



Tecnología Aplicada a la Gestión de Activos:

Autonomía y Sustentabilidad



Asociación
Colombiana
de Ingenieros

CIMGA 2023



Visión



Asociación
Colombiana
de Ingenieros



HEXAGON

Evolución de la Gestión de Activos



Maintenance 1.0 CMMS

Reactivo. Correr hasta a fallar y, a continuación, corregir.



Maintenance 2.0 CMMS and EAM

Mantenimiento preventivo por calendario y Registro de OT



Maintenance 3.0 EAM

Mantenimiento basado en la condición: los sensores monitorean la condición y envían alertas.

Mantenimiento predictivo: basado en datos de sensores.



Maintenance 4.0 APM

Mantenimiento predictivo: los algoritmos y los modelos de aprendizaje automático determinan cuándo fallará un activo.

Mantenimiento prescriptivo: diseña personas, procesos y herramientas para solucionar problema.



Industry 5.0 Sustentabilidad y Autonomía

Robótica, máquinas inteligentes y humanos trabajando juntos, mejor y más rápido, aprovechando tecnologías avanzadas como IoT y big data en pos de la autonomía

La Industria 5.0 expande los objetivos 4.0 al colocar seguridad, habilitación y tecnología para la sustentabilidad y la productividad en todas las industrias.



Fuente de definición: IndustryWeek 2nd June 2020 (Maintenance 1.0 – 4.0)
Understanding the enterprise asset maintenance maturity model

Fuente de definición: Hexagon September 2021 (Industry 5.0)
How Digitalization Drives Sustainable Transformation

Hexagon desde un vistazo



Nuestra Visión

Nuestro enfoque es la **autonomía**

Aprovechar los datos al máximo de su potencial, yendo más allá de la automatización, hacia la autonomía



Nuestro marco es la **Sustentabilidad**

Seguridad, eficiencia, productividad y calidad dan como resultado una sustentabilidad escalable

Nuestro metodología es la **innovación**

Con casi 4,000 empleados en I+D y más de 3,700 patentes activas

Nuestra estabilidad está **constantemente probada**

Crecimiento de las ventas de 500 millones de USD en 2,000 a 3,800 millones de USD en 2020 con aproximadamente 21,000 empleados en 50 países

Líder mundial en soluciones **de realidad digital** que están empoderando un futuro autónomo y sustentable al poner los datos a trabajar

Industrial Facilities – Realizing Value from Your Data

Autonomous Data Collection

Mundo Real

Capture & Transfer

New Assets



Existing Assets



Physical Activities

The Smart Digital Reality

Gemelo Digital

Visualize & Analyze



Safety



Quality



Productivity



Efficiency

Define Actions

Data Leverage

Nuestro Portfolio para la Gestión Inteligente del Ciclo de Vida de Activos



SAFETY



QUALITY



EFFICIENCY



PRODUCTIVITY

Digital Projects

Digital Assets

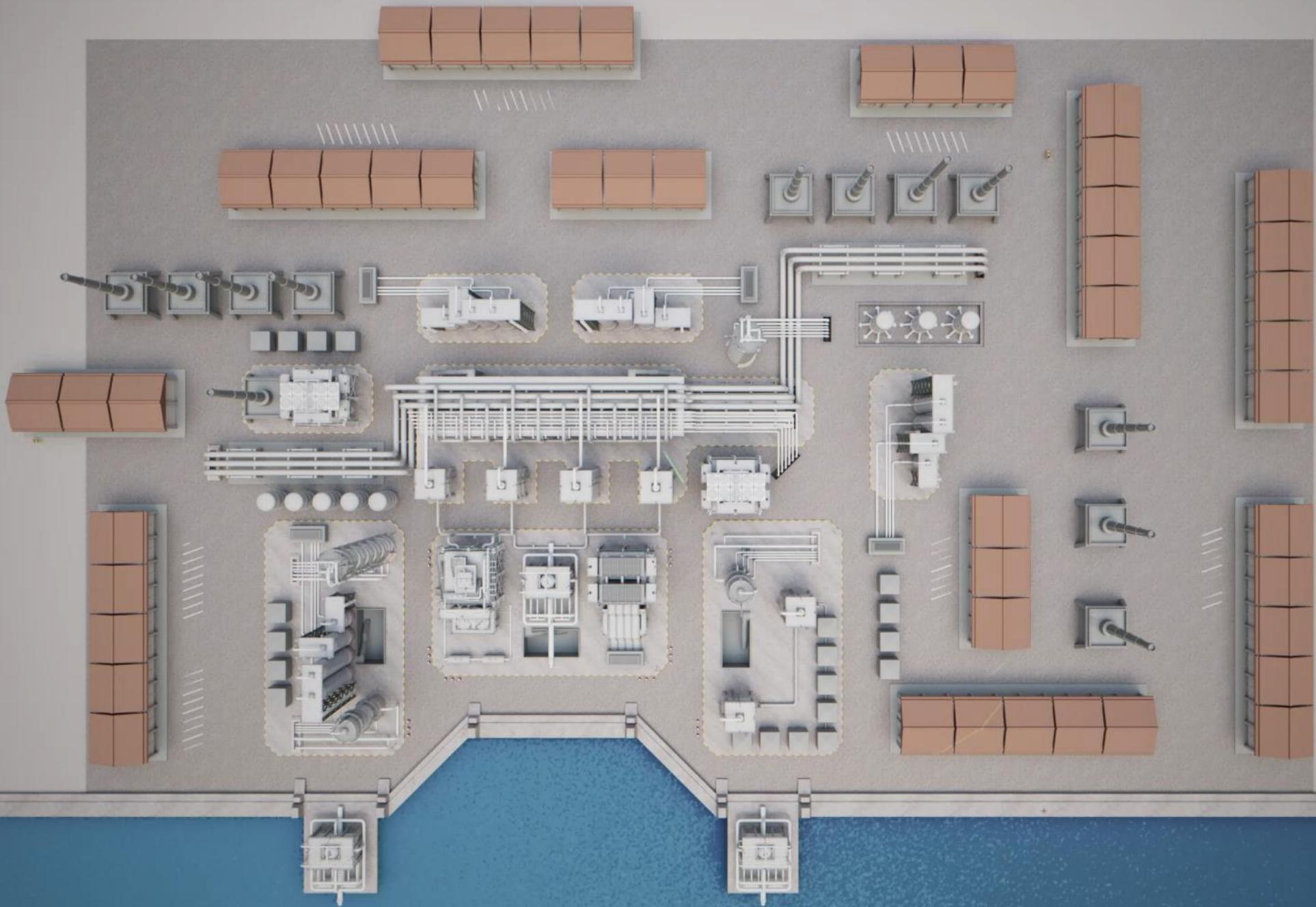
Plan	Design			Execute			Operate	Maintain			Secure
Portfolio & Project Planning	Conceptual Design	Detailed Engineering	Supply Chain	Fabrication	Construction	Operations Management	Environment, Health & Safety Risk	Maintenance Management	Asset Integrity & Reliability	Sustaining Engineering	OT / ICS Cybersecurity

Digital Backbone

Interoperability Connectors 	Common Data Environment 	Reality Capture 	Digitization 	Visualization 	Analytics 
--	--	--	---	--	--

Autonomy Enablers

Connected Worker 	Integration Middleware 	Cloud / SaaS 	Artificial Intelligence 	IIoT / Sensors 	Robots & Scanners 
--	--	--	---	--	---



¿Que datos necesito?

Data Inputs

- Reality Capture Data
- Design & Engineering Data
- IIoT and Sensor Data
- Operational Data

Digital Backbone



¿Que tengo que hacer hoy?

Embedded Work Processes



¿Que decisiones necesito tomar?

Decision Support Analytics



Outcomes

- SAFETY
- EFFICIENCY
- QUALITY
- PRODUCTIVITY

Presiones de la Industria que impactan a la Gestión de Activos



Casos de Aplicación



Asociación
Colombiana
de Ingenieros



Casos de aplicación, del modelo digital a la gestión de mantenimiento edilicio



Casos de aplicación, interacción con el modelo digital de una planta



Casos de Aplicación – Permisos de Trabajo en modelo Digital

Assets
WATER (ITSGDNA054_DEM) Org: USCAE Group/User: 2020/JBARWICK

00067333 Pump, centrifugal

Record View Comments Structure Details Events Costs PM Schedules LOTO Safety Permits Reliability Calculations Documents OC BIM

OpenCAD BIM 11.71.1

IFC models

Tree view

Class View

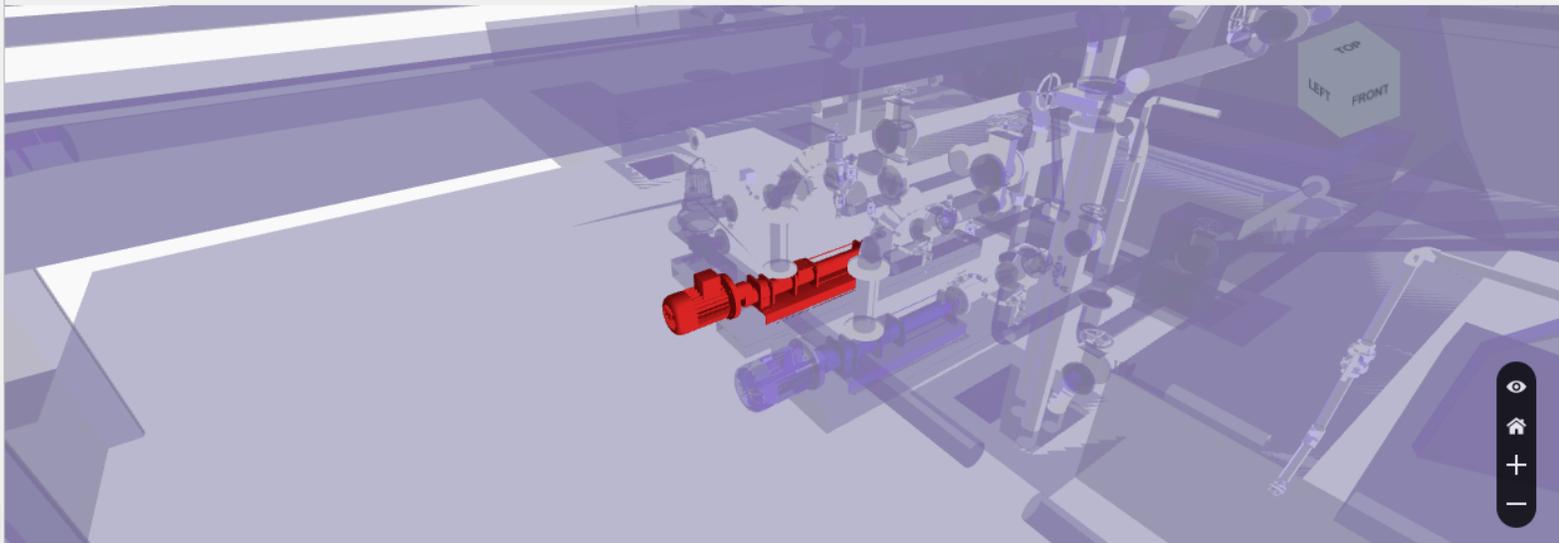
- ▶ EDC 4
- ▶ EDC 3
- ▶ EDC 2
- ▶ BPR-201-123
- ▶ APR-203-101
- ▶ EDR 5
- ▶ APR-203-131
- ▶ APR-203-121
- ▶ APR-203-111

HxGN EAM code:: # 00067333

Parent object

Element details

Attribute	Value
▼ p_set:	
AssetName	203-BPR-PV-120



Equipment

ExtId 1048490

00067333 Pump, centrifugal:
 Status: Installed
 Type: Asset
 Department: Columbia Water Plant
 Category: Centrifugal Pump
 Safety:
 Out of Service:

Asset details

Create work order

View Non-conformity

Work order list

Permit to work

8 Work Orders

AM Code	Description	Class	Criticality	Department	Type	
067333	Pump, centrifugal	001270	03	Columbia Water Plant	A	<input type="checkbox"/>
067334	Pump, centrifugal	001270	03	Columbia Water Plant	A	<input type="checkbox"/>
167347	C-Valve, isolation	P00012	03	Columbia Water Plant	A	<input type="checkbox"/>
1049150	USCAE Valve, isolation	00167399	03	Columbia Water Plant	A	<input type="checkbox"/>
127	USCAE The Water Treatment Plant	001-00167037		Columbia Water Plant	S	<input type="checkbox"/>

Page 1 of 1

Displaying topics 1 - 5 of 5

Start Center
Assets
PM Schedules
Parts
Standard WOs
Systems
Work Orders

Casos de Aplicación – Permisos de Trabajo Digitales

Work Materials Equipment Purchasing Operations Administration PTW Dashboard

PTW - DATA ANALYSIS

PTW Type

- Cold
- Hot

PTW - Data Analysis

Screen Map: STO-DT-0007-08_PLOT_PLAN-STO_GENERAL.SVG

PTW	PTW description	Status	Permit Type	Data required	Equipment	Equipment description	LOTO certificate	LOTO cert. description	Loto Type	Isolation Point	Isp Desc	Isp Method	Isp Type	Type	JSA
10000	Tank cleaning	Unfinished	Cold		TK-101-01	Tanque 101-01	M-LOTO: 10015 - E-LOTO: 10014	-	-	-	-	-	-	PTW	
10000	-	-	-		ADI-300-3	ADI-300-3	10015	Example M-LOTO Certificate (10001)	M-LOTO	ISO-000003	Aditivacion y Solplado, ...	M-SPADED	Clamp	ISO	
10000	-	-	-		ADI-300-1	ADI-300-1	10015	Example M-LOTO Certificate (10001)	M-LOTO	ISO-000001	Aditivacion y Solplado, ...	M-BLIND-INSTAL	Switch	ISO	
10000	-	-	-		M-931-01-02	Motor 01, MOV 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO_006174	Motor 01, MOV 02, Ta...	E-ISOLATED	Switch	ISO	
10000	-	-	-		LI-931-01-02	Indicador de Nivel 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO-005446	Indicador de Nivel 02, ...	E-ISOLATED	Switch	ISO	
10004	Cambiar el aceite de lubricac...	Ready for Auth...	Hot	25-May-2018	TK-101-08	TK-101-08	M-LOTO: - E-LOTO: 10014	-	-	-	-	-	-	PTW	
10004	-	-	-		M-931-01-02	Motor 01, MOV 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO_006174	Motor 01, MOV 02, Ta...	E-ISOLATED	Switch	ISO	
10004	-	-	-		LI-931-01-02	Indicador de Nivel 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO-005446	Indicador de Nivel 02, ...	E-ISOLATED	Switch	ISO	

Casos de Aplicación – Permisos de Trabajo Digitales

Work Materials Equipment Purchasing Operations Administration PTW Dashboard

PTW - DATA ANALYSIS

PTW Type

- Cold
- Hot

ISOLATION

- M-LOTO (hot)
- E-LOTO (hot)
- M-LOTO (hot)
- E-LOTO (hot)

PTW - Data Analysis

Screen Map: STO-DT-0007-08_PLOT_PLAN-STO_GENERAL.SVG

Refresh Clear Filter

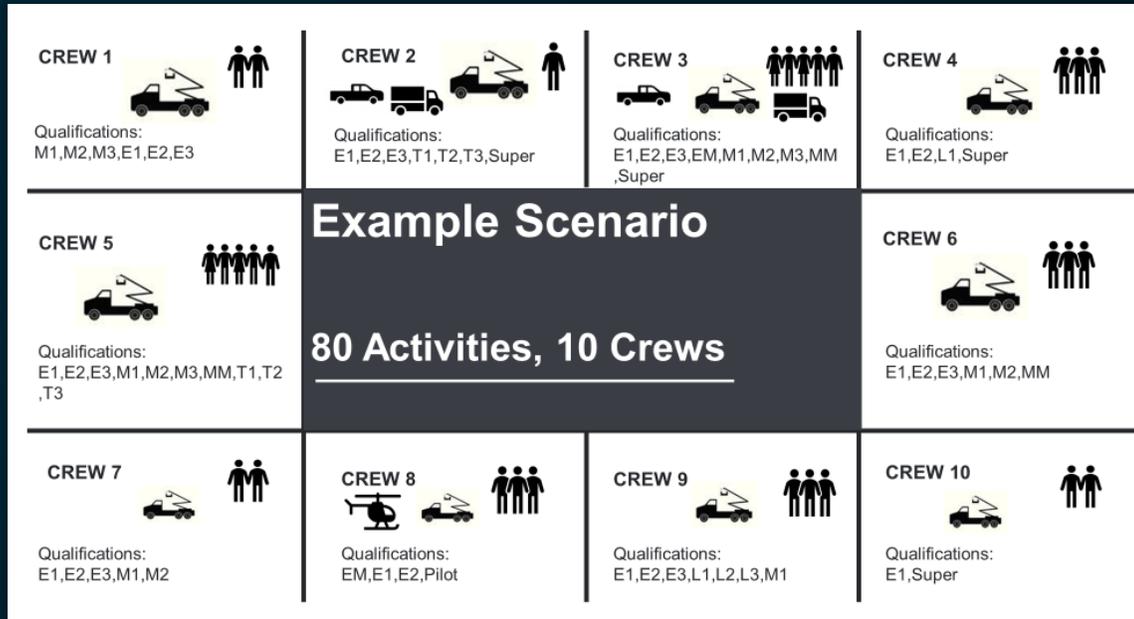
PTW	PTW description	Status	Permit Type	Data required	Equipment	Equipment description	LOTO certificate	LOTO cert. description	Loto Type	Isolation Point	Isp Desc	Isp Method	Isp Type	Type	JSA
10000	Tank cleaning	Unfinished	Cold		TK-101-01	Tanque 101-01	M-LOTO: 10015 - E-LOTO: 10014	-	-	-	-	-	-	PTW	
10000	-	-	-		ADI-300-3	ADI-300-3	10015	Example M-LOTO Certificate (10001)	M-LOTO	ISO-000003	Adivivacion y Solplado, ...	M-SPADED	Clamp	ISO	
10000	-	-	-		ADI-300-1	ADI-300-1	10015	Example M-LOTO Certificate (10001)	M-LOTO	ISO-000001	Adivivacion y Solplado, ...	M-BLIND-INSTAL...	Switch	ISO	
10000	-	-	-		M-931-01-02	Motor 01, MOV 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO_006174	Motor 01, MOV 02, Ta...	E-ISOLATED	Switch	ISO	
10000	-	-	-		LI-931-01-02	Indicador de Nivel 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO-005446	Indicador de Nivel 02, ...	E-ISOLATED	Switch	ISO	
10004	Cambiar el aceite de lubricac...	Ready for Auth...	Hot	25-May-2018	TK-101-08	TK-101-08	M-LOTO: - E-LOTO: 10014	-	-	-	-	-	-	PTW	
10004	-	-	-		M-931-01-02	Motor 01, MOV 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO_006174	Motor 01, MOV 02, Ta...	E-ISOLATED	Switch	ISO	
10004	-	-	-		LI-931-01-02	Indicador de Nivel 02, Tank Slops,STO	10014	Example E-LOTO Certificate (10023)	E-LOTO	ISO-005446	Indicador de Nivel 02, ...	E-ISOLATED	Switch	ISO	

Casos de Aplicación : Modelo Digital de Optimización de Recursos

Setup (HxGN EAM)

Optimize

Results (EAM)



Optimized Scheduler

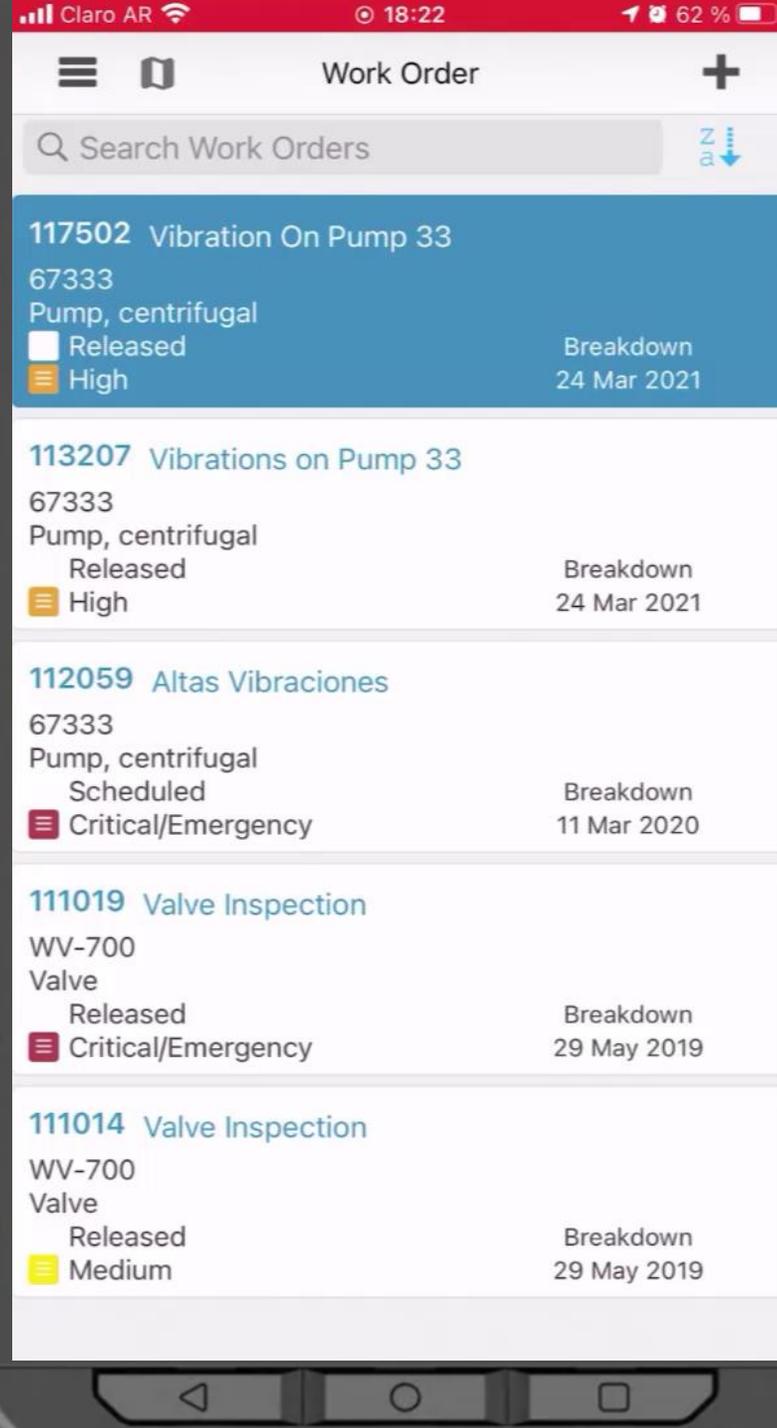
Schedule

- Crew 1
 - Activity A
 - Activity B
- Crew 2
 - Activity C
 - Activity B

Unassigned Activities

- Activity X
- Activity Y

Técnico



Caso de Aplicación: Modelo Digital de Activos Lineales

Assets

Assets

WATER (ITSGDENA054_DEM) Org: USCAE Group/User: 3010/CSAUNDERS

672579 Water Main from WN-756 to WN-703

Search within All Assets

Record View Comments Events **Linear Overview** PM Schedules Work Order Checklists Rankings Impacted Connections Documents

672579 - Water Main from WN-...
Status: Installed
Department: WTR01
Assigned To:

672580 - Water Main from WV-...
Status: Installed
Department: WTR01
Assigned To:

672581 - Water Main from WN-...
Status: Installed
Department: WTR01
Assigned To:

672582 - Water Main from WV-...
Status: Installed
Department: WTR01
Assigned To:

672596 - Water Main from WV-...
Status: Installed
Department: WTR01
Assigned To:

672603 - Water Main from WV-...
Status: Installed
Department: WTR01
Assigned To:

672605 - Water Main from WN-...
Status: Installed
Department: WTR01
Assigned To:

672606 - Water Main from WN-...
Status: Installed
Department: WTR01
Assigned To:

Work Orders Open Work Orders Edit Effective: 06/10/2022

Reference	0	12.9591	25.9182	38.8773	51.8364	64.7955	77.7546	90.7137	103.6728	116.6319
Linear References										
Points of Interest										
Condition Index				(4) Good/3.9					(5) Excellent/4.98	
Criticality Index				Low/122					Low/122	
Risk Priority Index				Low /5					Low /5	
Related Equipment										
Water Service Line		🏠							🏠	
Related Parts										
Work Orders										
118614										Planned Pipe Repair

Start Center Assets Call Center GIS Map Search Optimized Scheduler Setup Parts Systems Work Orders

Caso de Aplicación: Modelo Digital de Activos Lineales

The screenshot displays the Infor EAM (Enterprise Asset Management) interface. At the top, the user is logged in as 'Aline Johnston'. The main header shows 'Asset 7811-312 Track-GEO-508B'. Below this is a navigation bar with various tabs: Record View, Tech Details, Events, Structure Details, Costs, Statistical Failure Data, Reliability Calculations, RCM, Rankings, Ranking Survey, Documents, and More. A search bar on the left contains '7811-312'. The main content area is divided into several sections:

- Asset Information:** Asset ID: 7811-312, Department: YVR02, Organization: CAYVR, Class: 400-7811. Status: Installed / Active, Commission Date: 20-NOV-2010.
- Equipment Details:** Class: 400-7811, Category: LR, Manufacturer: SFTTR, Est Replace Value: 10,000.00, Replacement Value: [empty].
- GIS Details:** GIS ID: 100,001,170, Map: CAYVR, Map Org.: CAYVR, Profile: 400-7811-YVR, Layer: SpoorProRail, Location X: 189,511.218491, Location Y: 444,331.239639.
- Tracking Details:** [Collapsible section]
- Part Association:** [Collapsible section]
- Risk and Reliability - RCM Details:** [Collapsible section]
- Documents:** [Collapsible section]

The interface includes a sidebar on the left with a search bar and a list of assets. The top right corner has a search bar with the text 'Start Typing' and a user profile icon.

Caso de Aplicación: Digitalización de Manuales de Fabricantes

Assets

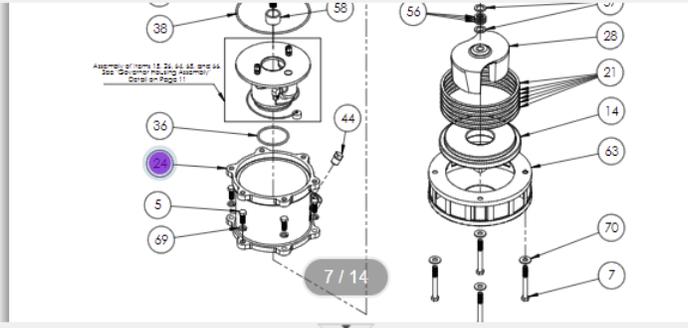
Work Orders

36102 Sludge Pump PM

36102 - Sludge Pump PM
Equip/Location: T101-PMP-SLD-01
Equipment Descri... Sludge Pump #102
Status: Assigned

Record View Activities x Material x Schedule Labor x Cost Summary x Permits x Book Labor x Closing x Safety x Checklist x **OpenCAD XBrowser x** More v

7 / 14



Material List

...	Item ID	Part number	Part description	Page	UM	Activity	Store	Bin	Lot	Available Qty	QTY	Plan. Qty	Res. Qty
	1	070.002.000	Bearing, Ball	7	EA	10	MA-1	B5	*	7	0	0	0
	9	180.002.155	Volute	7	EA	10	MA-1	B1	*	9	0	0	0
	10	200.004.330	Clamp, Muffler	7	EA	10	MA-1	B6	*	15	0	0	0
	11	200.005.115	Clamp, Hose	7	EA	10	MA-1	B2	*	11	0	0	0
	13	255.001.000	Coupling, Flexible	7	EA	10	MA-1	B7	*	14	0	0	0
	24	430.007.155	Housing, Intern...	7	EA	10	MA-1	B3	*	5	0	0	0
	26	430.009.155	Housing, Governor	7	EA	10	MA-1	B8	*	19	0	0	0
	27	430.010.150	Housing, Bearing	7	EA	10	MA-1	B4	*	2	0	0	0
	28	444.002.010	Impeller	7	EA	10	MA-1	B9	*	3	0	0	0

WO activity: 10 Check out

Page 1 of 1

Drawings List

Displaying topics 1 - 9 of 9

Caso de Aplicación: Digitalización de Manuales de Fabricantes

Assets

Assets

Work Orders

36102 Sludge Pump PM

Record View Activities x Material x Schedule Labor x Cost Summary x Permits x Book Labor x Closing x Safety x Checklist x OpenCAD XBrowser x

Search within All Open Work

36102 - Sludge Pump PM
Equip/Location: T101-PMP-SLD-01
Equipment Descri... Sludge Pump #102
Status: Assigned

Material List - Issue / Plann... X

Part number: 430.007.155
Part description: Housing, Intermediate
Store: MA-1
Bin: B3
Lot: *
Available QTY: 5
WO activity: 10

Issue Planning
Issue Quantity: 0

Cancel Continue

Material List

...	Item ID	Part number	Part description	Page	UM	Lot	Available Qty	QTY	Plan. Qty	Res. Qty
	1	070.002.000	Bearing, Ball	7	EA	*	7	0	0	0
	9	180.002.155	Volute	7	EA	*	9	0	0	0
	10	200.004.330	Clamp, Muffler	7	EA	*	15	0	0	0
	11	200.005.115	Clamp, Hose	7	EA	*	11	0	0	0
	13	255.001.000	Coupling, Flexible	7	EA	*	14	0	0	0
	24	430.007.155	Housing, Intern...	7	EA	10 MA-1 B3	5	0	0	0
	26	430.009.155	Housing, Governor	7	EA	10 MA-1 B8	19	0	0	0
	27	430.010.150	Housing, Bearing	7	EA	10 MA-1 B4	2	0	0	0
	28	444.002.010	Impeller	7	EA	10 MA-1 B9	3	0	0	0

WO activity: 10 Check out

Page 1 of 1

Displaying topics 1 - 9 of 9

Start Center Assets Calibrated Equipment PM Schedules Parts Positions Projects Systems Work Orders

Foco en la Sustentabilidad



Asociación
Colombiana
de Ingenieros



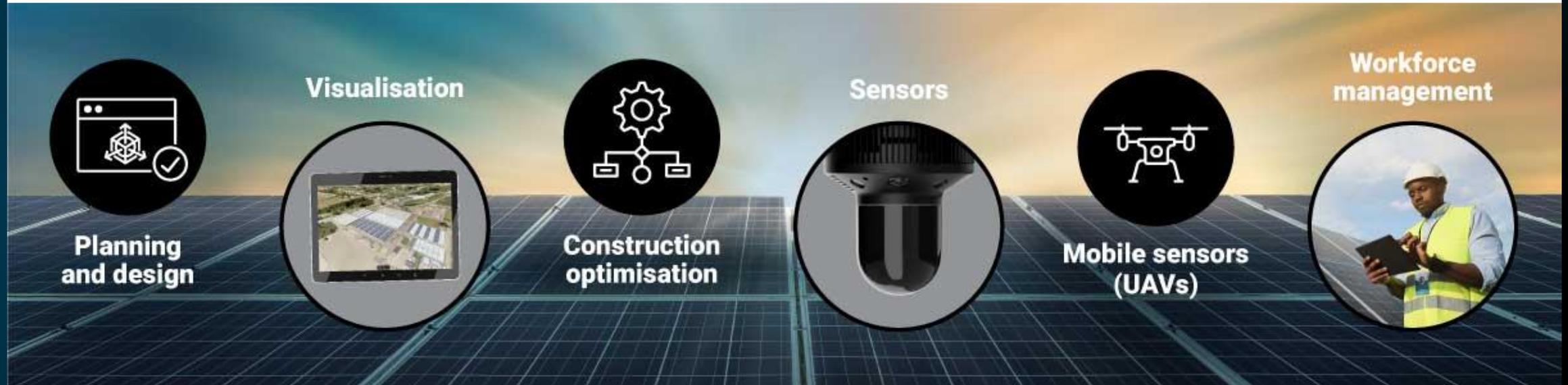


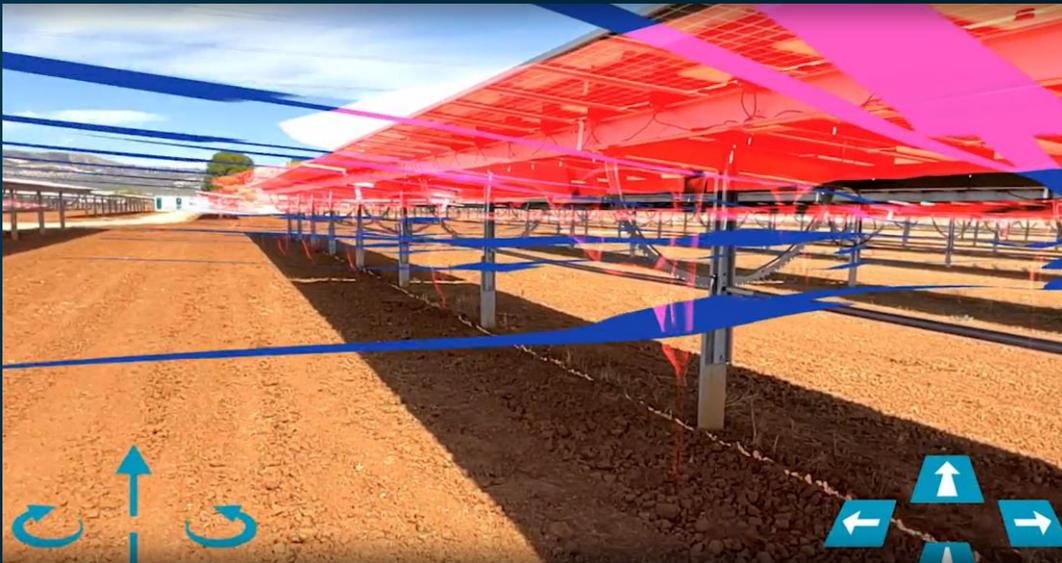
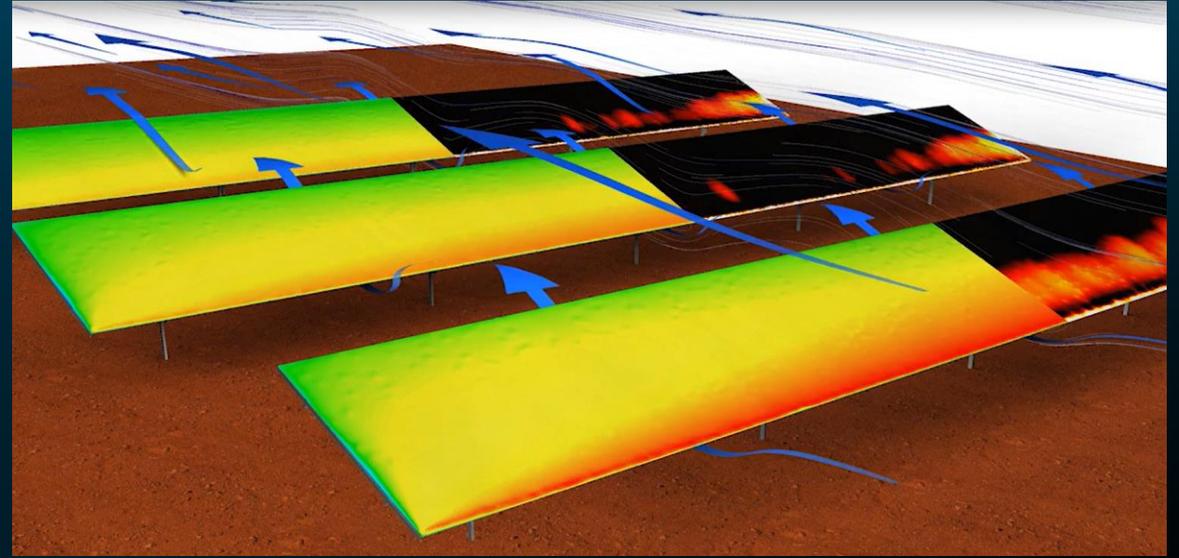
R-evolution

Powered by Hexagon

R-evolution in progress: Digitalising solar energy production

On the front lines of R-evolution







Digital Twin



Digital Thread

Plan Design Manufacture Comission Operate Optimise Decomission Recycle



Facilitating Hexagon and H2U's strategic partnership

Unleashing digital reality technologies to
accelerate and scale green hydrogen plant
design and performance

The time is now

R-initiatives are steady waves of innovation driving a more sustainable future

LEARN MORE →



R-evolution enables blue carbon credits

Blue carbon ecosystem discovered by sharks, validated with Bathymetric LiDAR enable the world's first blue carbon credits

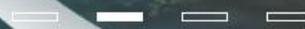
LEARN MORE →



R-evolution launches venture capital arm

The programme aims to help green-tech startups accelerate their next breakthroughs through seed funding or in-kind technology

LEARN MORE →



Hexagon, hacia una gestión de activos autónoma y sustentable

GRACIAS

Nicolas.Luders@Hexagon.com



Asociación
Colombiana
de Ingenieros

