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EPA Natural Gas STAR/Methane Challenge Annual Implementation Workshop

October 25, 2017

Douglas Jordan, Director Environmental Programs

SWN Ground Based LDAR to Aerial LDAR

- Southwestern Energy (SWN) Introduction
- SWN EPA Natural Gas STAR History
- SWN “SMART LDAR” Overview

- SWN UAS Aerial LDAR Beginnings

Forward-Looking Statements

All statements, other than historical facts and financial information, may be deemed to be forward-looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended. All statements that address activities, outcomes and other matters that should or may occur in the future, including, without limitation, statements regarding the financial position, business strategy, production and reserve growth and other plans and objectives for the company's future operations, are forward-looking statements. Although the company believes the expectations expressed in such forward-looking statements are based on reasonable assumptions, such statements are not guarantees of future performance and actual results or developments may differ materially from those in the forward-looking statements. The company disclaims any intention or obligation to update or revise any forward-looking statements, whether as a result of new information, future events or otherwise. You should not place undue reliance on forward-looking statements. They are subject to known and unknown risks, uncertainties and other factors that may cause the company's actual results, performance or achievements to be materially different from any future results, performance or achievements expressed or implied by the forward-looking statements. In addition to any assumptions and other factors referred to specifically in connection with forward-looking statements, these risks, uncertainties and factors include, but are not limited to: the volatility of commodity prices; access to and cost of capital for operations and capital investments; access to and availability of transportation, processing and refining facilities; success in discovering, developing, producing and estimating reserves including timing concerns and the intent to focus in specific areas or formations; the impact of regulation, including any increase in taxes, legislation relating to hydraulic fracturing, the climate, accounting and other operational matters; the costs and availability of equipment, services, resources and personnel required to complete the company's operating activities; success in property acquisition or divestiture activities; adverse outcomes in material litigation actions; environmental and weather risks; increased competition; credit risk relating to the financial strength of the company's counterparties; electronic, cyber or physical security attacks, including acts of war or terrorism; and any other factors listed in the reports the company has filed and may file with the Securities and Exchange Commission (SEC). For additional information with respect to certain of these and other factors, see the reports filed by the company with the SEC.

The SEC has generally permitted oil and gas companies, in their filings with the SEC, to disclose only proved reserves that a company has demonstrated by actual production or conclusive formation tests to be economically and legally producible under existing economic and operating conditions. We use the terms "estimated ultimate recovery," "EUR," "probable," "possible," and "non-proven" reserves, reserve "potential" or "upside" or other descriptions of volumes of reserves potentially recoverable through additional drilling or recovery techniques that the SEC's guidelines may prohibit us from including in filings with the SEC. These estimates are by their nature more speculative than estimates of proved reserves and accordingly are subject to substantially greater risk of being actually realized by the company.

The contents of this presentation are current as of January16, 2015.

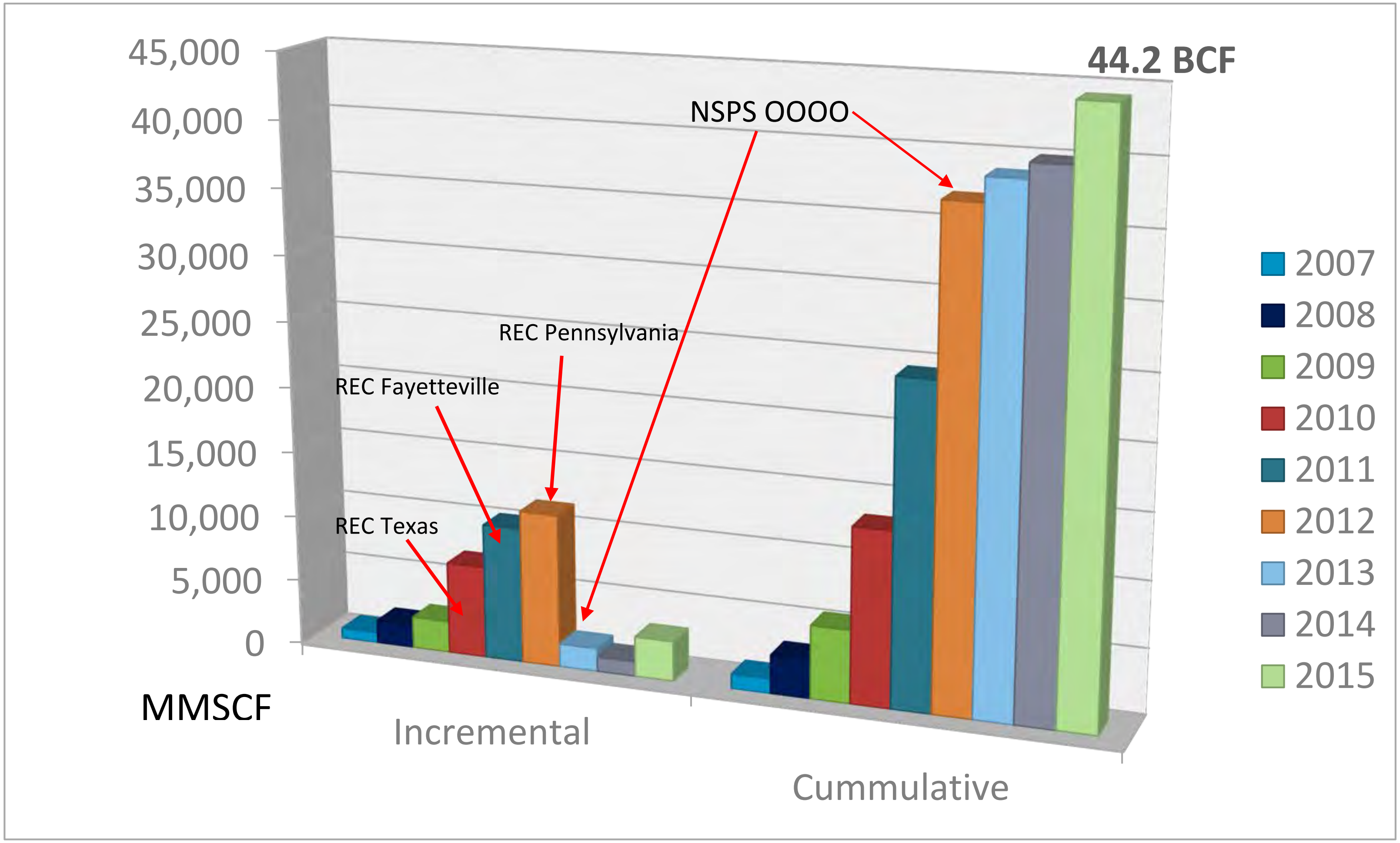
Southwestern Energy - Introduction

Primary Operating Assets

- Fayetteville Shale
- Southwest Appalachia
- Northeast Appalachia

The Right People doing the Right Things, wisely investing the cash flow from the underlying Assets will create Value+

SWN EPA Natural Gas STAR History



EPA Natural Gas STAR Methane Challenge

- ONE Future Emissions Intensity Commitment
  - Apache
  - BHP
  - Hess
  - Kinder Morgan
  - National Grid
  - Southern Company Gas
  - **Southwestern Energy**
  - Statoil
  - Summit Utilities
  - Transcanada

SWN SMART LDAR – purpose & scope

Purpose

The purpose of the SWN SMART LDAR Program is to “find and fix” methane leaks associated with SWN operations.

The SMART LDAR Program includes a process for conducting leak surveys, identifying leaking components/equipment, and repairing leaking components/equipment.

The program also includes recordkeeping and reporting requirements that will be used to assist SWN in tracking and trending leaking components/equipment

Scope

- Applies to SWN Exploration and Production operations.
- Applies to SWN Midstream Operations
- Is voluntary in states that do not have a regulatory based LDAR program
- May exceed the requirements of states with regulatory based LDAR requirements
- May incorporate additional leak detection and measurement methodologies that are currently under development and evaluation.
- Is not intended, at this time, to apply to underground equipment (including gathering lines), mobile equipment, or equipment that is not physically located at a SWN owned and operated well pad or compressor station.

SWN SMART LDAR – what we survey

- Valves
- Flanges
- Connectors
- Unions
- Pressure Relief Valves
- Open Ended Lines
- Actuators
- Regulators
- Gauges
- Desiccant Filters
- Compressor Pocket Vents
- Compressor Rod Packing
- Other
- Pneumatic Pumps
- Pneumatic Controllers
  - Liquid Level
  - Temperature
  - Flow
  - Pressure
- Tank Thief Hatches

SWN SMART LDAR - instruments

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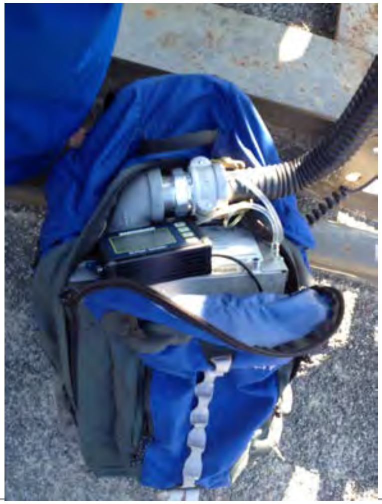
- OGI (Optical Gas Imaging) or Infrared Cameras
  - FLIR GF 320
  - Opgal EyeCGas

- Heath RMLD (Remote Methane Leak Detector)
  - Tunable Diode Laser Absorption Spectroscopy

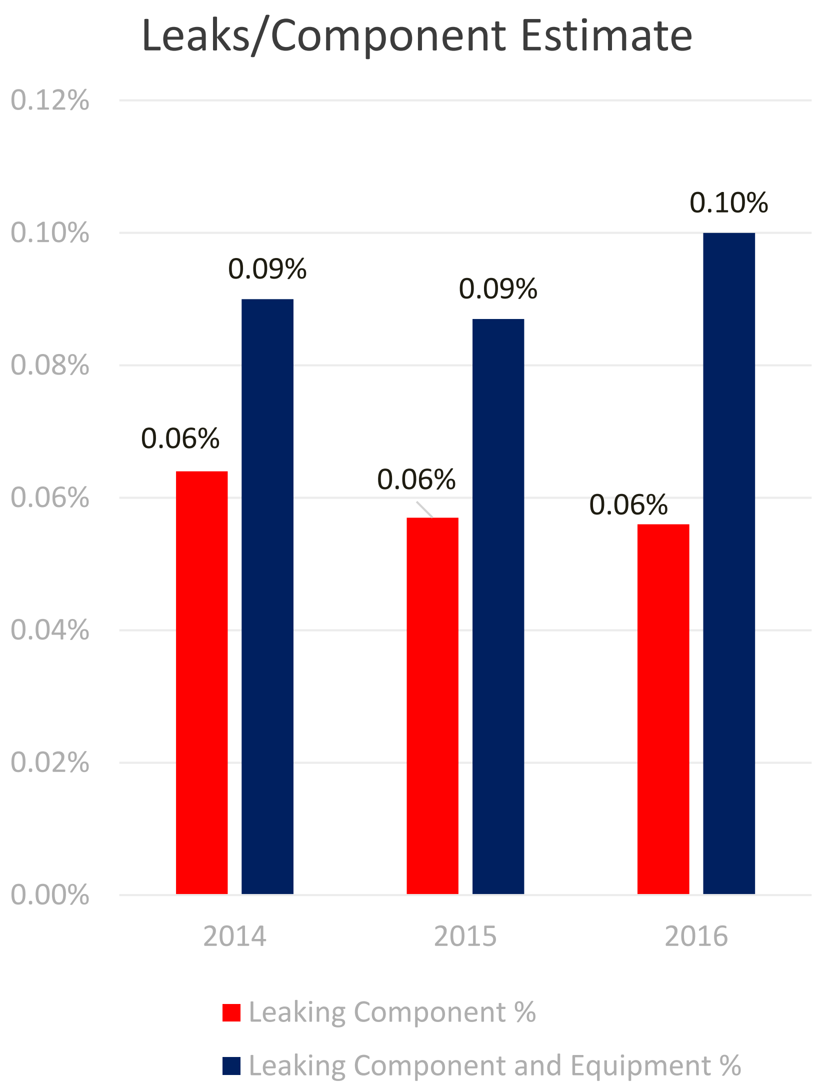
- Bacharach HiFlow
  - Quantifies leaks in terms of cubic feet per minute



SWN SMART LDAR – phased implementation

- 2014
  - LDAR surveys conducted by SWN employees
  - Initial survey of new wells and compressor stations within 60-days of operation
  - Target 50% of existing wells and 100% compressor stations for annual survey
  - Target 100% repair within 15 days (exclusion for delay of repair leaks)
- 2015
  - Initial survey of new wells within 60-days of operation
  - Target 100% of existing wells and compressor stations for annual survey
    - Target 50% of existing wells in area acquired in December of 2014 for annual surveys
  - Target 100% repair within 15 days (exclusion for delay of repair leaks)
  - Target 25% of leaks for HiFlow measurement
- 2016
  - Initial survey of new wells and compressor stations within 60-days of operation
  - Annual survey of existing wells and compressor stations
  - Target 100% repair within 15 days (exclusion for delay of repair leaks)
  - Target 25% of leaks for HiFlow measurement

Leaking Components vs Total Components



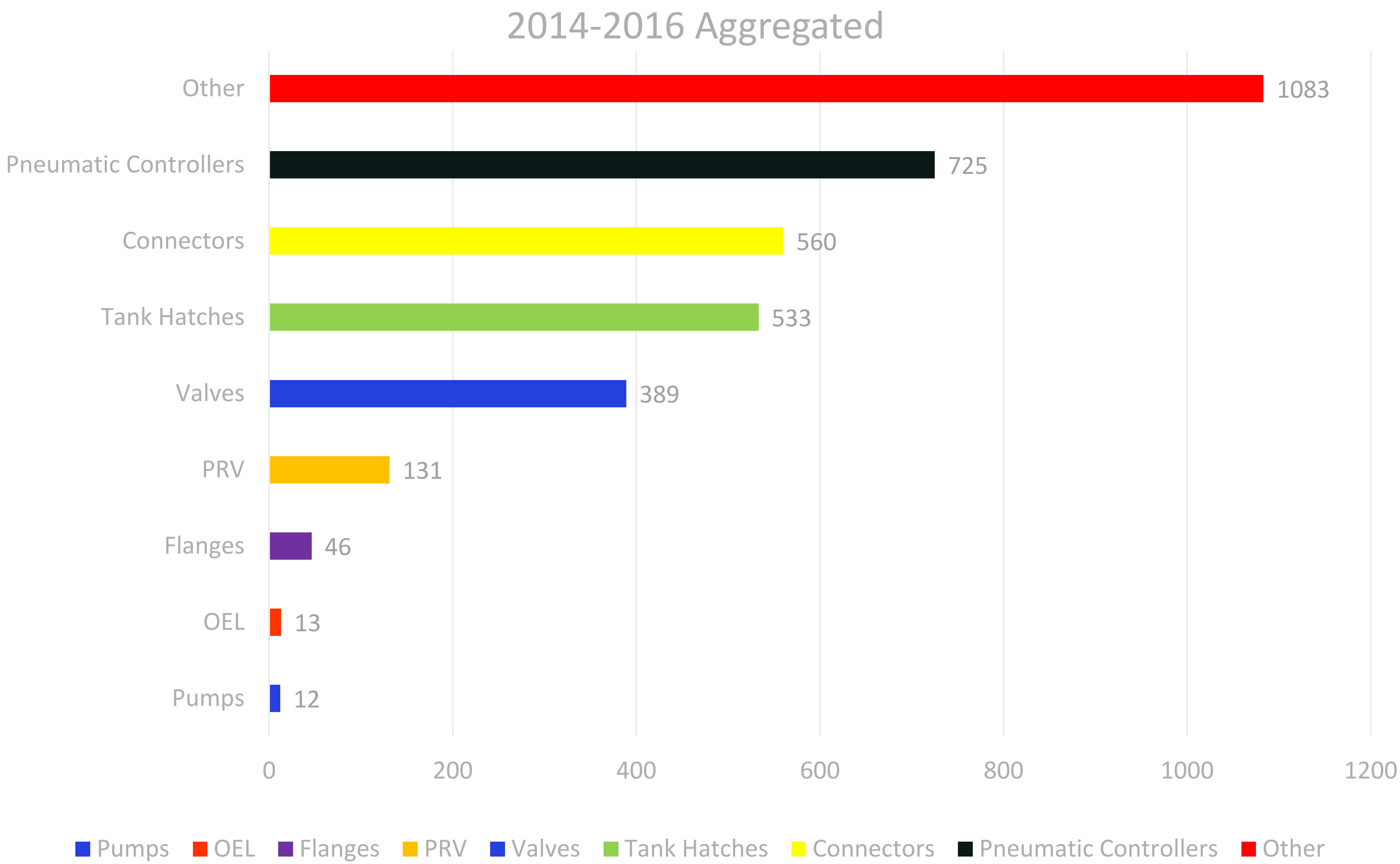
- Leaking Component % = Total Leaking components observed/Total estimated components at site

- Leaking Component and Equipment % = Total leaking components and equipment observed/Total estimated components at the site

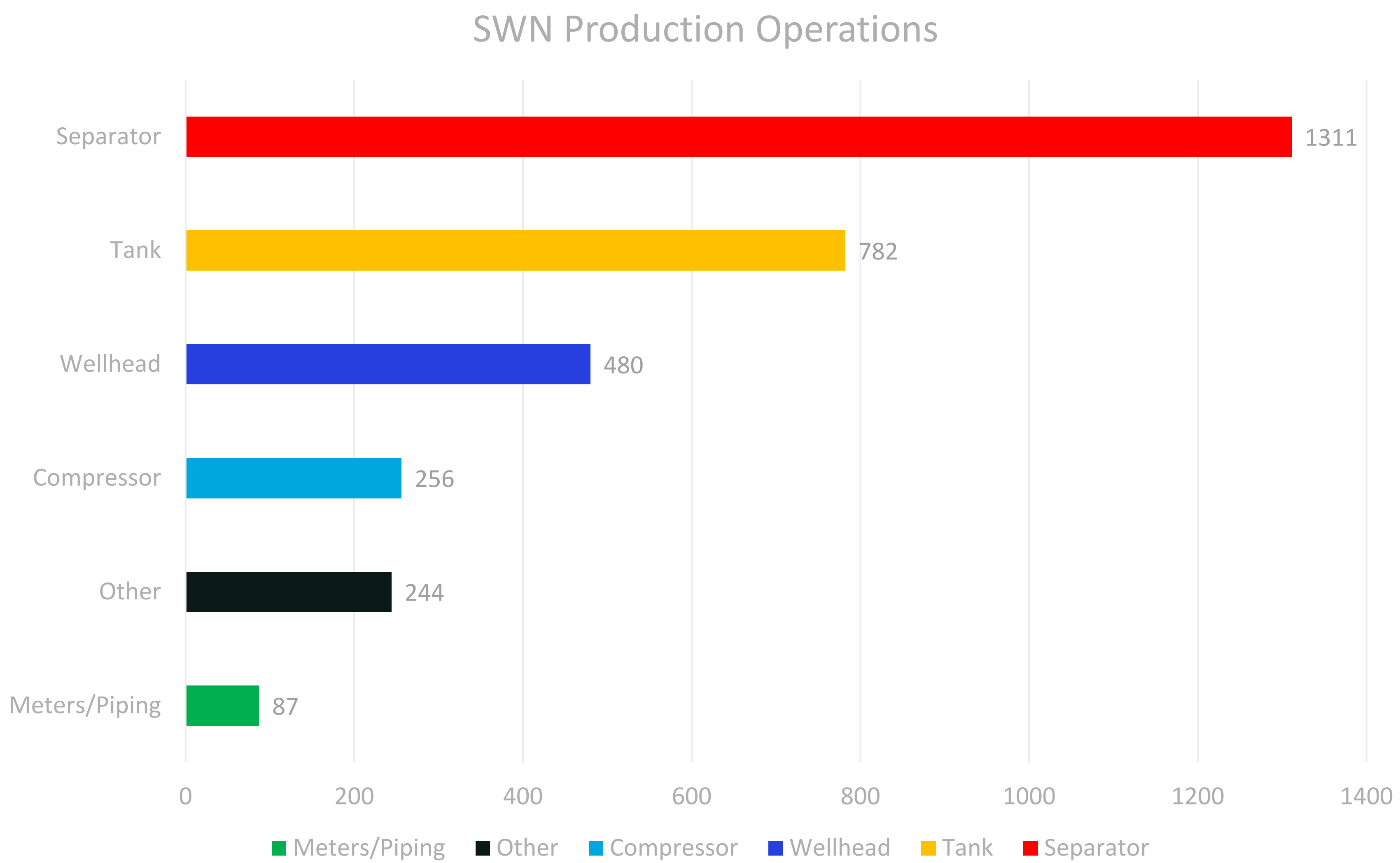
- EPA factors to estimate components are limited to valves, connectors, open ended lines and PRV and do not include all components we observe leaking. EPA does not have factors to estimate equipment.

- Without physical counts of components and equipment at each facility (which is very resource intensive), we use EPA component factors realizing that they do not estimate the total components/equipment. But even with this conservative approach, the percentage of leaks versus component estimates is very small

SWN Production Operations Component and Equipment Leak Types



Leaks By Major Equipment (2014-2016 Aggregated Production)



CUSTOMIZED LDAR PROGRAM FOCUS

Regional Component/Equipment Leak Types (2014-2016 Aggregated Production)

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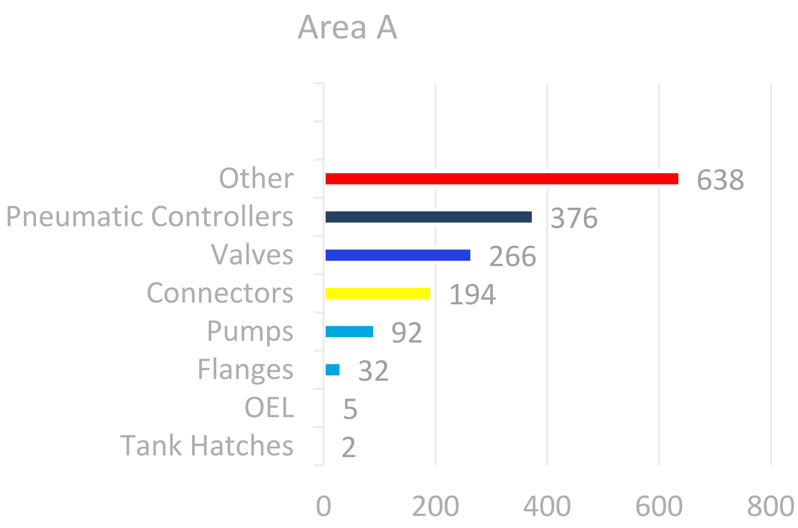
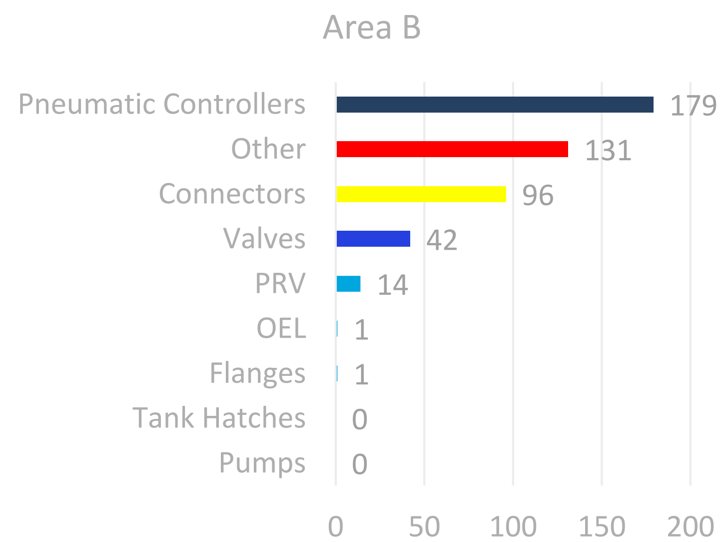
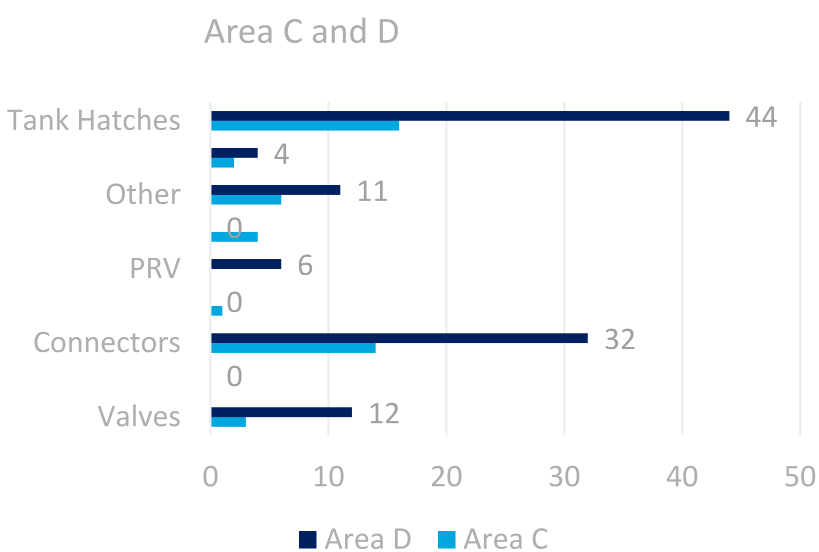
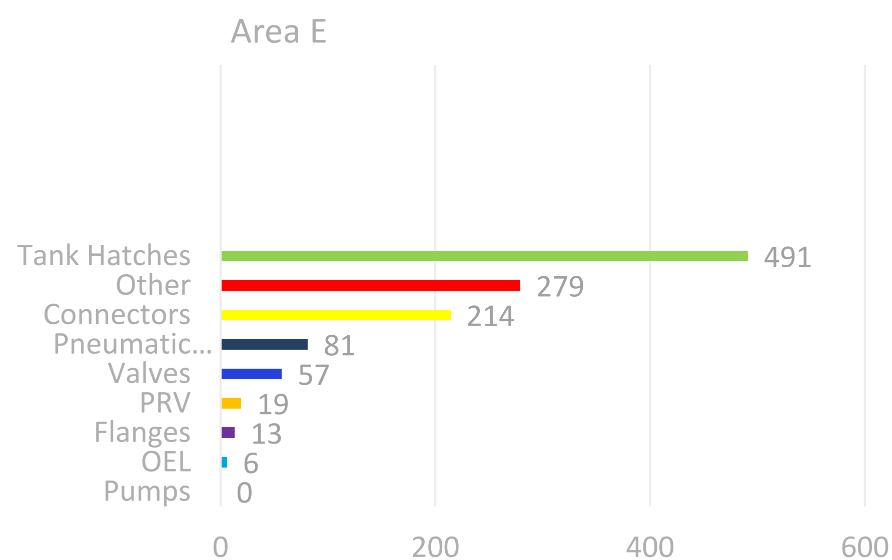
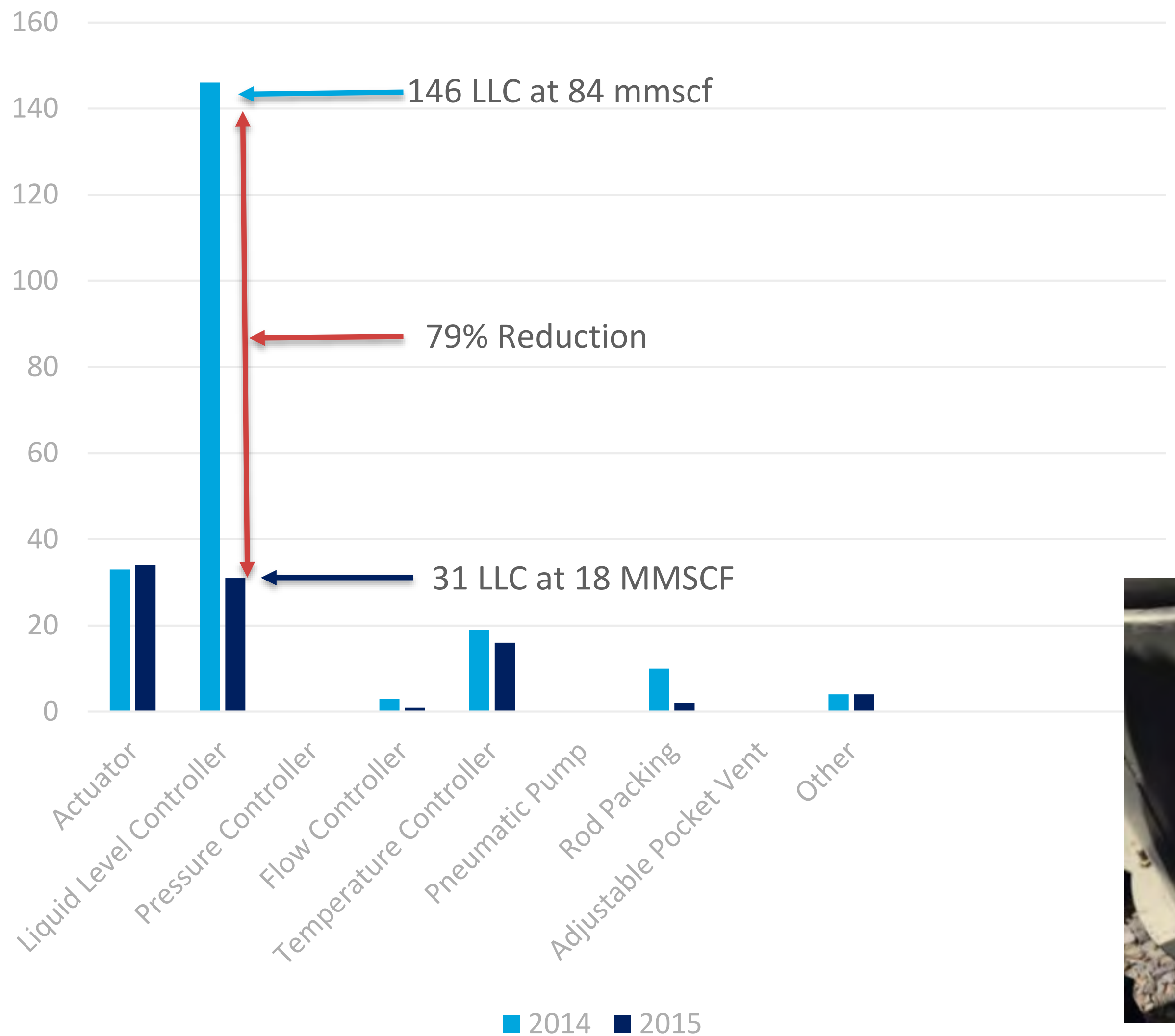








SWN SMART LDAR Directed Inspection & Maintenance



Subpart W OGI Factor vs SWN HiFlow Factors (Production Only)

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	Subpart W OGI Factor	SWN 2014-2016 HiFlow Factor	# HiFlow Measurements 2014-2016	Leaks Measured 2014-2016
	cfhr	cfhr	count	percent
Valves	4.9	12.6	90	24%
Flanges	4.1	48	12	26%
Connectors	1.3	16.8	123	22%
OEL	2.8	6.48	5	38%
PRV	4.5	26.4	55	42%
Chemical Pumps	**3.7**	**1.5**	5	17%
Other	4.5	18.39	238	15%

Sub W population factor estimate 7867 tonnes

SWN HiFlow emissions factor 2480 tonnes

Subpart W leaking component factor estimate 439 tonnes

- Difficult to compare to Subpart W Population factor emissions as there isn't a component factor nor a population emissions factor for flanges or "other"

SWN Production Annual Reductions

	MCF Components/Well			MCF Components & Equipment/Well		
	2014	2015	2016	2014	2015	2016
Area A	24	16	15	29	21	18
Area B	63	6	52	67	25	77
Area C	-	80	34	-	107	91
Area D	166	183	143	262	437	179
Area E	108	516	-	108	968	-
SWN	29	25	23	38	34	39

- MCF/Well is one "normalized" metric for year to year comparisons
- Area D has few wells. Emissions in 2014-2015 similar but well count was 21 vs 17
- Areas E has very few wells but observed significant spikes in observed leaks between 2014 and 2015 (2-22)
- Area A is largest operating area and hence significantly affects SWN aggregate values

SWN Production LDAR Cost versus "Recovery"

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	2014	2015	2016
SWN SMART LDAR Implementation Cost **(Not OOOOa)**	$378,000	$546,000	$582,000
Component Gas Recovered MMSCF	90	135	126
Component Leak MCF/Well Surveyed	29	25	23
Component Leak Recovery Value	$270,000	$274,000	$245,000

- More total gas recovered due to more wells surveyed from 2014-2016
- Normalized MCF/Well reflects decrease from year to year
- Value of gas significantly affects cost effectiveness
    - 2014 based on $3/MMSCF after royalty reduction
    - 2015 based on $2.03/MMSCF after royalty reduction
    - 2016 based on $1.95/MMSCF after royalty reduction

SWN UAS Aerial LDAR Beginnings

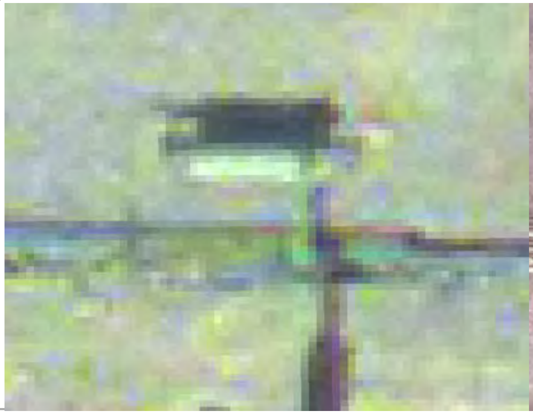
- Development Timeline
- Utilization Opportunities
- Design
- Early Observations
- Challenges

SWN UAS Aerial LDAR Development Timeline

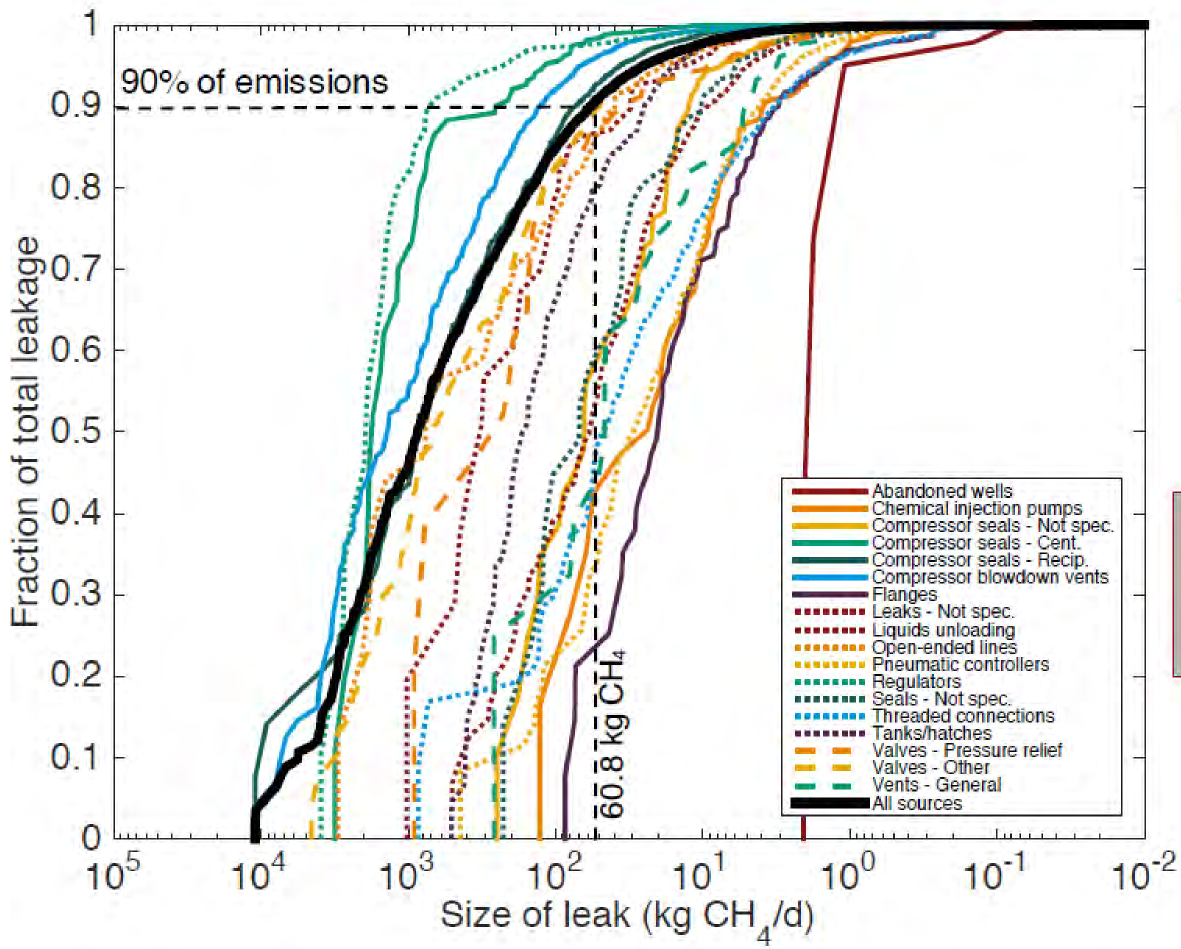
- Early Summer 2016: Began researching technology
- Issued preliminary review
- July 2016: Cost-benefit analysis
  - Identified processes that could benefit
  - Compared cost of current methods vs modeled UAS utilization
- Aug 2016: Decided to move forward with investment
- Sept 2016: Began evaluating suitable platforms and sensors
- Nov 2016: Obtained FAA certifications
- Dec 2016: Selected and placed orders
- Apr 2017-present: Training, testing, producing

SWN Aerial UAS Utilization and Opportunities

- Roof inspections
- Tower inspections
- Rig inspections
- Right of Way inspections
- Pond/impoundment inspections
- Asset inventory
- Incident response/crisis management
- 3-D Imaging of Facilities
- **Aerial LDAR**



SWN UAS Aerial LDAR Opportunity
Chasing the Exceptional Minority



90% of volume
leak size > 61 kg/d

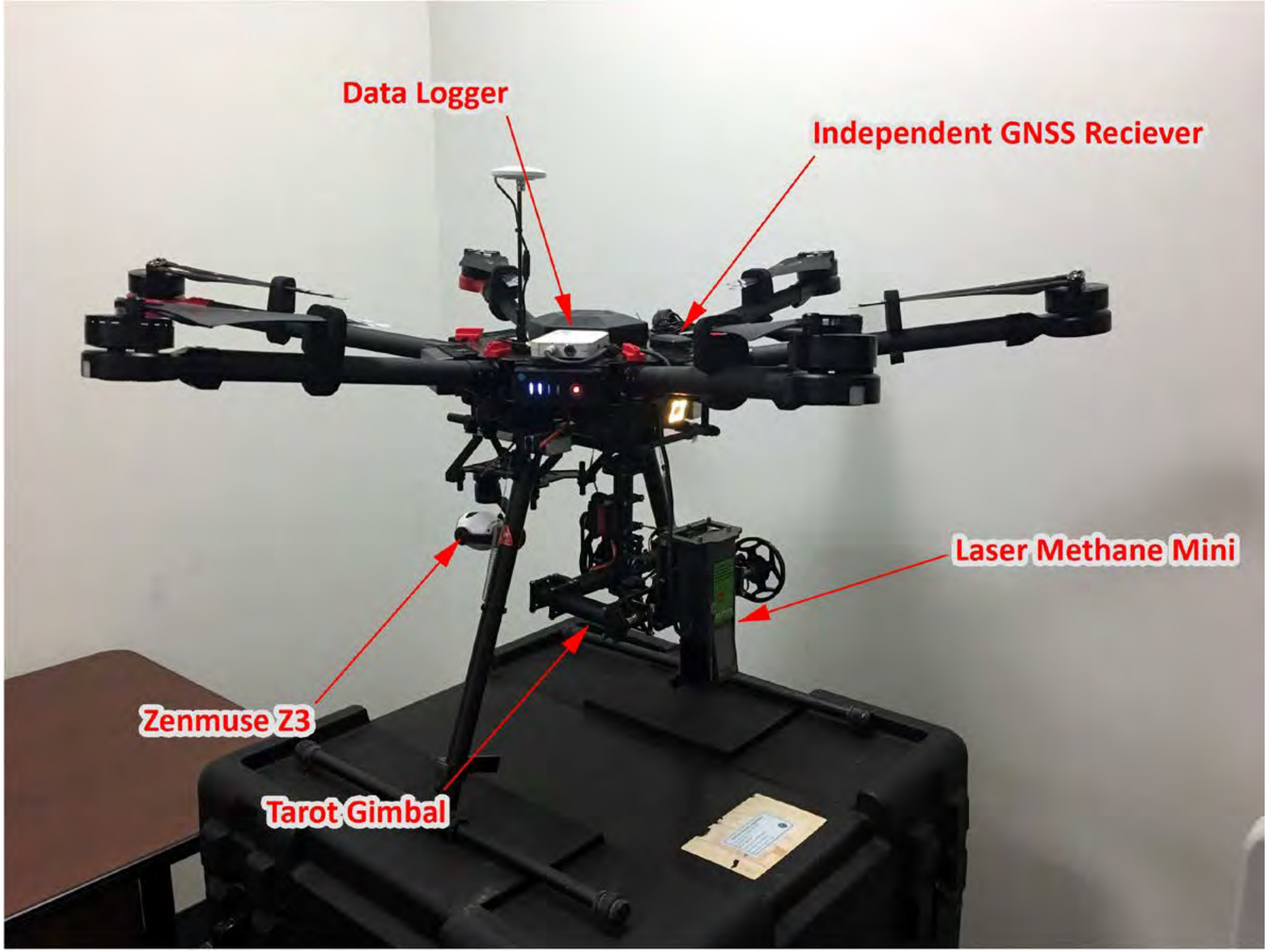
ARPA-E target
leak size = 2.7 kg/d

Brandt et al. (2016)

SWN UAS = M600

- DJI Matrice 600 (Industrial) (Multi-rotor)
  - Payload
    - Laser Methane Mini spectrometer with independent GNSS and datalogger
      - Continuously nadir pointing by custom 2-axis Tarot gimbal
      - 0.1s pulse rate
      - 1.65 µm wavelength (a fundamental CH_4 absorption band)
      - 100’ effective range
    - Zenmuse Z3 RGB camera
      - 3.5x Optical Zoom
      - 4K video
  - General info/specs
    - Hexarotor
    - Up to 40 min endurance
    - 12 lbs max payload

SWN M600


Data Logger
Independent GNSS Reciever
Laser Methane Mini
Zenmuse Z3
Tarot Gimbal

SWN Aerial Leak Detection Observation

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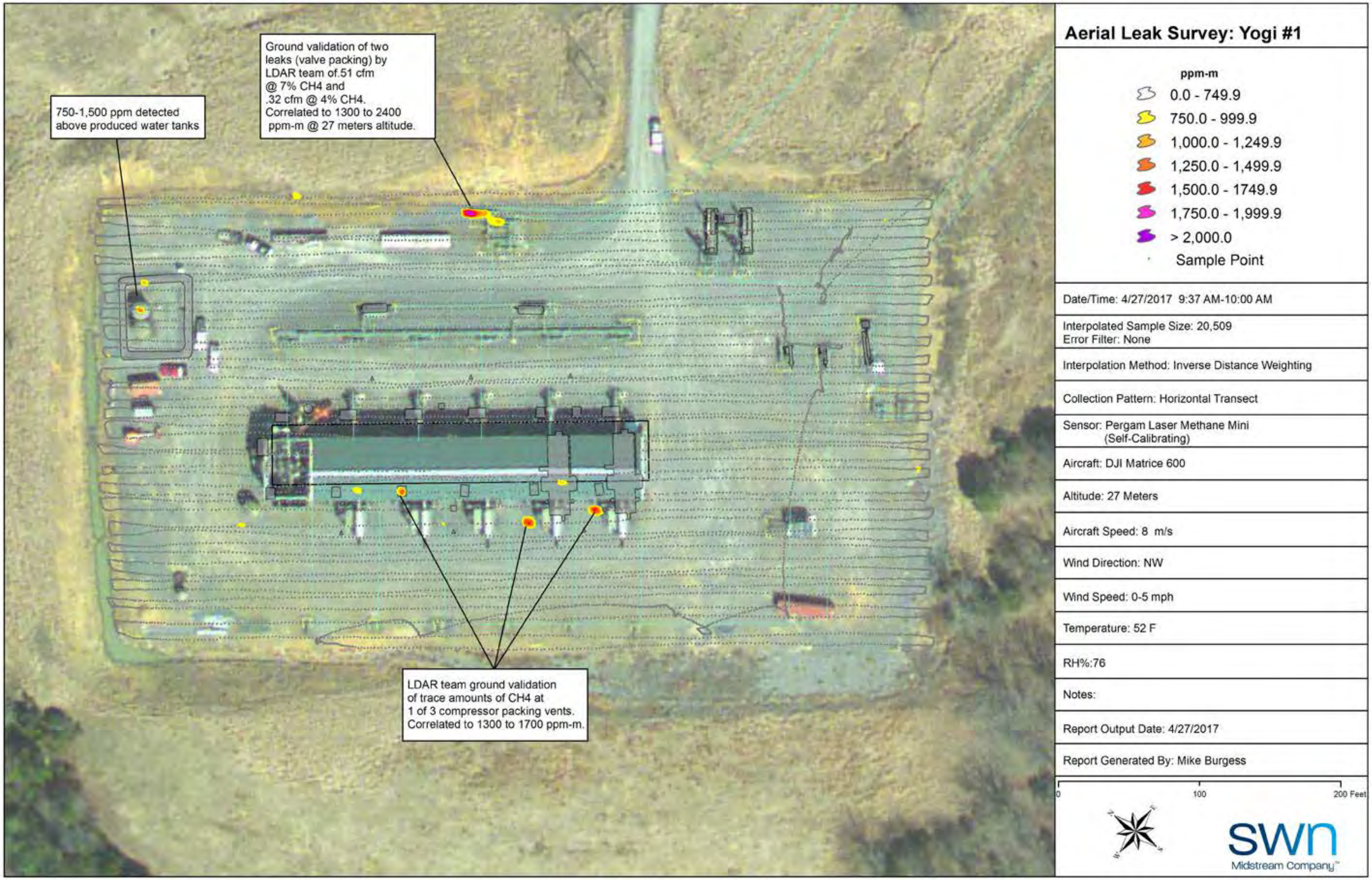

SWN UAS Aerial Leak Detection Challenges

- Operational Considerations
  - Flight speed
  - Wind speed
  - Distance from sources
  - Facility “rastering”
- Changing traditional LDAR “mindset”
  - Ground based surveys vs Aerial based surveys
  - Component by Component survey vs Spatial survey
  - Chasing small leaks (mundane majority) vs targeting larger leaks (exceptional minority)
  - Human/Instrument vs Instrument/Human
- Establishing alternative “equivalency”

Air Jordan chasing Methane Molecules