USGS post-event overflight to assess impacts of the 1 December 2018 M 7.0 Anchorage Earthquake

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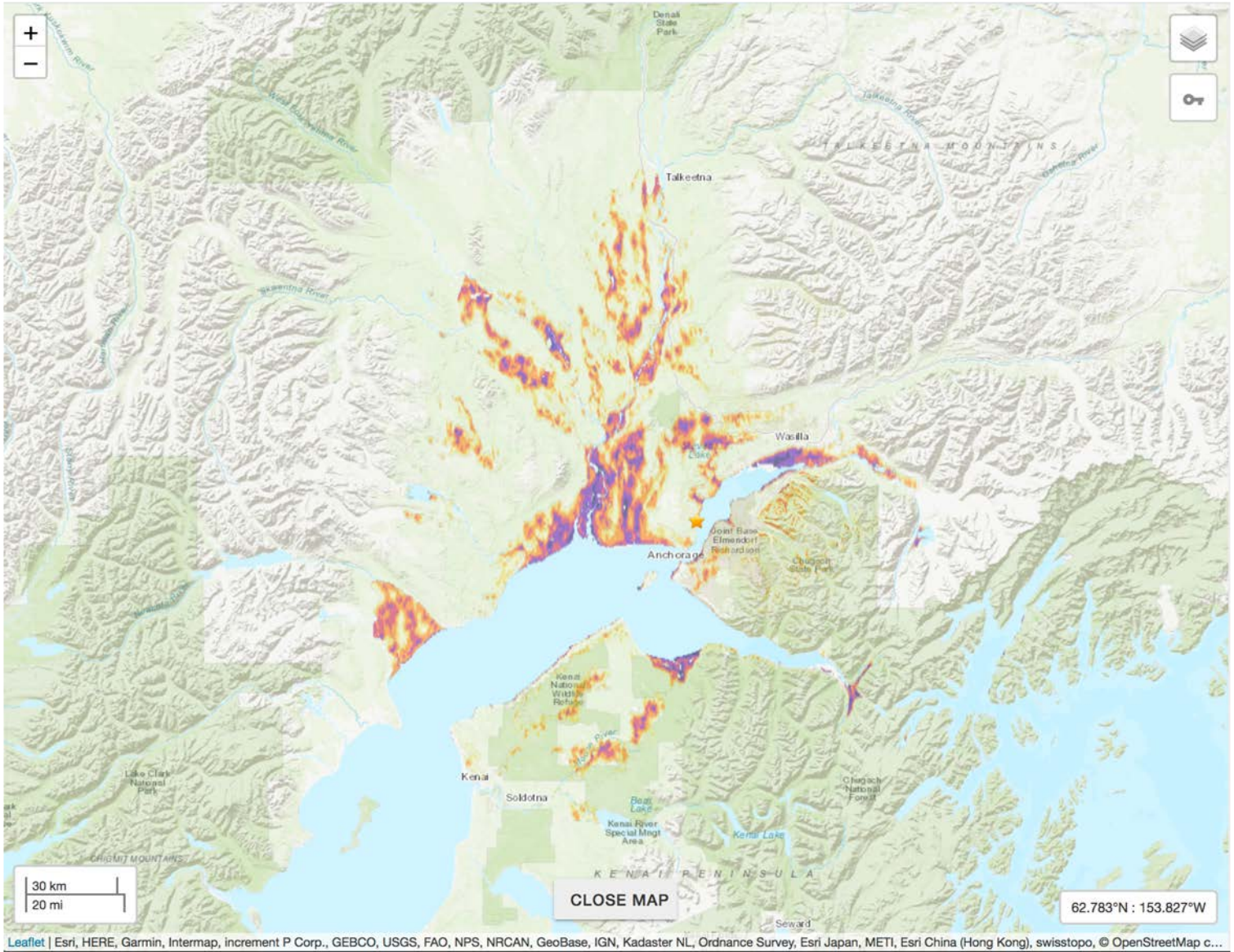
OBJECTIVES OF THE OVERFLIGHT

1. Locate, photograph, and assess large ground failures, including landslides and liquefaction
2. Assess secondary hazards like landslide dams and incipient cracks that may develop into future slope failures
3. Check for reactivation of large translational slides triggered in 1964

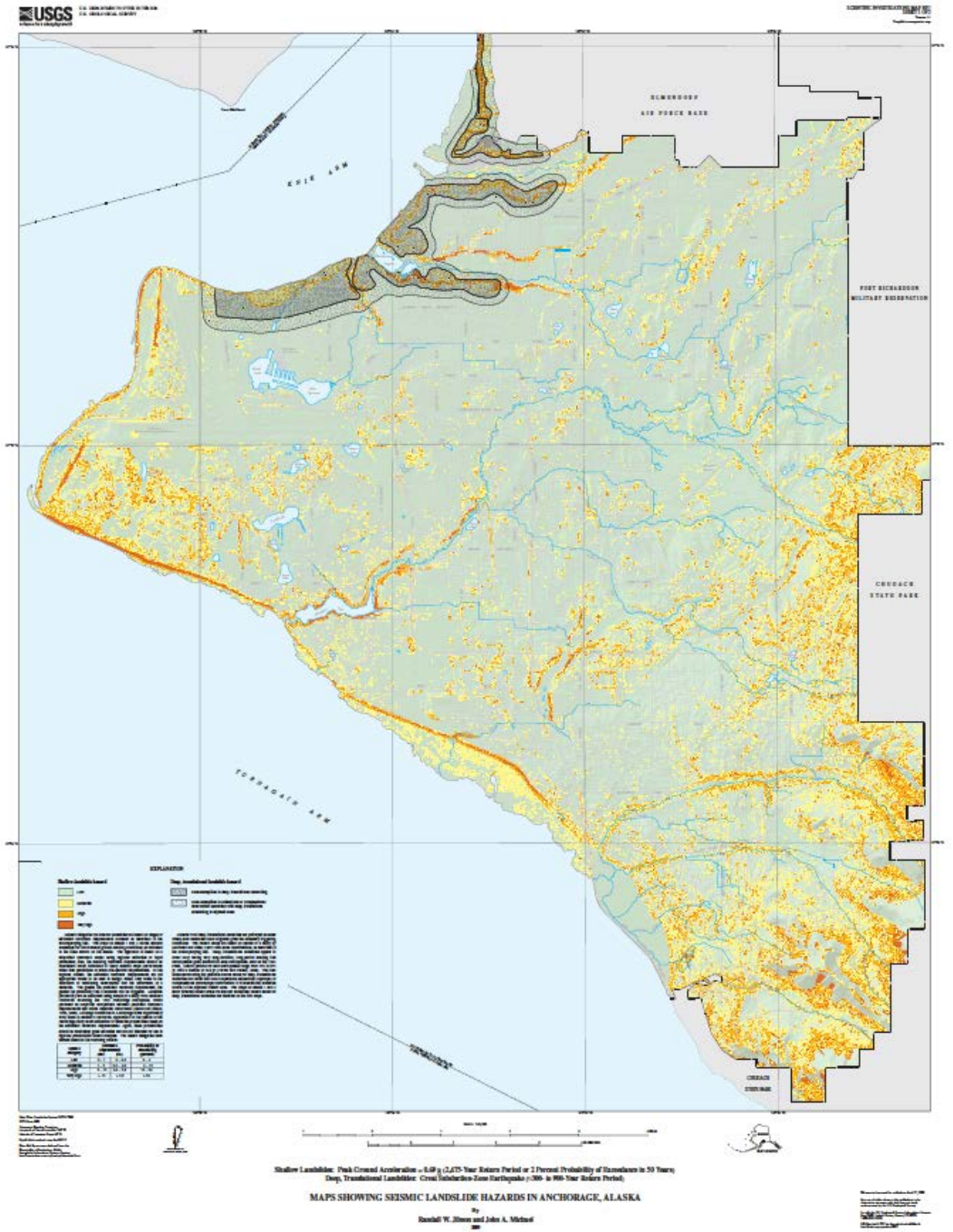


USGS Ground Failure Probability Maps



USGS Seismic Landslide Hazard Maps (Jibson and Michael, 2009)

- Quantifies seismic landslide hazard
- Used for planning, zoning,and emergency response
- Three landslide hazards shown
  - Deep, translational slides triggered by megathrust events
  - Shallow slides triggered by strong shaking
  - Shallow slides triggered by moderate shaking



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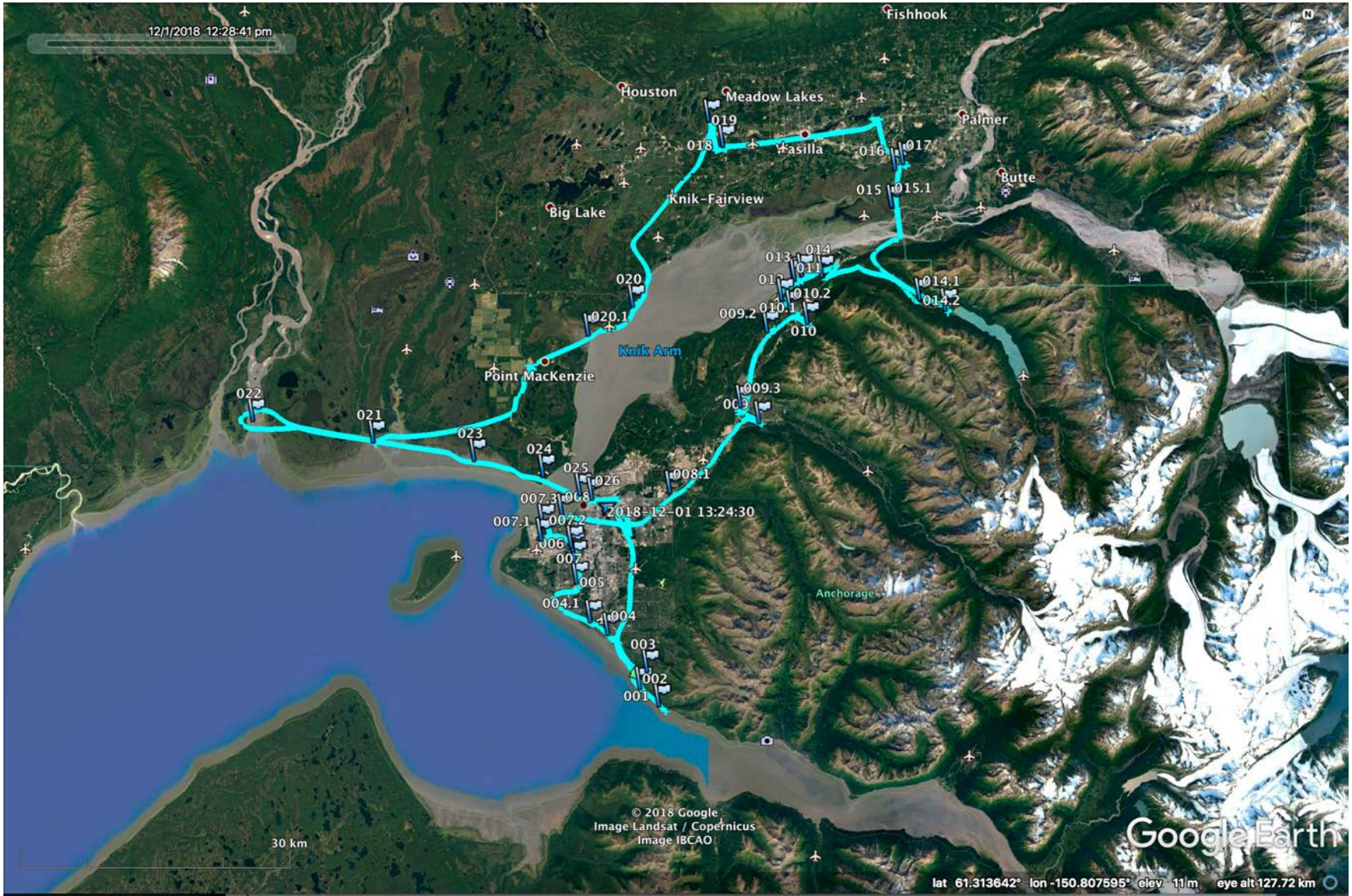
Flight path and sites investigated



Rock avalanche, Rainbow Peak

Large rockfall on east-facing slope of Rainbow Peak, about 8 miles east of Potter Marsh along the Seward Highway. This rockslide has fallen into a valley and may have impounded a stream. Secondary hazards include landslide dams that may break and cause flooding.

Photo credit: Vin Robinson via FaceBook

Ground cracks present the potential for future slope failure during aftershocks or heavy rainfall. These cracks occur at the top of a steep valley wall on the south side of Potter Creek in south Anchorage.

Lateral spreading disrupted Vine Road near Wasilla. Many failures of engineered materials occurred on or adjacent to saturated lowlands filled with organic sediment, silt, or sand.

Complex earthflow slumping along Alaska Railroad overlooking tidal flats along Knik Arm near Mirror Lake. Failure of these low bluffs may have involved liquefaction.

Eklutna Dam where we observed no evidence for ground deformation from aerial reconnaissance. Municipal utilities appeared to perform well during the earthquake.

Debris avalanches on bluffs composed of glacial outwash sediment along the Eklutna River.

Sediment vented by earthquake-triggered liquefaction at the mouth of the Little Susitna River.

CONCLUSIONS AND FUTURE WORK

1. We observed no clear evidence for reactivation of 1964 slides
   - However, we recommend further examination in the field to look for small displacements
2. The large Rainbow Peak rockfall between Anchorage and Girdwood presents possible additional hazards if it impounded a stream.
   - Additional overflight recommended.
3. Numerous ground cracks occur at the crests of steep slopes along Potter Creek, Eagle River, Peters Creek, and other deep valleys impacted by ground shaking.
   - These cracks present secondary landslide hazards that could be triggered by aftershocks or heavy rainfall and should be monitored to assess continued movement.
4. Next steps in our assessment includes overlaying the locations of large ground failures with geologic map of the Anchorage-Matsu area
   - Further work will evaluate landslide materials and possible failure mechanisms.
5. Our findings will be shared with local, state and federal partners, including:
   - Alaska Division of Geological & Geophysical Surveys to support lidar acquisition
   - Earthquake Engineering Research Institute to support geotechnical and engineering inspections
   - Alaska Earthquake Center to support education and outreach
   - Alaska's Congressional Delegation