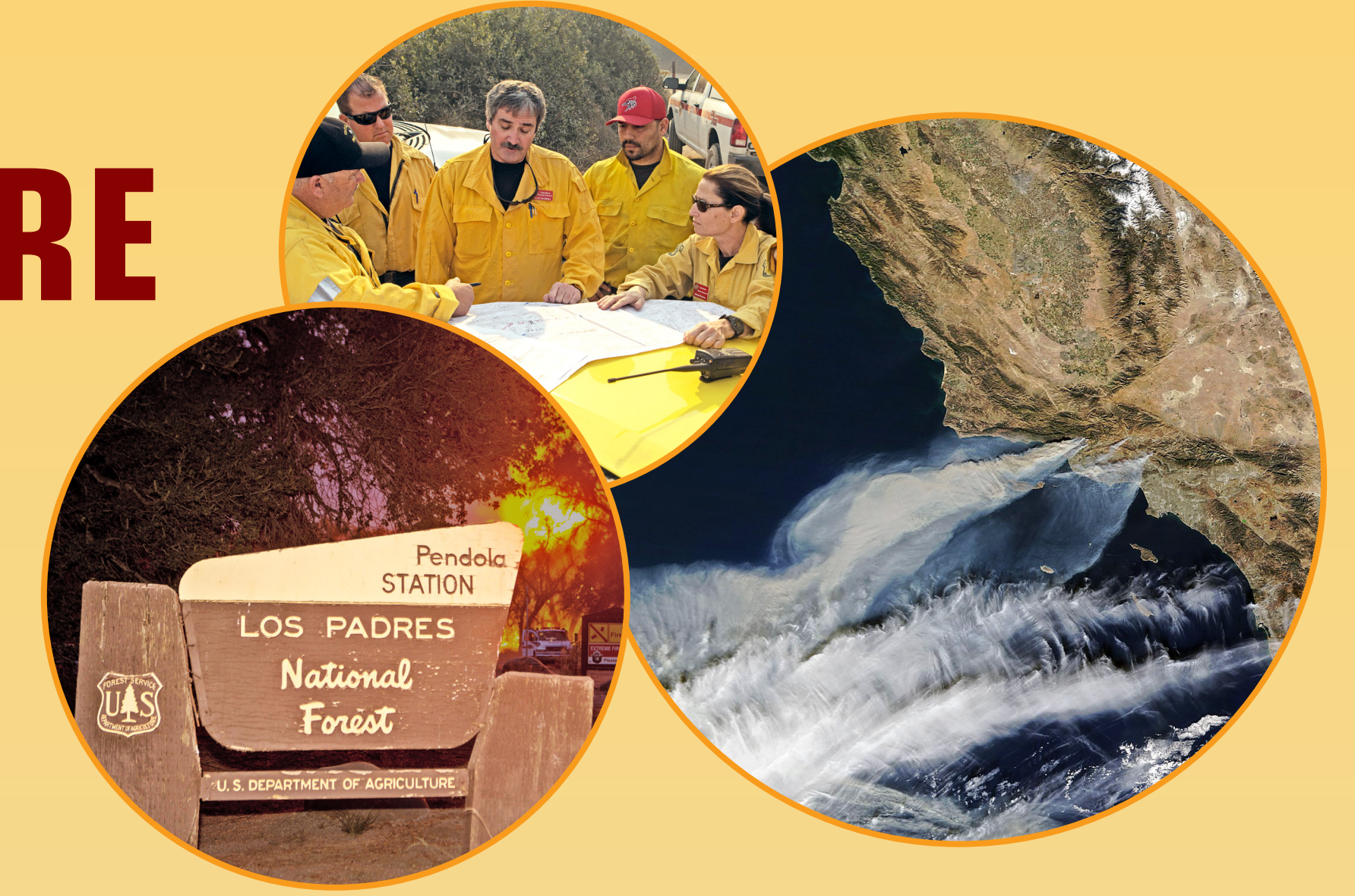


NATIONAL INFRARED OPERATIONS/NIROPS HI-TECH HEAT-SEEKERS

The USDA Forest Service's NIROPS program is the premier source for airborne infrared imagery to support wildland fire management across the United States. Daily NIROPS infrared imagery is ordered for hundreds of incidents each year and is used to create image-derived products that locate and map current heat concentrations at a fire spatial scale.

THE DAILY CYCLE OF WILDLAND FIRE INFRARED IMAGING SUPPORT



THOMAS FIRE

Incident Type: Wildfire
Cause: Under Investigation
Date of Origin: December 04, 2017 approx. 18:28 PT.
Location: Santa Barbara and Ventura Counties, California

8 Data Delivery

NIROPS data products are integrated into various work flows to support fire management operations, including compilation of the incident planning map to support the daily incident briefing conducted at 06:00 PT.

7 Image-Derived Data/Products

Trained IRINs interpret the imagery to produce standard mapping products. IRINs also document findings from the interpretation process and coordinate with the Incident Management Team to advise on technical issues.

6 In-Flight, Low Latency Delivery

Preprocessed infrared imagery is uploaded to a server minutes after acquisition via in-flight, broadband Internet transfer and accessed by Infrared Interpreters (IRINs).

5 Synoptic Coverage

The six mile wide swath of imagery acquired on a single pass by a NIROPS aircraft allows for coverage at a rate of ~300,000 acres per flight hour. Consequently, an approximately 10,000 acre fire can be imaged in less than two minutes

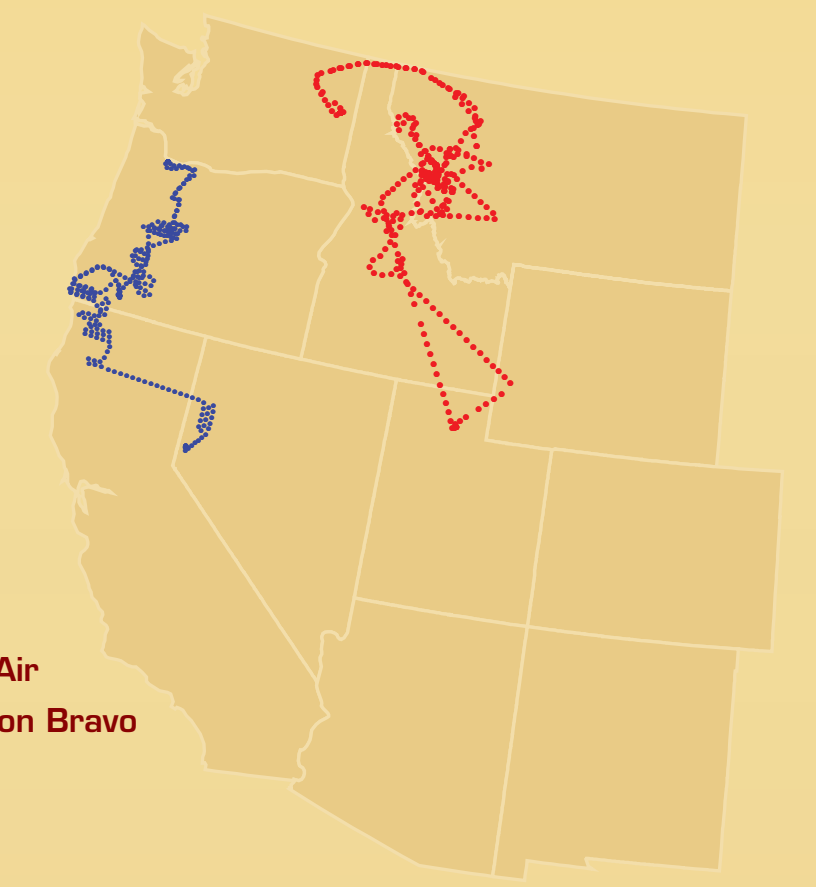
1 Infrared Flight Request (IR)

Incident management team submits an infrared order via NIROPS website by 15:30 MT. The first request for Thomas was received December 05, 2017, 11:06 PT— during the first full operational period of the fire, approx. 17.5 hours after ignition.

2 Flight Planning

NIROPS develops flight plans to acquire imagery for all requested incidents received that day.

NIROPS Coverage Across the Western United States
42 fires on complexes flown by the two aircraft on September 01-02, 2017.

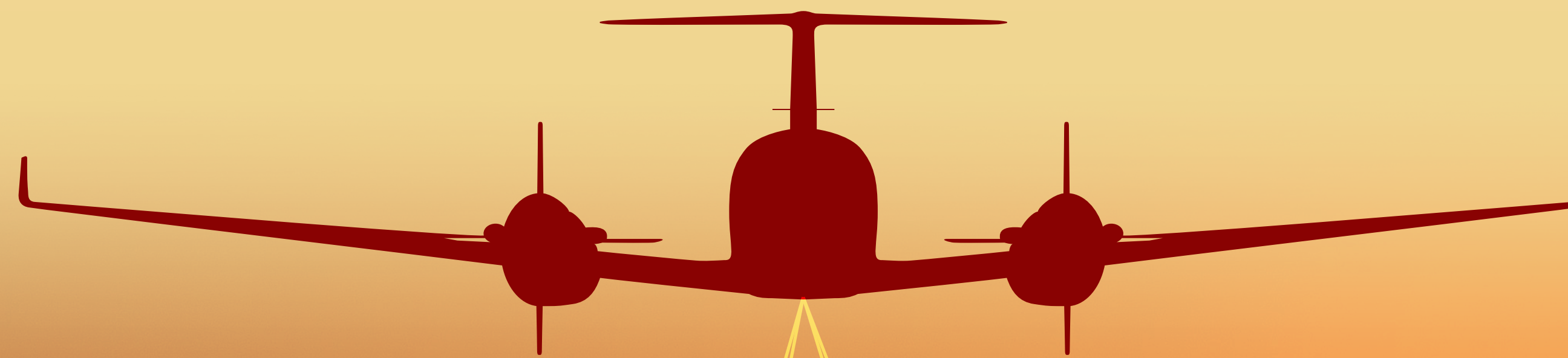


3 Eyes in the Night Sky

All NIROPS missions are flown at night to take advantage of temperature contrasts. Thermal imagery is acquired using the Phoenix sensor which can detect a hot spot smaller than the size of a paper plate from 10,000 feet above ground level.

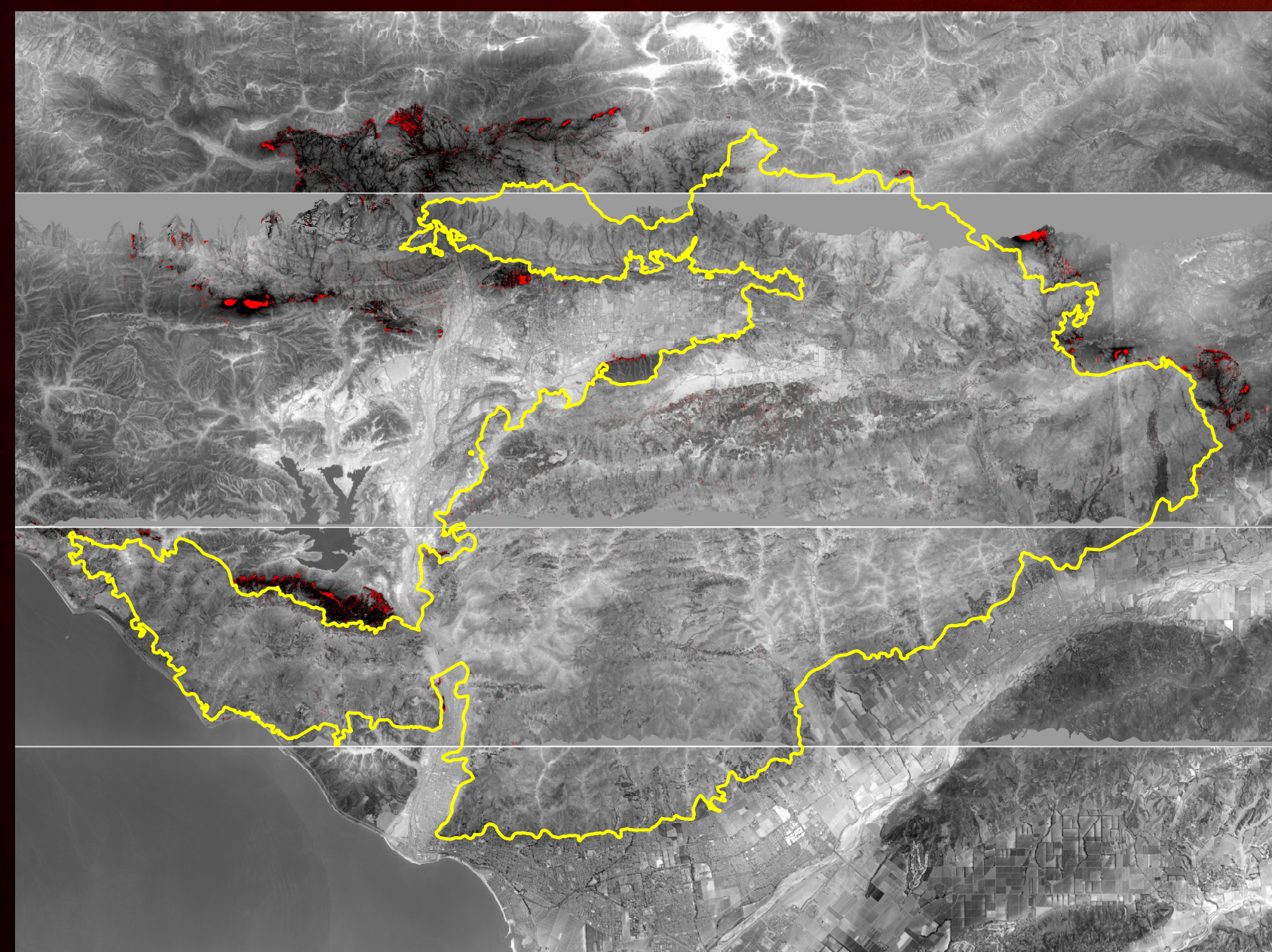
4 On board Data Processing

Infrared technicians on the aircraft monitor and ensure quality data collection. Imagery is processed on board the aircraft to remove distortions caused by the terrain.

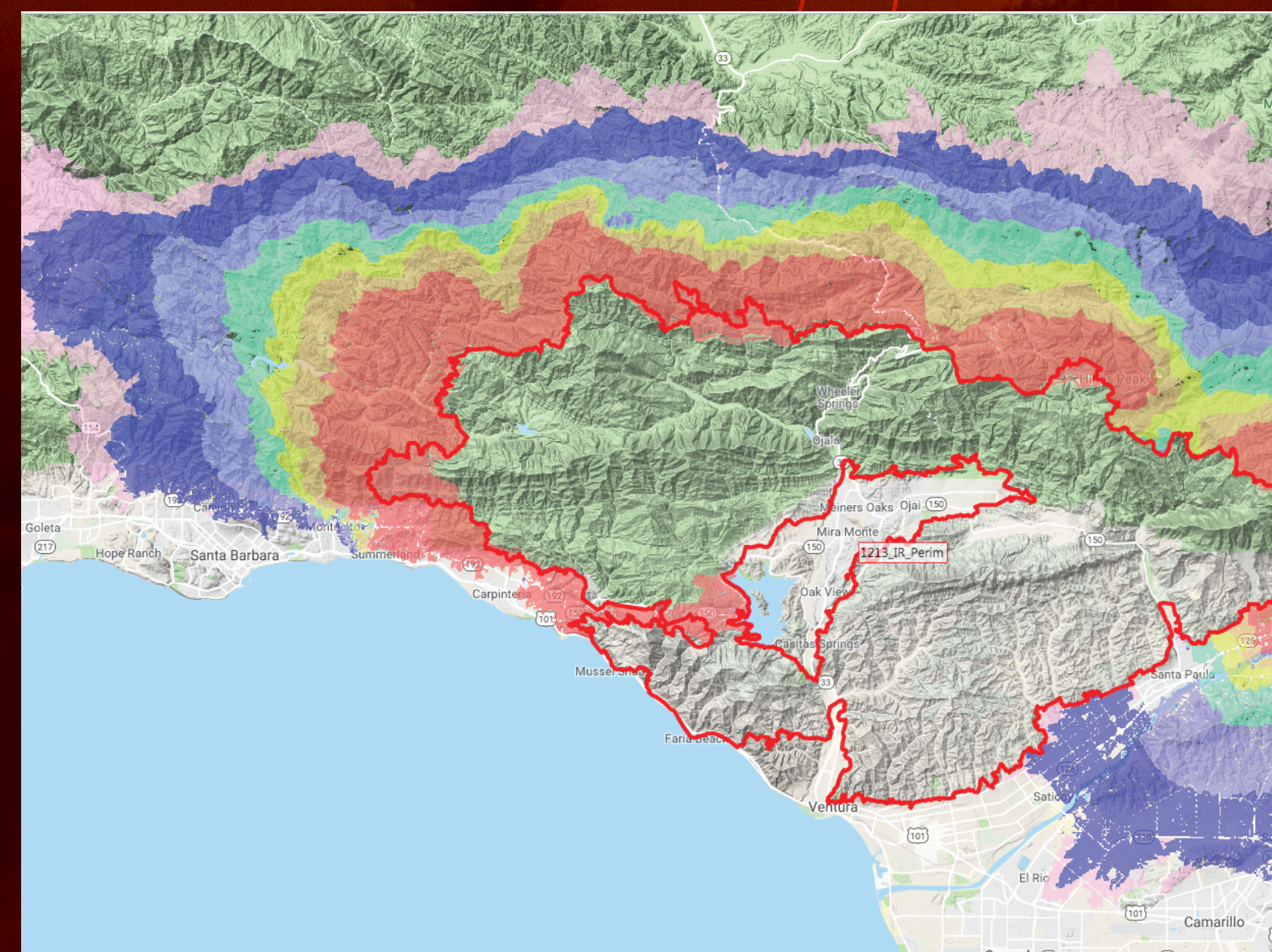


PRODUCTS AND APPLICATIONS

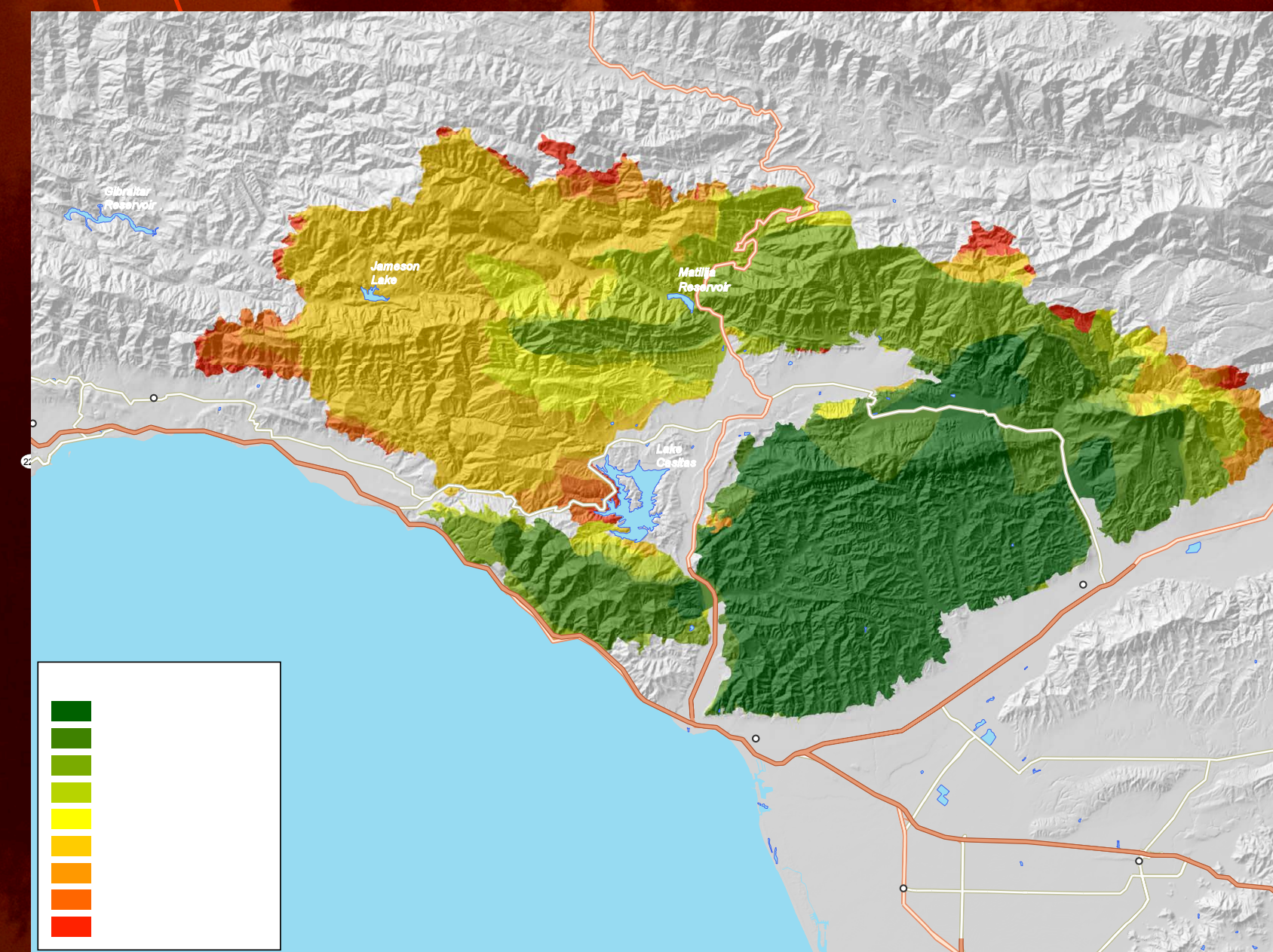
Data and maps are used to initiate fire behavior models, support fire management decision making, and inform the public.



Phoenix thermal imagery acquired by NIROPS on December 07, 2017, 22:10 PT. Red areas indicate fire activity automatically detected by the Phoenix fire detection algorithm. The yellow outline is the fire perimeter from the previous day.



FS-Pro modeled fire spread probability over a 7 day period conducted within the Wildland Fire Decision Support System (WFDS) on December 13, 2017, 19:07 PT. Current NIROPS fire perimeters are frequently a key model input parameter.

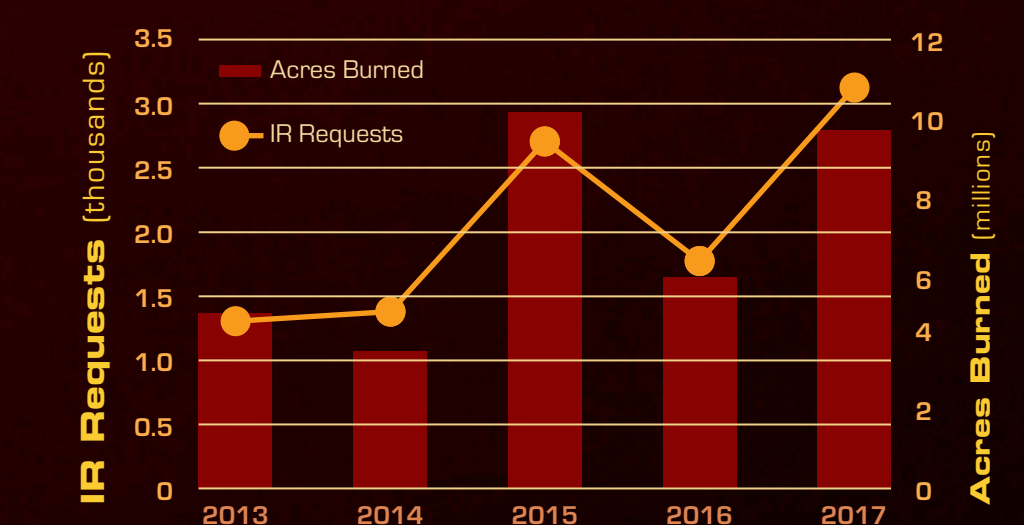


Fire intelligence map products are produced using NIROPS data, including daily incident planning maps to support tactical fire management and suppression operations as well as fire progression maps that illustrate daily fire growth over the duration of an incident.

THOMAS FIRE CONTAINED

Size: 281,893 Acres
Duration of Incident: 40 days
Containment date: January 12, 2018
Cause: Under Investigation
NIROPS completed 18 of the 19 Thomas Fire infrared mission requests during December 2017.

IR Utilization 2013 - 2017



The number of requests for NIROPS infrared imaging is increasing with more extreme fire activity and longer fire seasons.

