 2: new motor with controller/development board.*

## Improved Image Resolution

- Analog Digital Converter (ADC)
  - 4 -16 bit - Fully Differential Channels
  - 30 % Useable bandwidth (Increased Resolution)
- Digital Signal Processing (DSP)
  - Receives the INS data
  - Precision line synchronizing
- Designed by Sheldon Instruments

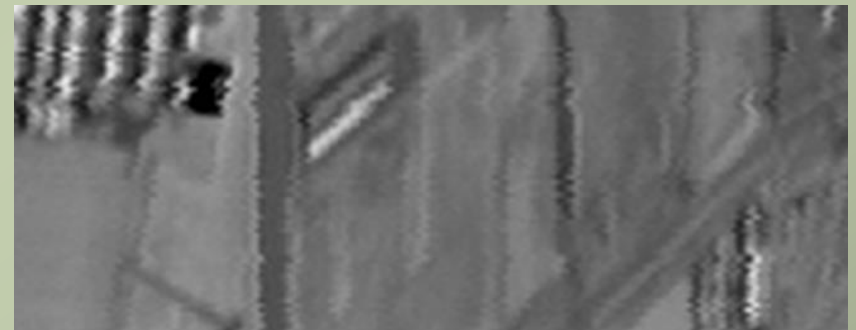


Figure 3: New ADC/DSP

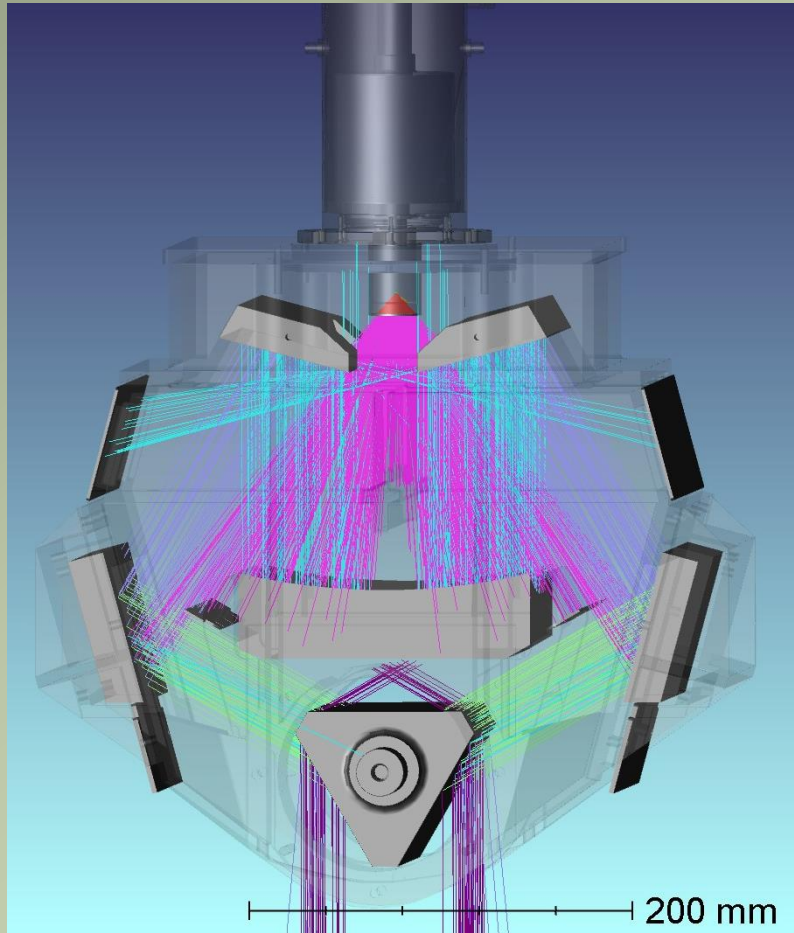


## Enhanced Orthorectification

- Triggerable sync pulse
  - No horizontal line zig zag
- Length of left and right scan lines off nadir shrink or stretched independently



*Figure 4: Orthorectified image with noticeable zigzag*

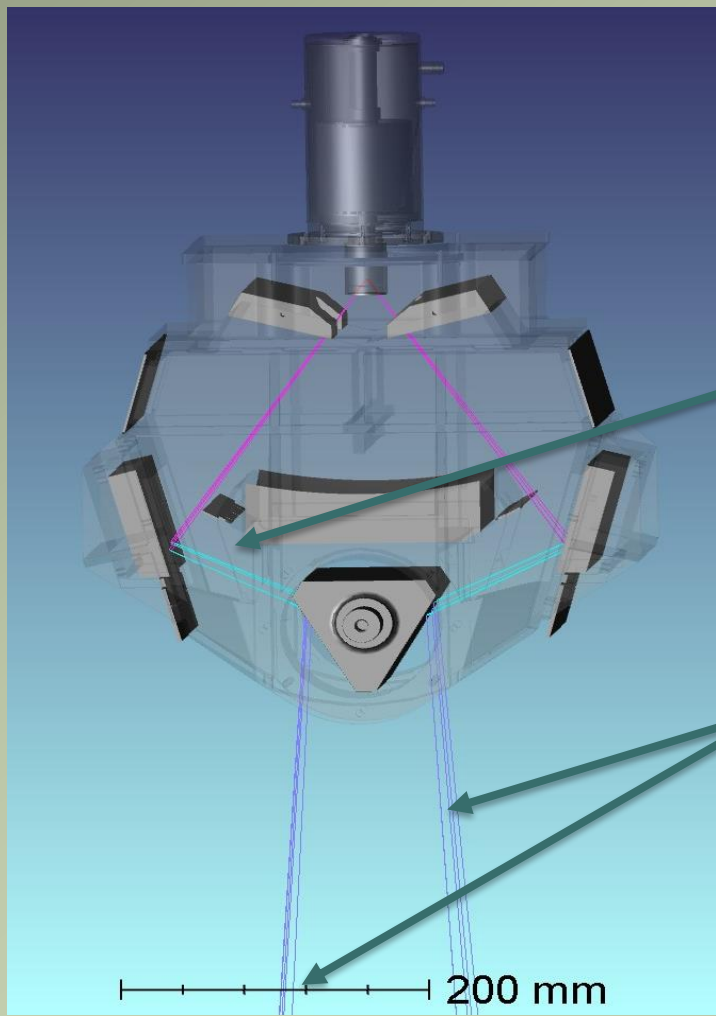


## Reduced Artifacts

- Xiomas Optical study
- Designed new baffle to eliminate “ghosting” in images

*Figure 5: Scanner assembly with the rotating mirror looking “down” and light entering the scanner from ground.*

## Reduced Artifacts



Light misses baffle and enters scanner

Stray light paths out of the scanner leave the scanner at an angle to the direction that the scanner is pointing towards on the ground.

Detectors see light from areas at an angle to the ground target, which causes apparent flaring of the bright images.

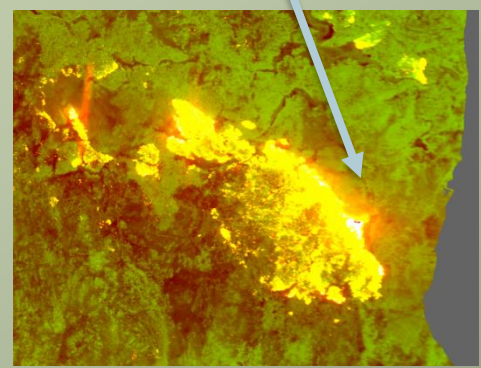
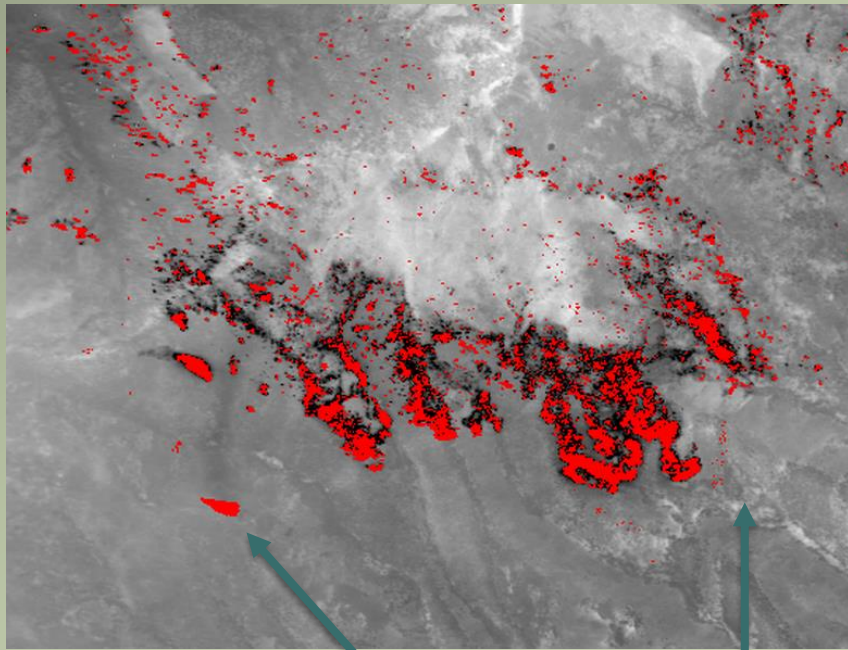


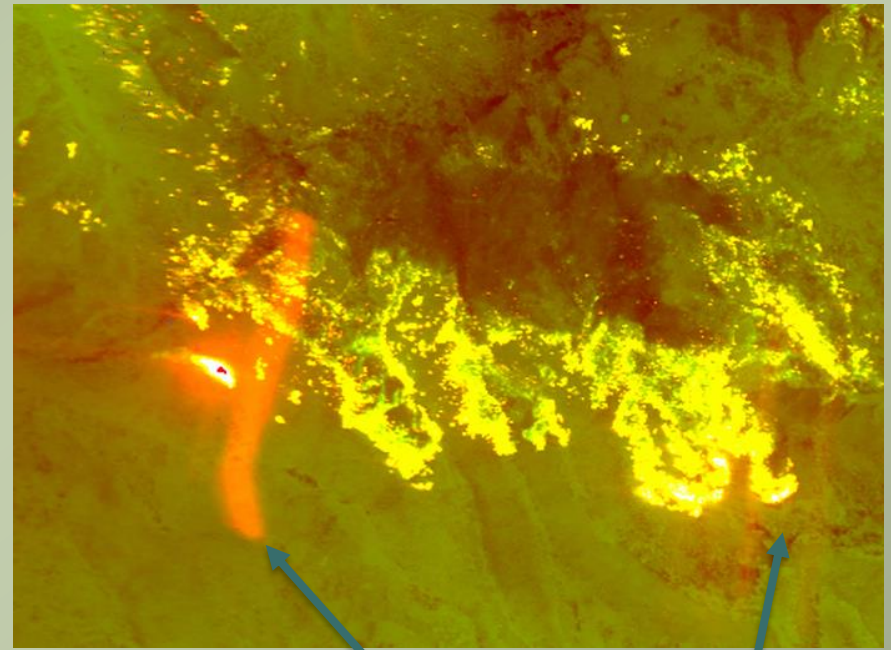
Figure 6: Scanner assembly showing only the stray light paths exiting from the scanner.

# NATIONAL INFRARED OPERATIONS



False trips off ghosting stray light path

Figure 7: Decker Fire 2019 Ortho image



Ghosting artifacts shown in raw color image

Figure 8: Decker Fire 2019 color image

## Autonomous Modular Sensor (AMS)

- Contributed funds to GTAC for NASA technical AMS support
- UAVSys
  - Data collection portion operational and working
  - 64 - bit
- LinkMod
  - Image processing portion ready to be tested.
  - Need 144Z – NASA working on alternative platform for testing



End of  
Presentation