



# Flare inspection by Unmanned Aerial Vehicle (UAV) at GC7

By

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# BACKGROUND



Flare systems F-5301, F-6923 and F-6983 at GC7 had been serviced for a long time since commissioning on 1988, 1989 and 2013. In the past, we inspected these flares by conventional method every 5 years. The flares need to be shut down for period of three - five days to install scaffolding along the flares height 20m then visual inspect at the flare tip. The limitation of this method are high cost of scaffolding, flare need to be shut down for a long time and there is a risk of work at height.

The inspection technology by using unmanned aerial vehicle (UAV) or drone has widely use for visual inspection of flare system. The benefits of this method are including:-

- UAV inspection is fast, safe and efficient as well as able to provide a totally unique visual perspective
- The UAV crew can perform a full 360-degree inspection of a flare tip in a matter of days while the flare system remains fully operational.
- The human work crew can remain on the ground and out of danger for the entire duration of the inspection

In PTT group, the flare inspection by drone had already used at PTTGC2 , PTTGC3 and Thai oil. Therefore, the drone inspection will be applied to use for flare inspection at PTTGC7 on 25-27 November 2019.

# OBJECTIVE

The objective of UAV (Unmanned Aerial Vehicle) or drone inspection on flare systems F-5301, F-6923 and F-6983 is investigating the external of the flare system components while the flare is in service. The thermal inspection with IR thermography camera is also included to monitor the pilot flame to adjust the flight planning of UAV inspection scope.

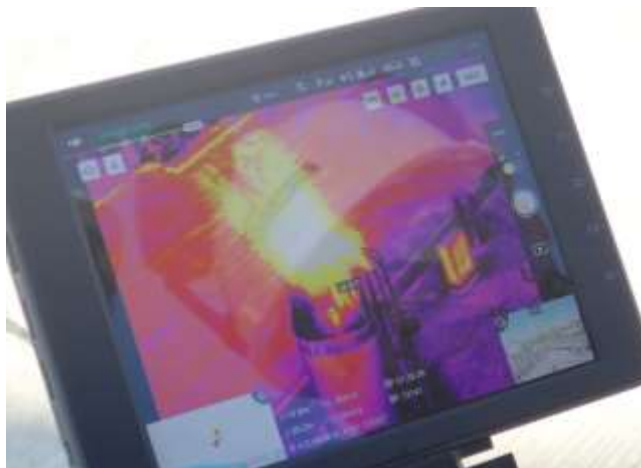
However, correctly identifying any flare system issues will help to define the turnaround scope of the flare early enough for the equipment procurement and maintenance schedule arrangement. The report will be consisted of photograph and recommendations.



Model : Drone DJI Matrice 210  
Camera : DJI Zenmuse X5S  
IR camera : DJI Zenmuse XT2

# METHOD

1. Prepare government authority approval from IEAT for using drone.
2. Prepare JSEA for safety review. The safety practice should be follow as following:-
  - The area of drone take off and landing should be far more than 5 meters away from flare.
  - Prepare nearby fire extinguisher.
  - Drone should be set up mode for automatic return to home when reaching low battery limit.
3. Perform drone inspection
4. Review final report





# RESULT



Found some ashes on flare gas tip



Pilot burner metal case is broken

Tag No.:	F-5301
Flare Type:	Flare Stack
Manufacturer:	John Zink
Year:	32 years
Height:	20 m

General corrosion on flare stack body, the steam injection system and molecular seal



Minor distortion on flare gas tip metal case

# RESULT

## Measurements

Sp1 50.2 °C

## Parameters

Emissivity 0.98

Refl. temp. 36 °C

## Geolocation

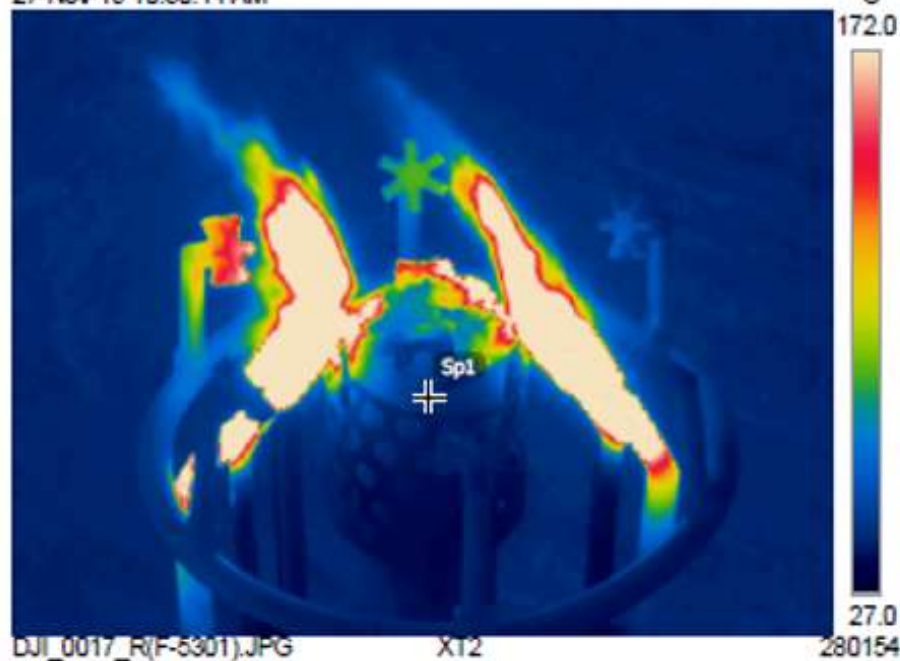
Location N 12° 40' 48.25", E 101° 7' 42.52"

<http://maps.google.com/?z=17&ll=4.64=12.6901,101.1>

## Note

F-5301

27-Nov-19 10:50:14 AM



27-Nov-19 10:50:14 AM





# RESULT



Minor distortion and metal tearing on flare gas tip

Tag No.:	F-6923
Flare Type:	Elevated Flare
Manufacturer:	John Zink
Year:	31 years
Height:	15 m



Metal tearing on pilot burner

# RESULT

## Measurements

Sp1	58.1 °C
Sp2	37.7 °C
Sp3	27.5 °C

## Parameters

Emissivity	0.96
Ref. temp.	38 °C

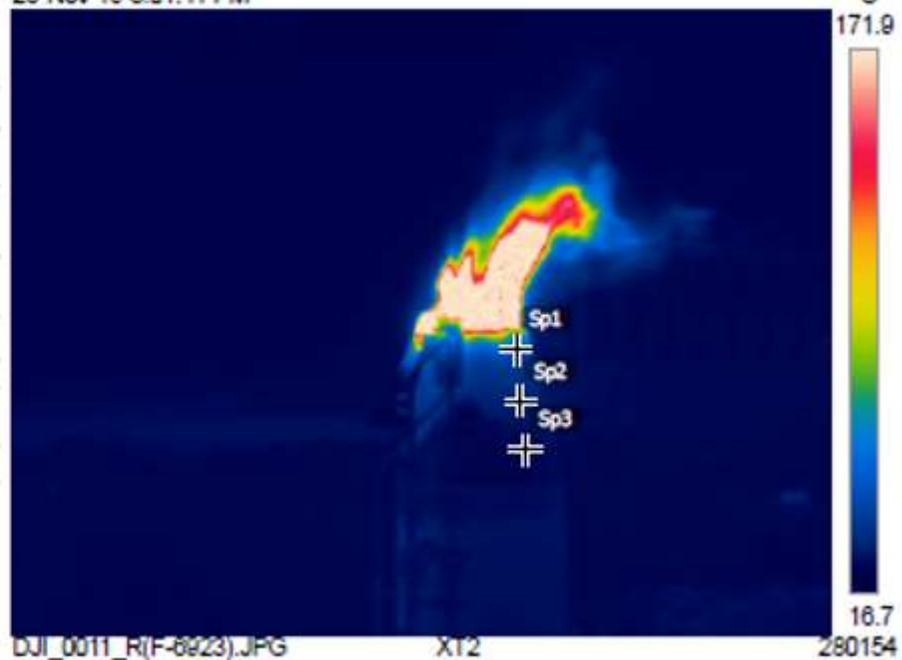
## Geolocation

Location	N 12° 40' 49.51", E 101° 7' 42.58"
	<a href="http://maps.google.com/?z=17&amp;ll=12.6804,101.1285">http://maps.google.com/?z=17&amp;ll=12.6804,101.1285</a>

## Note

DCIM\100MEDIA\DJ1\_0011\_R.JPG

26-Nov-19 3:01:11 PM



26-Nov-19 3:01:11 PM





# RESULT



Minor incomplete Insulation

Tag No.:	F-6983
Flare Type:	Enclosed Flare
Manufacturer:	Callidus Technologies by Honeywell
Year:	7 years
Height:	18 m

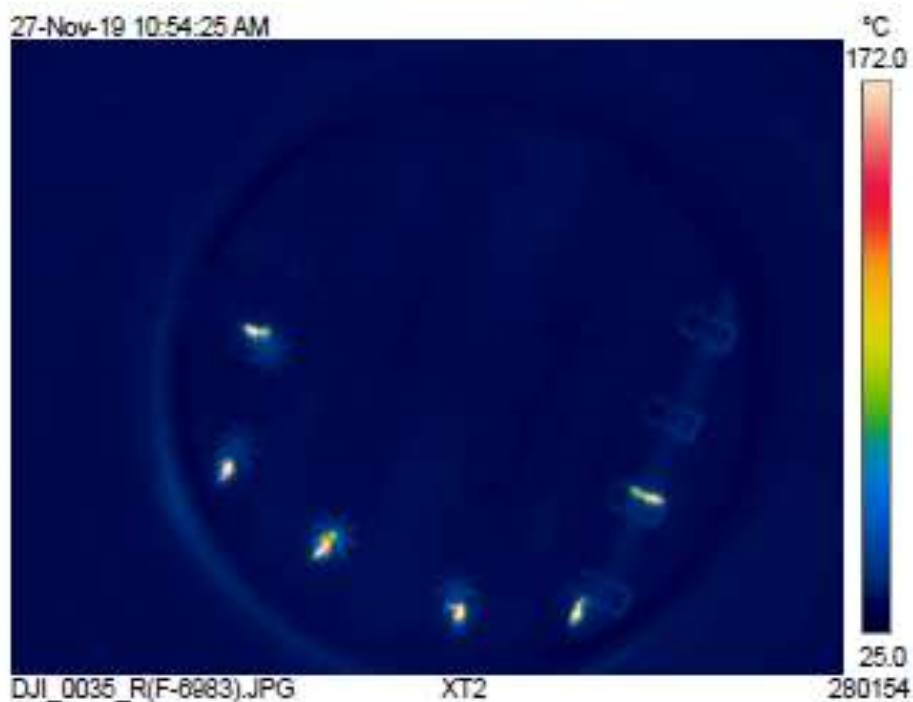


General corrosion



# RESULT

Parameters	
Emissivity	0.96
Ref. temp.	36 °C
Geolocation	
Location	N 12° 40' 49.06", E 101° 7' 43.10"
	<a href="http://maps.google.com/?z=17&amp;hl=es&amp;q=12.6803,101.1161">http://maps.google.com/?z=17&amp;hl=es&amp;q=12.6803,101.1161</a>
Note	
F-6983	



27-Nov-19 10:54:25 AM

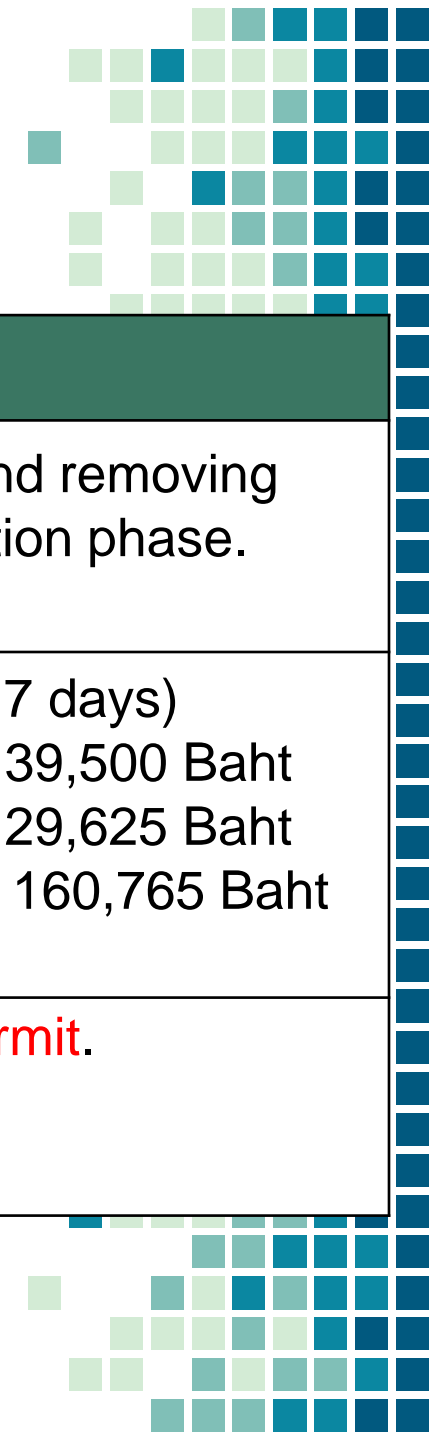


DJI\_0036(F-6983).jpg

# RESULT

Item	Concern Issue	Location	Photo No.	Recommendation
<b>F-5301 Flare Stack</b>				
1	General Corrosion	<ul style="list-style-type: none"> <li>Flare Stack Body</li> <li>The Steam Injection System</li> <li>Molecular Seal</li> </ul>	Fig. 5, 6, 7 Fig. 5, 6, 7 Fig. 10, 11	All parts that appear severe dark scale surfaces should be measured thickness and/or removed in next maintenance period.
2	Minor Distortion	<ul style="list-style-type: none"> <li>Flare Gas Tip Metal Case</li> </ul>	Fig. 5, 6, 7	Should be keep monitoring to ensure none of the progressive damage.
3	Broken Damage	<ul style="list-style-type: none"> <li>Pilot Burner</li> </ul>	Fig. 6	Properly replace new components in next maintenance period.
4	Found some ashes on the components	<ul style="list-style-type: none"> <li>Flare Gas Tip</li> </ul>	Fig. 5, 6, 7	Properly inspect or replace in next maintenance period.
<b>F-6923 Elevated Flare</b>				
1	Coating Damage and Corrosion	<ul style="list-style-type: none"> <li>Flare Head</li> </ul>	Fig. 12	All parts that appear severe dark scale surfaces should be measured thickness and/or removed in next maintenance period.
2	Minor Distortion	<ul style="list-style-type: none"> <li>Flare Gas Tip</li> </ul>	Fig. 13	Should be keep monitoring to ensure none of the progressive damage.
3	Metal Tearing	<ul style="list-style-type: none"> <li>Flare Gas Tip</li> <li>Pilot Burner</li> </ul>	Fig. 13 Fig. 12,13	Properly replace new components in next maintenance period.
<b>F-6983 Enclosed Flare</b>				
1	General Corrosion	<ul style="list-style-type: none"> <li>Insulation inside Enclosed Flare</li> </ul>	Fig. 14 Fig. 15 Fig. 16 Fig. 17 Fig. 18	Should be keep monitoring to ensure none of the progressive damage.

# BENEFIT



	DRONE	SCAFFOLDING
TIME	1 - Day for preparation and inspection phase.	<u>3 – 5 Day or more</u> for installing and removing scaffolding and included inspection phase.
COST	133,936 Baht	Volume (m <sup>3</sup> ) x 79 Baht (rate 7 days) Flare F-5301: 500 m <sup>3</sup> x 79 Baht = 39,500 Baht Flare F-6923: 375 m <sup>3</sup> x 79 Baht = 29,625 Baht Flare F-6983: 2,035 m <sup>3</sup> x 79 Baht = 160,765 Baht Total <u>229,890 Baht</u>
SAFETY	No work at high permit required	Required work at high permit.

