Leveraging on Unmanned Aerial Vehicle (UAV) for Effective Emergency Response and Disaster Management

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Introduction

➢ Over the past two decades, the impact of disasters has been devastating, affecting 4.4 billion people, resulted in 1.3 million causalities and $2 trillion in economic losses.

➢ Each year Canada is affected by one or several major disasters, which tend to increase in hazard and vulnerability intensity (Henstra & McBean, 2005, cited by Niederer, 2015).

➢ According to a report by the Toronto Dominion Bank (TD, 2014), the long-term financial impacts of disaster is estimated to cost Canadians $5 billion per year in 2020 and $21-$43 billion by 2050 in infrastructure damages, healthcare costs, reduced performance of Canadian industry and lost labor hours.

➢ Most of the insured losses were caused by extreme weather events *(IBC, 2012, cited by Niederer, 2015).* This global upwards trend of socioeconomic cost caused by disasters is a major concern for the national and international community.

➢ The Sendai Framework for disaster risk reduction 2015 – 2030 therefore emphasis on disaster risk management as opposed to disaster management, a goal focused on preventing new risk and reducing existing risk *(UNISDR, 2015, cited by Niederer, 2015).*

Types of disasters

- ➤ **Natural**
  - ➤ earthquake , flood, volcano , landslides, drought, storm.

- ➤ **Manmade**
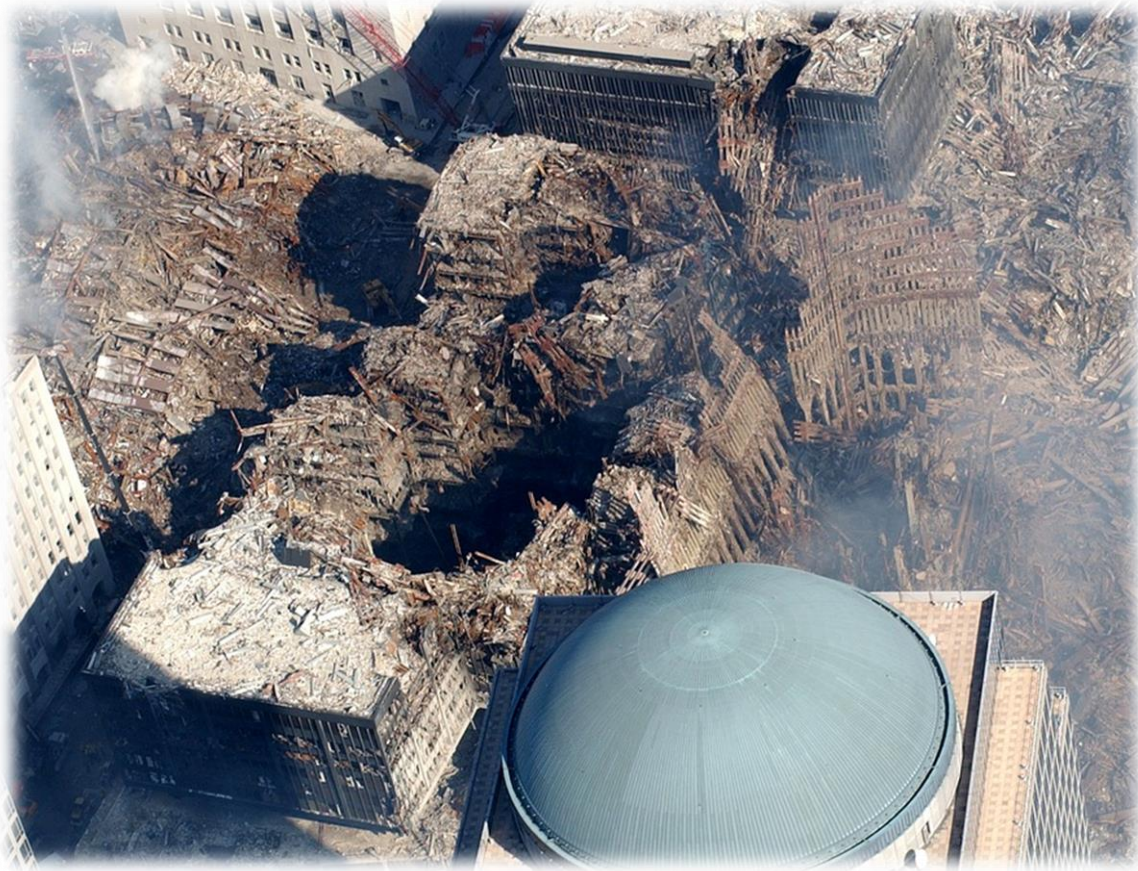 - ➤ urban fire, chemical & nuclear leak, terrorism, war.

- ➤ **NATECH (Natural Hazard Triggering Technological Disasters)**
  - ➤ tremendous risks to countries and communities that are unprepared for such risks.
  - ➤ High risk areas: nuclear power plants, chemical plants, microbiological research labs military warehouses.

Natural disasters

Manmade disasters

Natech disasters

Unmanned Aerial Vehicle (UAV)

➢ Advances in Unmanned Aerial Systems (UAS) production and capabilities has lowered barriers to entry for UAV operations and lead to a rapid growth in usage.

➢ UAV is a **disruptive technology** and will impact many industries.

➢ A multi-billion economic impact is being predicted in the US *(UAS-USA-New Economic Report 2013 - AUVSI 2015-2020).*

➢ Using UAV to access the disaster affected areas and to monitor and capture data to make well-informed decisions, combined with the efficiency of a project team and strong coordination, project success should increase.

Public perception

Military intrusive device

Toys

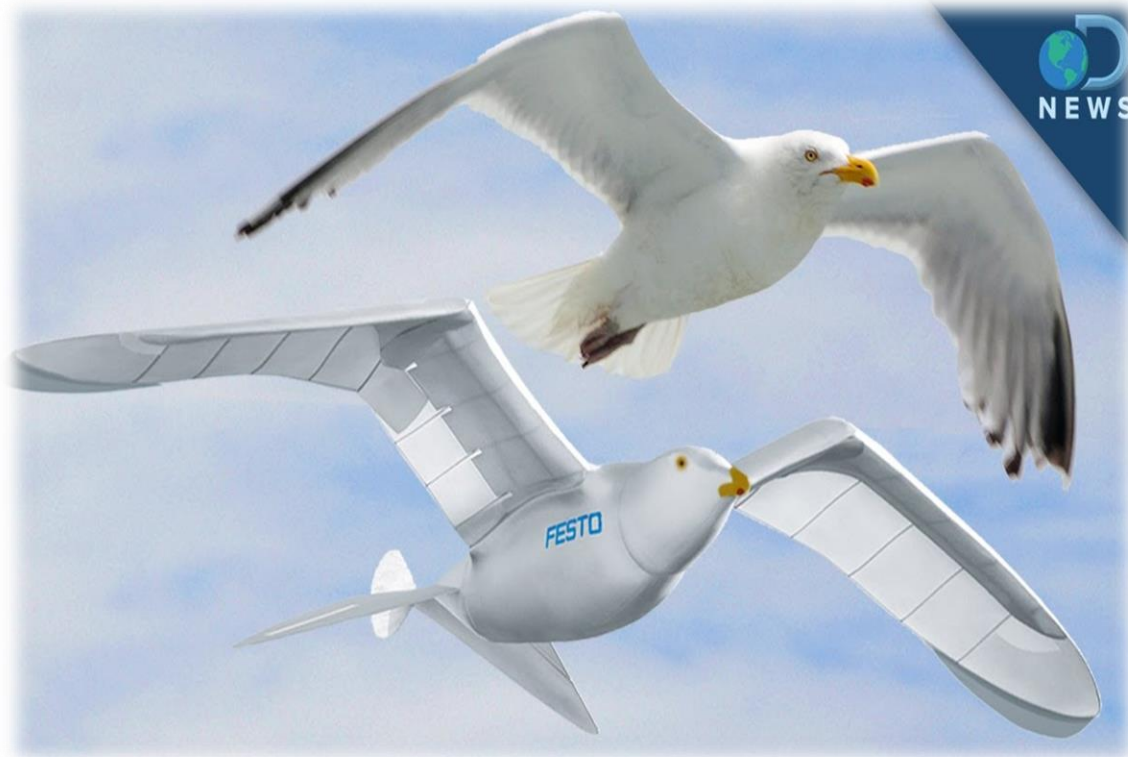# Is UAV a disruptive technology?

UAV nanotechnology

UAV, World War II

http://www.gadgetonics.com

UAVs Innovation

Effective emergency response

➢ Effective emergency response and sustainable post-disaster reconstruction are crucial and lie at the heart of disaster management agencies in almost every cautious country around the globe.

➢ The success of the reconstruction phases, i.e., rescue, relief, and rehabilitation, is mainly dependent on the accessibility to the site, availability of efficient project teams and timely information to make informed decision.

➢ Using UAV to access the affected areas and to monitor and capture data to make well-informed decisions, combined with the efficiency of a project team and strong coordination, project success should increase.

What is the best UAV platform for emergency management ?

What is the best UAV platform for emergency management ?

➢Ease of use

➢Cost effectiveness

➢Maintainability in all conditions

➢Short learning curve

➢Compatibility with open sources

➢Upgrading flexibility

UAV Research Initiatives
Emergency management Inventory

➢ Multirotor
- o DJI s1000 (8 rotor)
- o DJI s900 (6 rotor)
- o Phantom II & III
- o DJI inspire professional

➢ Fixed-wing
- o Skywalker X8
- o Skywalker 1800
- o Ranger
- o Talon
- o TBM
- o Mugin

UAVs Sensors and Software

➢ Camera/Sensor/Software

  o Canon EOS 5D Mark III with a 24mm f2.8 lens mounted on a DJI Zenmuse Z15-5D gimbal (s1000)

  o GoPro 4 camera mounted on a DJI Zenmuse H3-3D 3-Axis Gimbal (s900)

  o Tau 2 LWIR Thermal Imaging Camera Cores (s900)

  o GPS and on-board flight inertia systems

  o Software – Pix4D, ArcGIS, AutoCAD, Microstation, REVIT, Autopilot, Ground Station

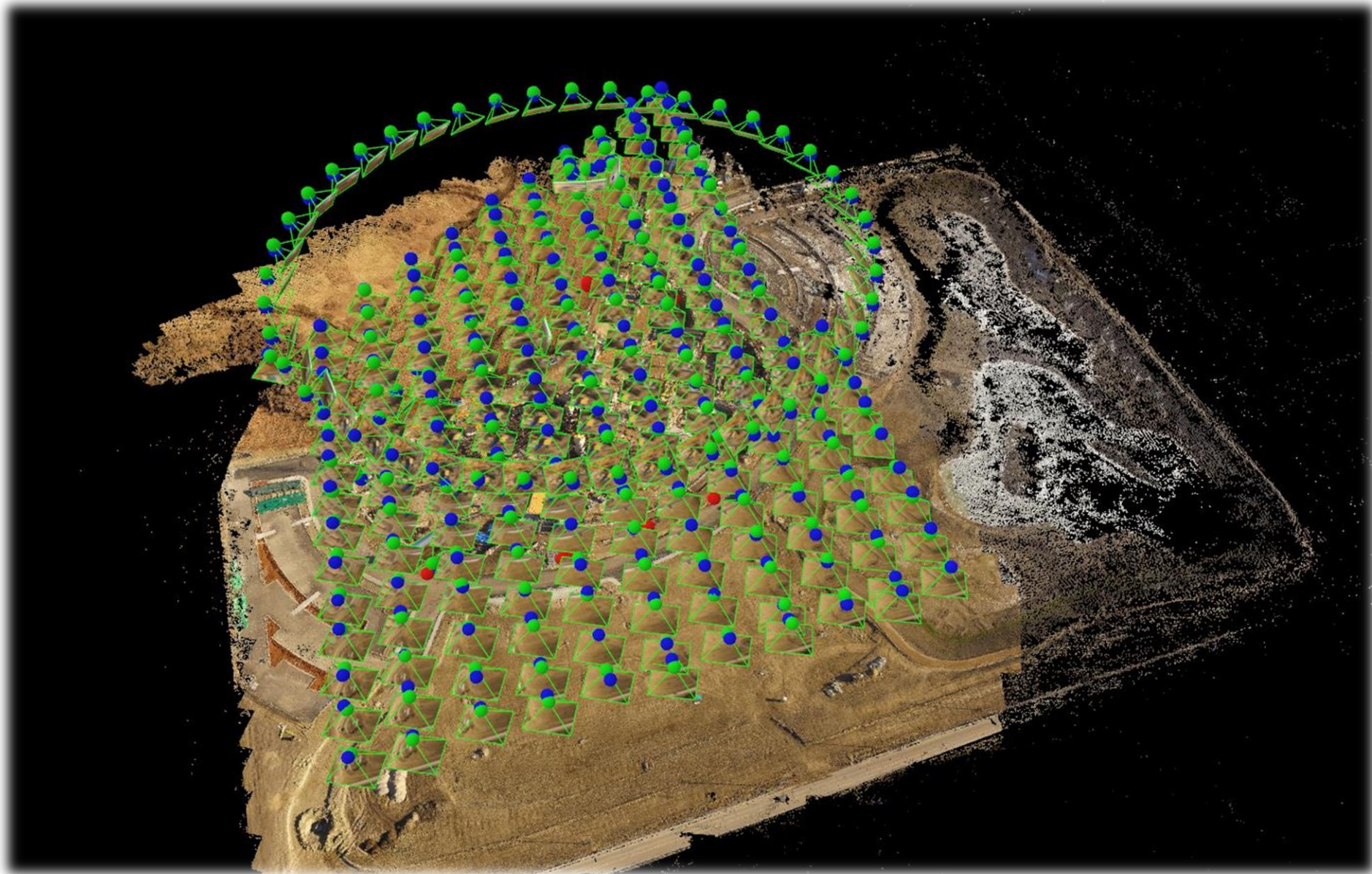# UAV application for humanitarian operation .Sudan, Darfur
Dangerous area to operate

UAV application for humanitarian operation .Sudan, Darfur
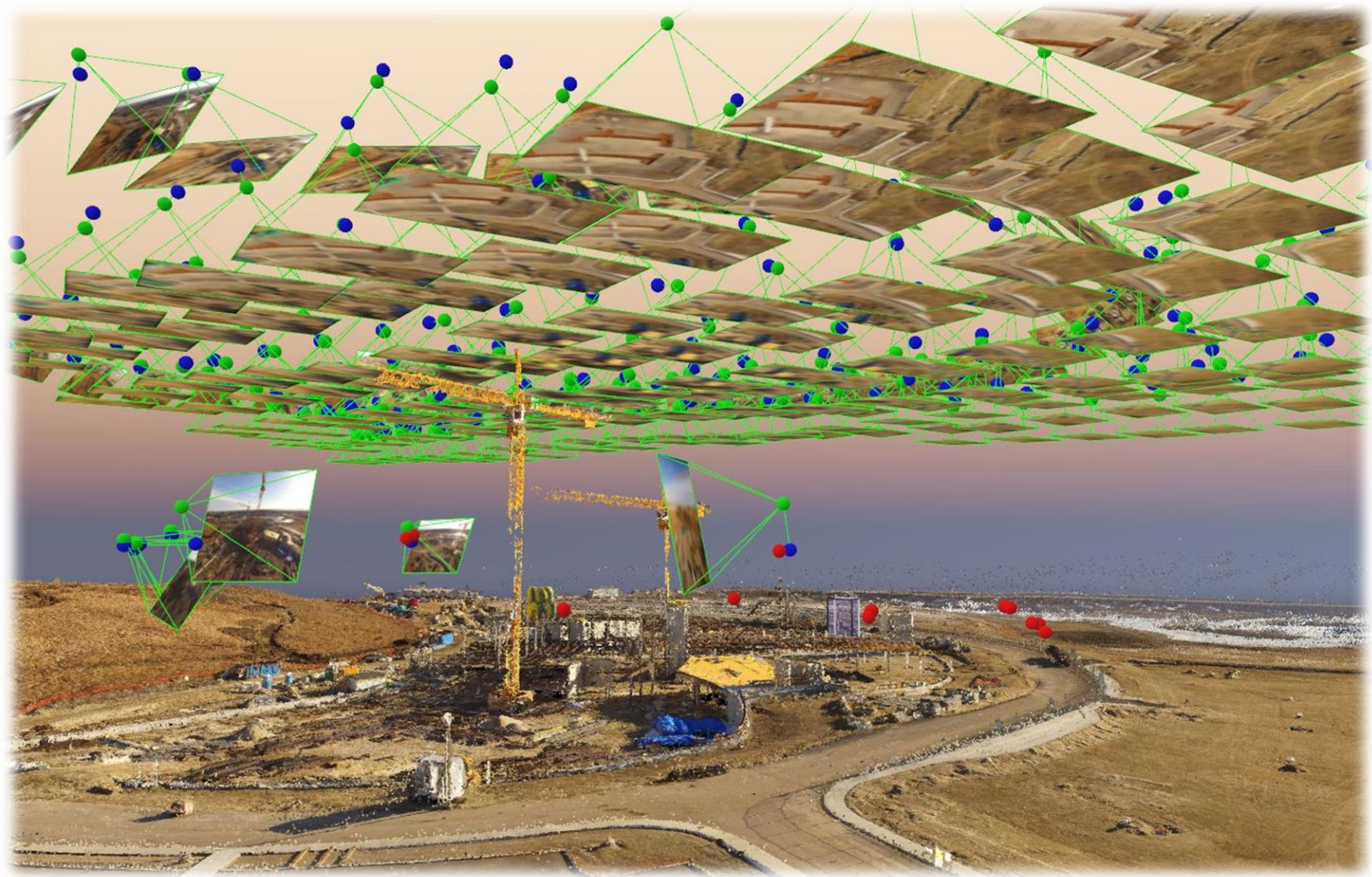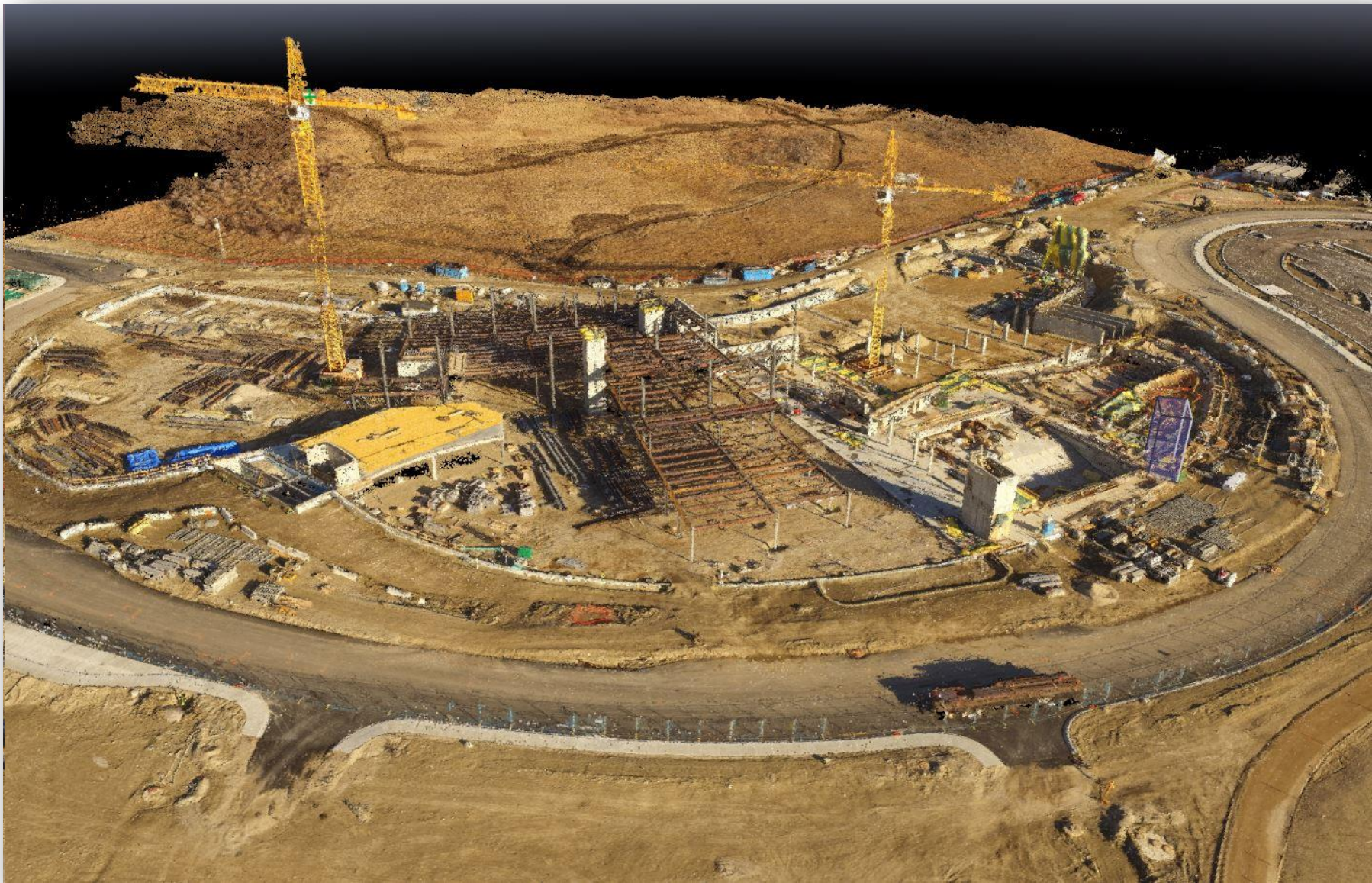*(constant estate of emergency)*

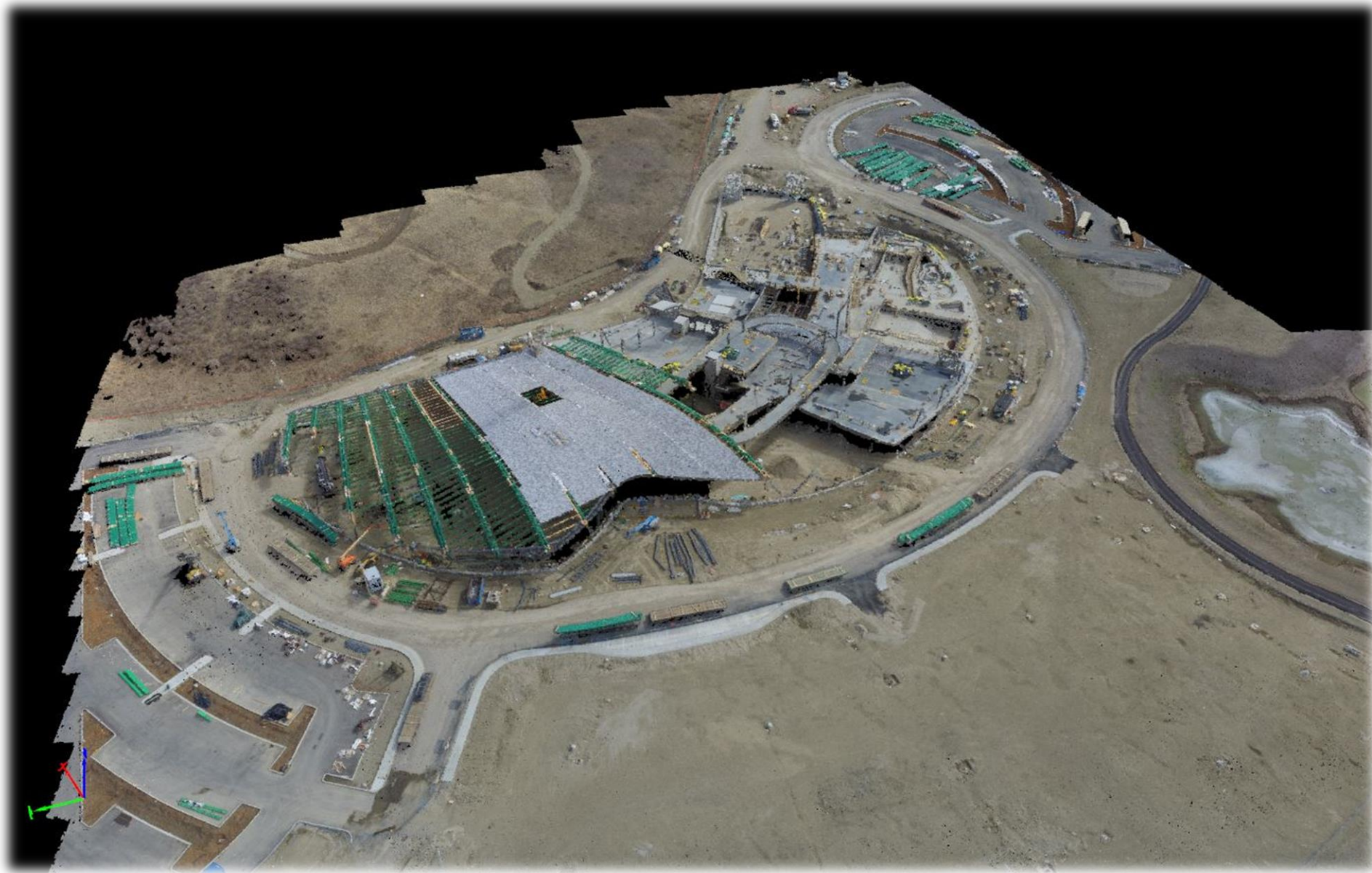# UAV application and data collection and accuracy

UAV application for emergency management

Real time monitoring

Damage assessment

Why UAVs?

http://metro.co.uk/2013/07/09/toronto-floods-passengers-rescued-from-train-as-severe-thunderstorm-brings-record-rain-3874438/
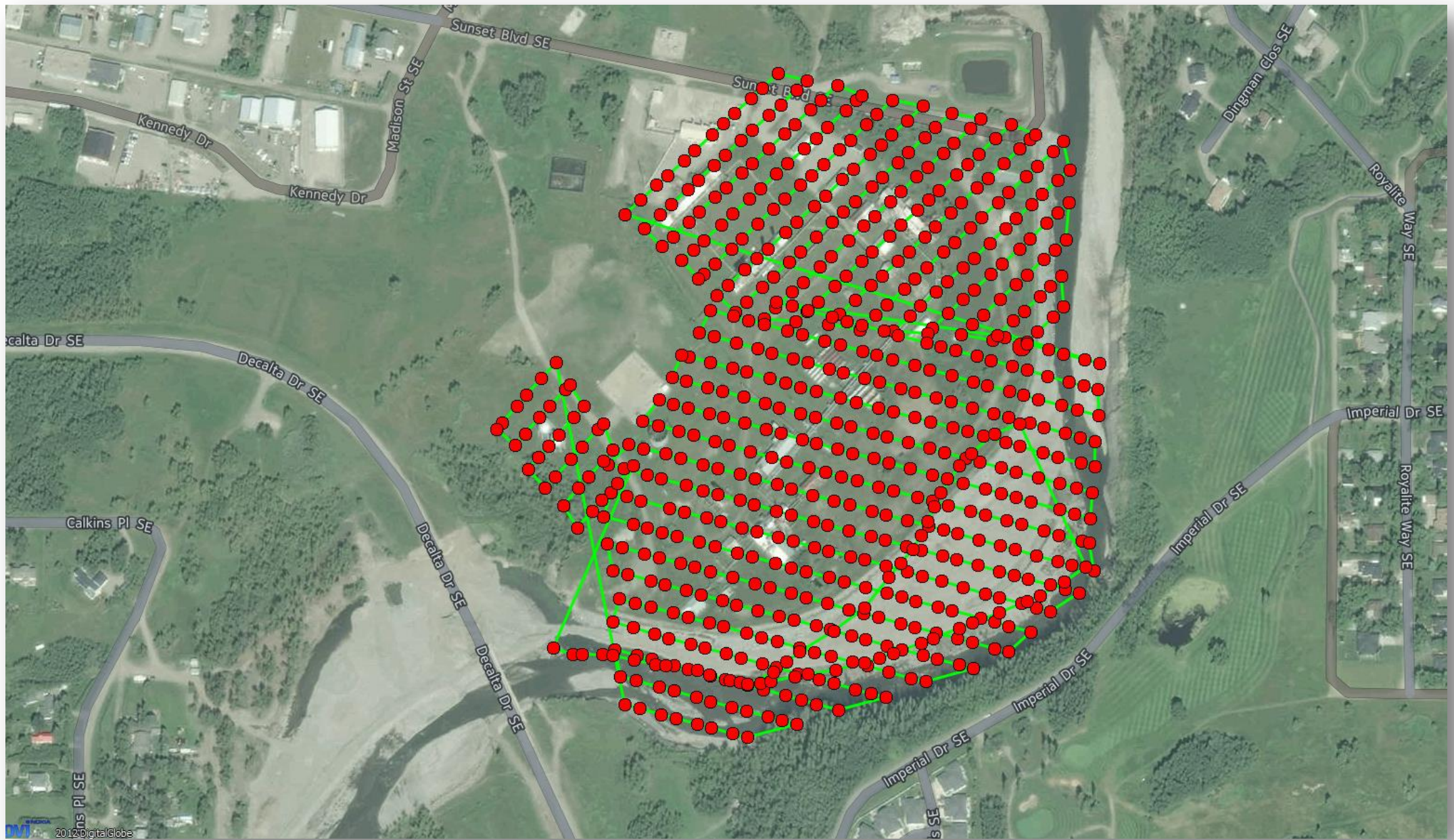
http://thetyee.ca/News/2015/11/19/Bracing-for-the-Next-Deluge/

Avalanche Beacon Receiver
Barryvox VS 2000 PRO EXT

External
3d Helicopter Antenna

Antenna Cable
Length ~5 m
in a Nylon Sheet

INTERCOM Cable
Length ~2 m

https://www.usbid.com/datasheets/dsid/183792.pdf

https://www.usbid.com/datasheets/dsid/183792.pdf

Safety Assessment and Monitoring Using Unmanned Aerial Systems (UAS)
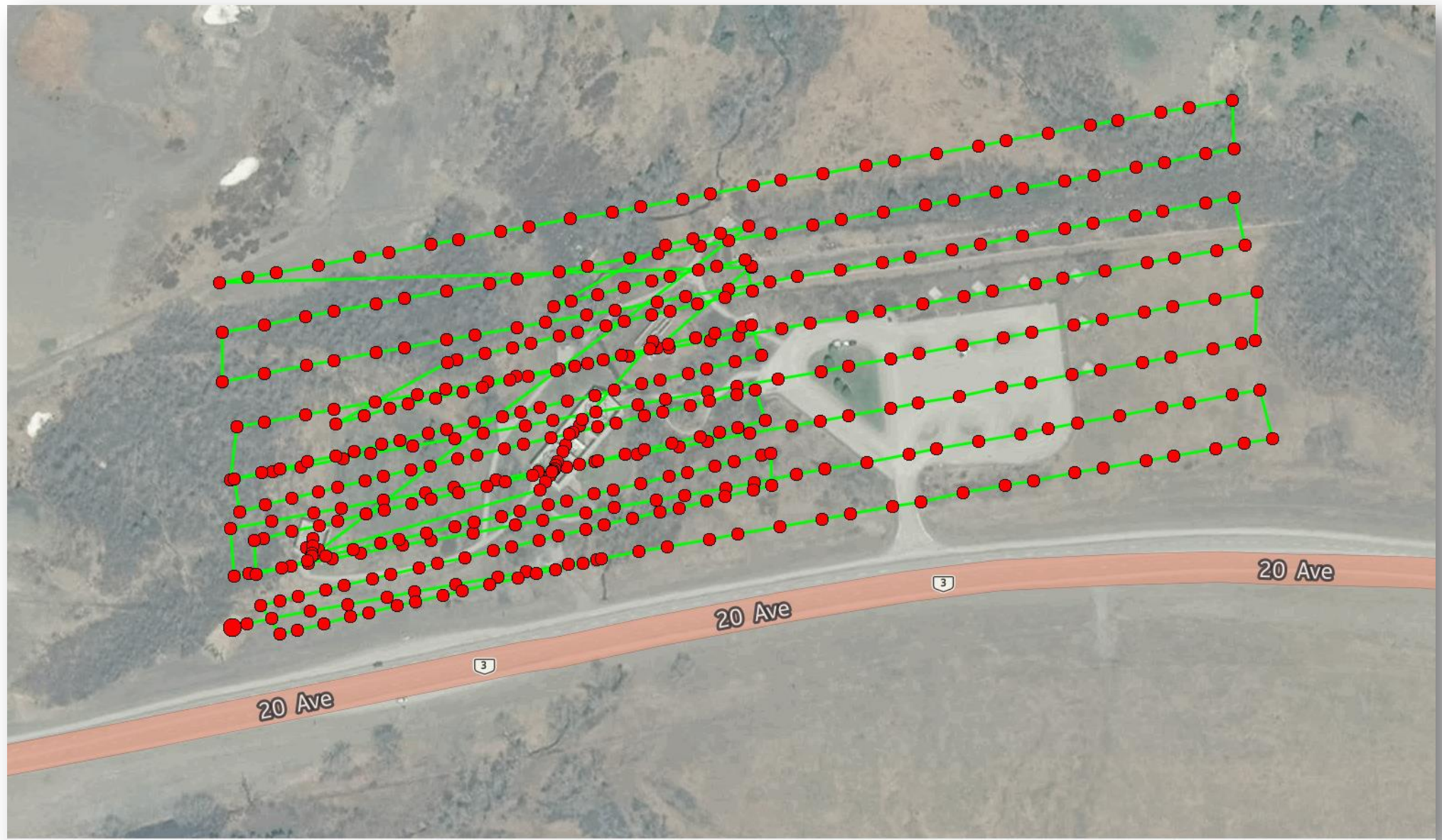
Turner Valley Gas Plant, emergency flight planning

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Turner Valley Gas Plant , critical infrastructure assessment

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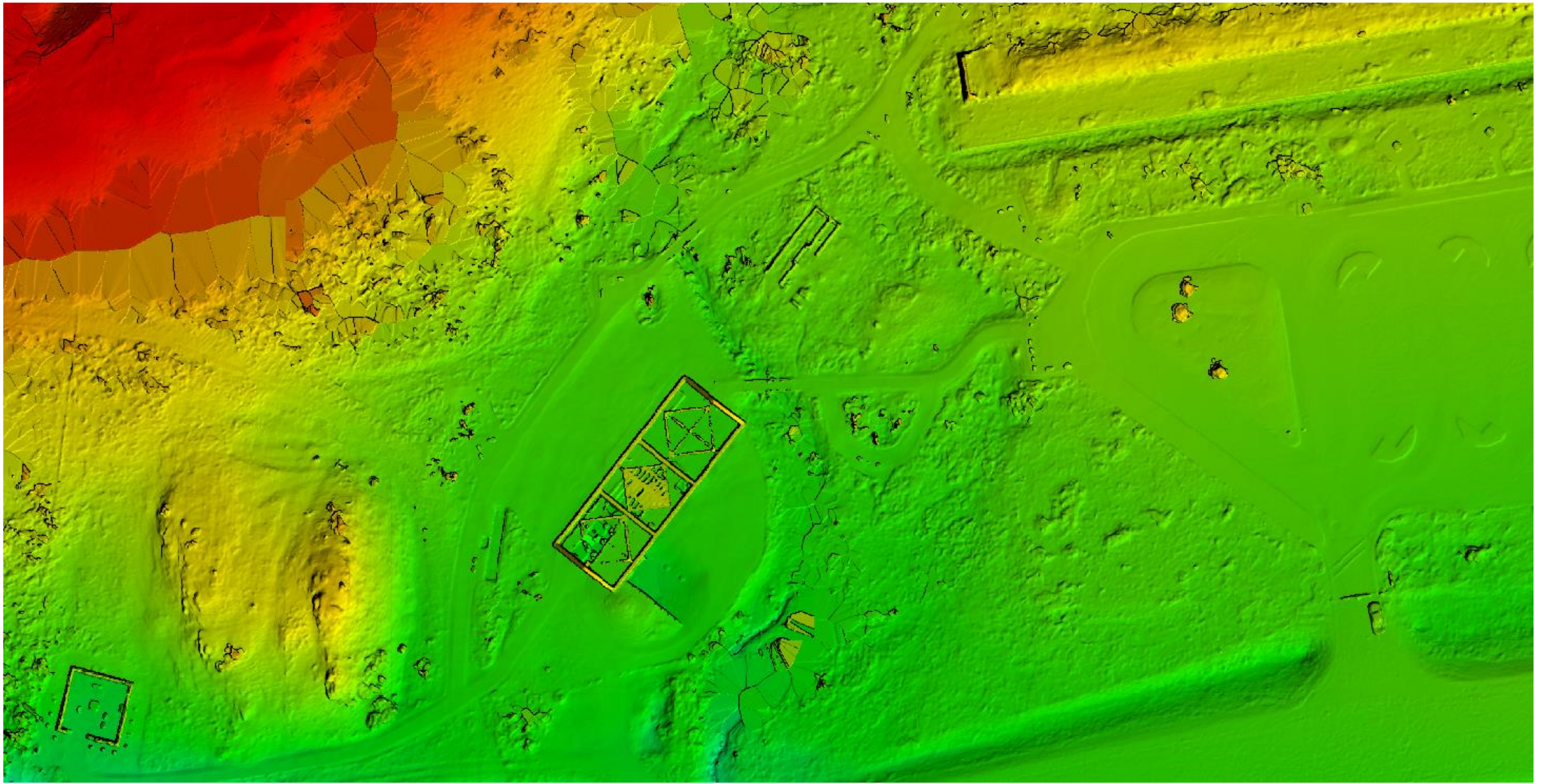Turner Valley Gas Plant , critical infrastructure assessment

Historic site 3D modeling using UAV in flood-prone area (Leitch Collieries Provincial Historic Site)

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Application of UAV for disaster management

➢ The potential application of UAV would be helpful for emergency response management teams to:

  ➢ access areas that are otherwise not accessible,

  ➢ take timely measures by learning from captured information,

  ➢ making informed decisions related to effective emergency response

  ➢ detecting high risk areas by aerials earlier than reporting it by ground crew

  ➢ timely access and information will support a better and more efficient system for sustainable disaster management

Application of UAV for disaster management
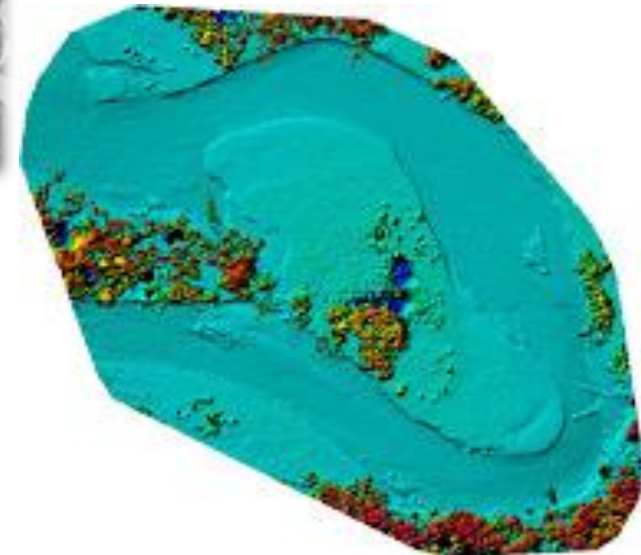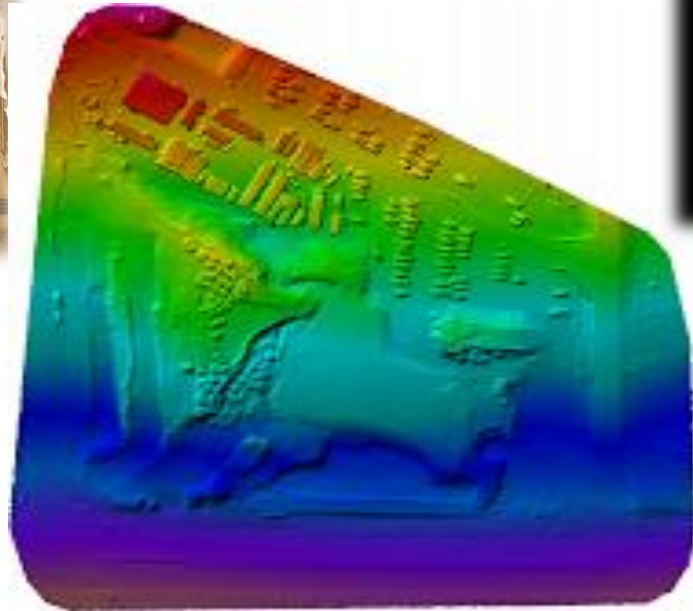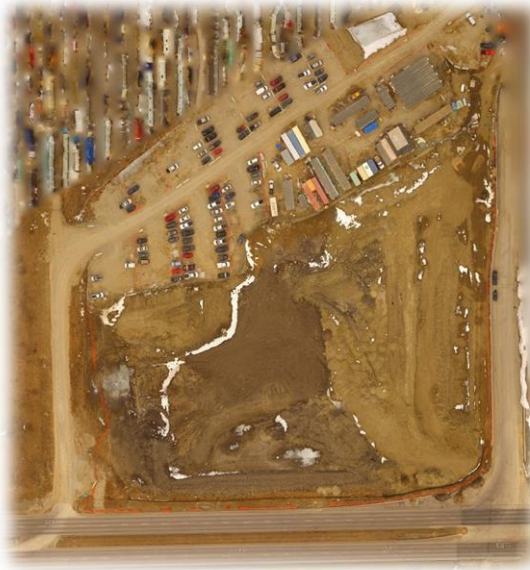
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UAVs challenges

➢ This rapid growth has resulted in a low level of awareness for safe and compliant operation of UAV's

➢ This low level of awareness will create challenges for industries on how to best utilize UAV applications

➢ Need for certification, training, experience and applications of the technology

➢ Privacy issue & regulatory problems

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http://defensetech.org/2011/08/29/mystery-drone-crash-in-pakistan/

UAVs challenges

"More than 400 large U.S. military drones have crashed in major accidents around the world since 2001, a record of calamity that exposes the potential dangers of throwing open American skies to drone traffic, according to a year-long Washington Post investigation" *Washington post*
http://www.washingtonpost.com/sf/investigative/2014/06/20/when-drones-fall-from-the-sky/

http://www.nigerianeye.com/2014/12/kenyan
-military-plane-crashes-in-somalia.html

http://lugansk-news.com/ukrainian-army-shot-down-
russian-uav-forpost-that-costs-6-million-usd/

http://www.timesofisrael.com/iran-says-it-has-built-new-drone/

UAVs challenges

➢ high level of training and practices

Conclusion

➢ UAV can help managers keeping high risk areas under observation.

➢ UAV enable managers to collect data with high accuracy to assess the situation and manage the operation.

➢ UAV can be used for high risk area detection, intervention monitoring and also for post-disaster monitoring.

➢ In case of nuclear or chemical accident or hazardous material leakage UAV is also a very effective or can be the only one tool for supporting disaster management.

➢ UAV can also assist in transporting medical help to disaster struck areas and also airlifting critically injured human beings to near by medical support venues.

Questions