

# Resumen de las Actividades de la División de Ecoenergía Mayo - Agosto 2019



Con especial satisfacción informamos a clientes y amigos que en este período nuestro Laboratorio Setisa Lab Subdivisión Ambiental ha recibido la Auditoría y Confirmación de Acreditación por el Organismo Salvadoreño de Acreditación (OSA) para los ensayos de: Determinación de Material Particulado PM2.5; Determinación de Material Particulado PM10; Determinación de Partículas Totales Suspendidas PTS; y Determinación Ruido Ambiental. Somos la única empresa de Ingeniería que cuenta con dicha acreditación, la cual planificamos expandir próximamente. Continuamos incrementando nuestros servicios en el área de Energía, además hemos suministrado Analizadores de Vibraciones de la marca ERBESSD a la empresa OPP FILM y a la Universidad Centroamericana José Simeón Cañas (UCA) incluyendo charlas técnicas para su personal. Realizamos una presentación técnica sobre Software ETAP para Estudios Eléctricos a los profesores y alumnos de la Universidad Politécnica de El Salvador (UPES), próximamente con el apoyo de ETAP haremos una donación de 25 licencias de Software ETAP que servirán para establecer un laboratorio de esta importante especialidad. Con el patrocinio de la Agencia Japonesa de Cooperación Internacional JICA la División de Química Analítica de SETISA a través de la marca Agilent Technologies, ha suministrado e instalado en el Centro de Investigaciones y Aplicaciones Nucleares (CIAN) de la Facultad de Ingeniería y Arquitectura de la Universidad de El Salvador (UES), un Espectrofotómetro de Emisión Atómica de Plasma Acoplado Inductivamente (ICP-OES), para análisis de metales, a ser utilizado en el Proyecto de Técnicas de Termoluminiscencia aplicadas a la Evaluación de Reservorios Geotérmicos (Proyecto SATREPS Geotermia); el proyecto incluyó la capacitación de docentes de la UES. Nuestro grupo de jóvenes ingenieros SETISA-Edu continúa publicando en las redes sociales actividades de diseminación de tecnología y efectuando presentaciones especializadas en diversos centros educativos.



“Agilidad, Excelencia Técnica, Innovación”



El Organismo Salvadoreño de Acreditación, OSA, evalúa la competencia técnica de los organismos de certificación, inspección y laboratorios de ensayo y calibración; a través de sus servicios, determina si un producto, proceso, sistema, persona u organismo cumple con requisitos de acuerdo a normas y reglamentos con validez internacional.



## Renovación de Acreditación por el Organismo Salvadoreño de Acreditación

Nos complace informar que el Organismo Salvadoreño de Acreditación, OSA ha dictaminado mantener la acreditación otorgada a nuestro Laboratorio Sub división Ambiental para los siguientes ensayos:

- Determinación de Material Particulado, PM2.5
- Determinación de Material Particulado, PM10
- Determinación de Partículas Totales Suspendidas, PTS
- Determinación Ruido Ambiental.

*Actualmente somos la única empresa de Ingeniería que cuenta con dicha acreditación, la cual planificamos expandir próximamente.*



ACREDITACIONES





*OPP Film, es una empresa que se dedica a la producción de materiales de empaques de Polipropileno Biorientado (BOPP, por sus siglas en inglés), en las variedades: transparente, mate y metalizado. Opp Film es una filial de Oben Holdign Group que cuenta con plantas de producción en Perú, Ecuador, Colombia, Chile y Argentina.*



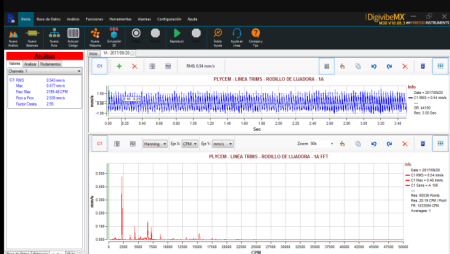
SETISA es representante exclusivo de ERBESSD INSTRUMENTS, empresa especializada en equipos de Análisis de Vibraciones y Balanceos Dinámicos. El análisis consiste en la recolección de datos, procesamiento e interpretación de resultados que permiten generar conclusiones y recomendaciones, como parte de un Plan de Mantenimiento Predictivo (PMP) que SETISA realiza.

Los equipos **DigivibeMX** de ERBESSD son los analizadores de vibraciones y balanceo dinámico con mayor prestigio en el mercado.

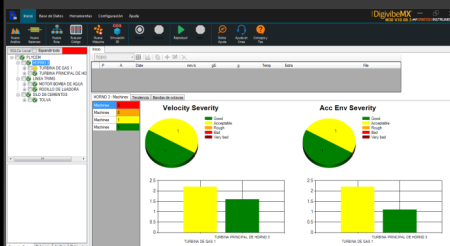
**Recientemente OPP Film y la Universidad Centroamericana "José Simeón Cañas" (UCA) adquirieron el modelo DigivibeMX M30.**

*La Familia DigivebeMX ofrece los mejores Sistemas para Balanceo Dinámico, Análisis de Vibraciones y Recolección de Datos.*

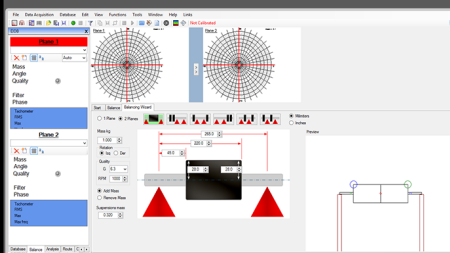
*La interfase es fácil de usar e incorpora funciones avanzadas para entender y analizar las Vibraciones y actuar rápidamente para implementar ajustes correctivos y preventivos en toda su maquinaria.*



**Spectros de Vibración**



**Análisis de Equipo**



**Balaceo Dinámico**

**DIGIVIBEMX 11, REVOLUCIONANDO EL ANÁLISIS DE VIBRACIONES**

Los analizadores de vibraciones han tenido un salto de calidad en cada versión y con la llegada próxima de la versión DigivibeMX11 ésta no será la excepción.

-Grabaciones de **muy larga duración.**

-**Auto-guardado** de sesión de balanceo.

-**Compatibilidad** WISER3X.

-Diseño para el Nuevo **Medidor de Ángulos** Bluetooth

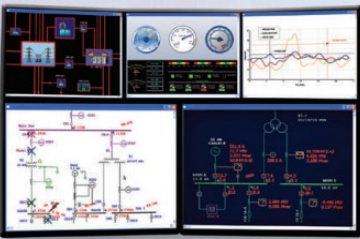




Servicios Técnicos de Ingeniería  
S. A. de C.V.



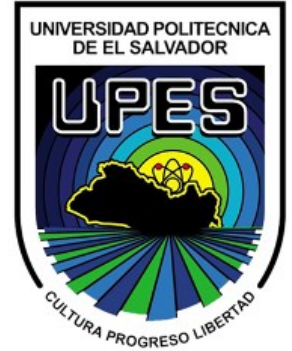
ETAP Real-Time™



ETAP Real-Time extiende los sistemas tradicionales de adquisición de datos a una solución inteligente y de administración de energía para los operadores en plantas de energía. Junto con sus aplicaciones modulares pueden adaptarse a las necesidades de cada empresa, desde sistemas de energía pequeños a grandes Sistemas. Las instalaciones industriales, empresas de transmisión, distribución, plantas generadoras y empresas de servicios integrados pueden beneficiarse de las características y administración de energía que ofrece ETAP en tiempo real.

## SETISA realizó una Charla Técnica a estudiantes de Ingeniería Eléctrica de la Universidad Politécnica de El Salvador.

La charla tuvo como título: “Introducción al software ETAP con Estudios Eléctricos de Potencia”. Se desarrollaron los temas de ETAP Real -Time, Grid y ADMS, haciendo énfasis en el proyecto desarrollado en la Planta de HOLCIM con el sistema (ILS) de soluciones en tiempo real como una herramienta predictiva.



El alcance global con el que cuenta ETAP consiste en: apoyo técnico en el sistema educativo a través de los Laboratorios ETAP, sus nuevos módulos, versiones y demostración del software con proyectos que SETISA ha realizado.



SETISA es representante exclusivo de ETAP en El Salvador brindando soporte técnico y Power Lab de ETAP para apoyar a estudiantes de las carreras de Ingeniería Eléctrica de diferentes universidades como la UCA y el ITCA que ya cuentan con este tipo de laboratorios. La donación de “ETAP Power Lab®” es un entrenamiento especializado en ingeniería; justamente, con el apoyo de ETAP haremos una donación de 25 licencias de software ETAP que servirán para establecer un laboratorio de esta importante especialidad.

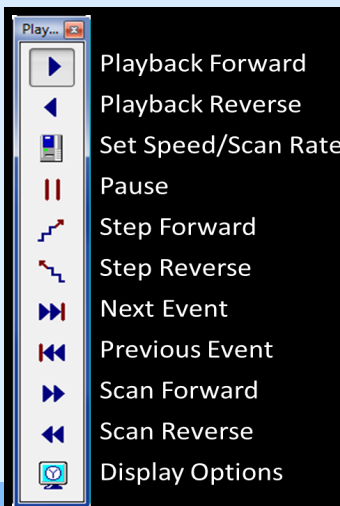


ETAP® Latinoamérica, promueve la donación de software para análisis de sistemas eléctricos



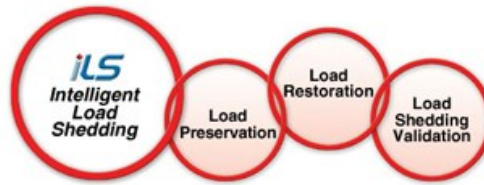
Una característica clave del Sistema ILS es su capacidad de actualizarse y reconfigurar la lógica del rechazo de carga sin realizar la reprogramación de los PLC's. El cambio de prioridades de las cargas, añadir, remover cargas del sistema y optimizar la lógica son algunos ejemplos de acciones que no requieren reprogramación. También se tiene la aplicación de:

## Playback Controls



# Sistema Inteligente de Desconexión de Cargas

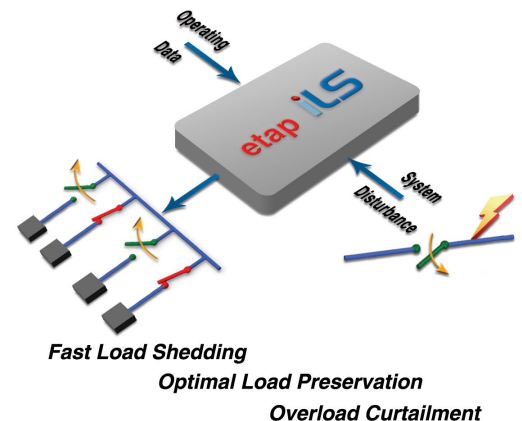
## En HOLCIM, El Salvador



Durante este período, hemos actualizado nuevamente el funcionamiento del Sistema de Desconexión Inteligente de Cargas (ILS), que opera satisfactoriamente desde el 2011 en las plantas de energía y producción de Holcim; este produce desconexiones instantáneas y selectivas de cargas ante perturbaciones externas y pérdidas de generación. El software ILS calcula la potencia mínima requerida que debe ser desconectada en cada sub-sistema según el tipo y ubicación de la perturbación, generación disponible, reserva rodante, carga, configuración, distribución de carga, y prioridades. Posteriormente, ILS selecciona la mejor combinación de cargas que satisfagan estas necesidades, ejecutando las acciones en menos de 100 mseg después de perturbaciones en la red del Sistema Nacional, eliminando paros innecesarios de su carga crítica. Contribuye a su alta velocidad la utilización de PLC's y Circuitos de Fibra Óptica.

### **Características del Sistema ILS:**

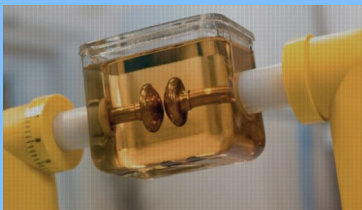
La respuesta dinámica o en estado estacionario del sistema puede ser verificada y analizada utilizando las capacidades de simulación de ETAP para Flujo de Carga y Estabilidad Transitoria. El simulador del ILS puede utilizar tanto los datos de diseño como los leídos en tiempo real del sistema. Este simulador es la herramienta perfecta para predecir la respuesta del sistema y las acciones de desconexiones de cargas en los escenarios de "¿Qué pasaría sí?" y ver que sucede al hacer modificaciones al Sistema, incluir nuevas cargas o hacer modificaciones de los enclavamientos. Luego de que la lógica del ILS es verificada y se establecen los niveles de acceso adecuados, el operador del sistema puede actualizar el servidor de una manera muy fácil sin sacar el sistema de línea y sin interrumpir la operación del servidor. **Este tipo de**



**Sistemas se puede implementar en Plantas Industriales, Generadoras, de Distribución Eléctrica ya que también se puede incluir el modulo de despacho económico.**

# HANES Brands Inc

Hanesbrands Inc. es una compañía de ropa estadounidense con sede en Winston-Salem, Carolina del Norte. Emplea a 65.300 personas a nivel internacional. El 6 de septiembre de 2005, la compañía fue escindida por la Corporación Sara Lee.



## • **Análisis de DGA, HUMEDAD, RIGIDEZ en aceite de transformadores en HBI BONAVENTURE**

**" SETISA emite un certificado por dos Ing. Electricistas Registrados y un Químico autorizado por el OSA"**

Se realizó el Análisis de Gases Disueltos, mediante cromatografía, Determinaciones de Humedad y Rigidez en los transformadores principales instalados en las diferentes plantas mencionadas. SETISA realizó la extracción de aceite al vacío a los transformadores y efectuó el análisis cromatográfico e interpretación de los datos obtenidos mediante un informe completo de las pruebas realizadas. Algunos de estos análisis se describen a continuación:

Análisis de Gases Disueltos	ASTM D-3612
Índice de Acidez	ASTM D-974
Examen Visual y Color	ASTM D-1500 ó 1524
Rigidez Dieléctrica	ASTM D-877
Humedad	ASTM D-1533B

### Normas para análisis de transformadores

#### Acidez

Esta prueba da un indicativo del deterioro del aceite y del papel aislante a causa de la oxidación interna del transformador conforme este va envejeciendo.

#### Color y visualización del Aceite

El aceite de transformador tiende a oscurecerse debido a la oxidación y/o presencia de contaminantes. Un aceite nuevo se caracteriza por ser prácticamente incoloro. A medida que el transformador se va envejeciendo, el aceite se va deteriorando y tornándose oscuro. Para la evaluación objetiva de este parámetro, en los aceites minerales se ha elaborado

una escala de colores que va de 0.5 a 8.0.

#### Rigidez Dieléctrica

Esta prueba determina las propiedades aislantes del aceite, las cuales se pueden ver disminuidas por la presencia de humedad y también por la presencia de gases dentro del transformador.





Tecnología de Avanzada en Fibrocemento

Plycem es una empresa líder en la industria de la construcción, que cuenta con una amplia trayectoria de 48 años desarrollando y comercializando soluciones completas e integrales en fibrocemento y productos complementarios que satisfacen las necesidades de cualquier segmento del mercado.



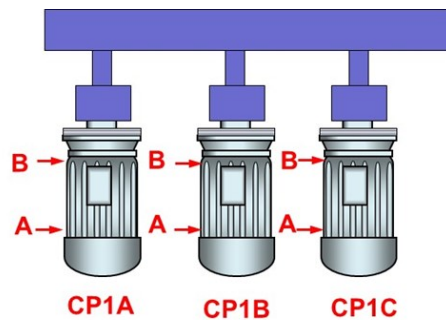
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## SUBDIVISIÓN ENERGÍA, ÁREA MECÁNICA

### Plan de Mantenimiento Preventivo de Análisis de Vibraciones y Balanceo Dinámico en PLYCEM, HBI BONAVENTURE

Utilizando Analizadores de Vibraciones ERBESSD, empresa a la que SETISA representa, se realizó Análisis de Vibraciones y Balanceos Dinámicos en los equipos la planta Plycem y HBI Bonaventure, el análisis consiste en la recolección de datos, procesamiento e interpretación que permite generar conclusiones y recomendaciones, como parte de un Plan de Mantenimiento Predictivo (PMP) que

#### Análisis de Vibraciones

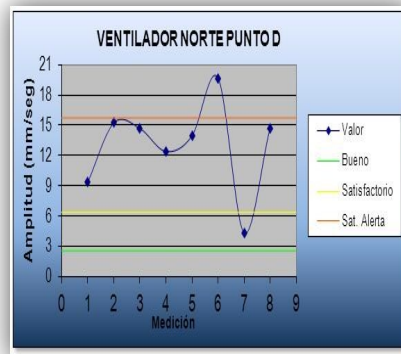


Por medio del monitoreo se determinaron los elementos que necesitan correcciones para anticipar paros en el proceso.



Dentro de un Plan de Mantenimiento Predictivo (PMP), anual, se realizan balanceos dinámicos en los equipos principales de las plantas que así lo requieran.

De igual manera se prepararon los gráficos de tendencia con los niveles registrados. De esta manera se lleva un registro para anticipar problemas y programar mantenimientos.



Curva de comportamiento

**Phantom** es un sistema de monitoreo continuo de vibraciones y de otros parámetros como temperatura, RPM, corriente y velocidad. Los sensores cuentan con una batería de duración de 3 a 6 años y son de muy fácil instalación.

El sistema de monitoreo de vibraciones envía los datos a su base local o a nuestro sistema basado en la nube EIAntalytic en el cual se podrá dar seguimiento a los equipos desde cualquier dispositivo.



El sistema de monitoreo continuo ayuda a predecir las fallas de las maquinaria y reducir costos de paros no programados en la producción.

Las fallas que se pueden identificar con el sistema de monitoreo continuo son:

- Falla de rodamientos nivel I, II, III y IV
- Desbalanceo
- Desgaste de flecha y cojinetes
- Holgura mecánica
- Desalineamiento
- Ruido eléctrico
- Resonancia





## **Análisis de Emisiones de Gases con nuevo equipo en: PLYCEM , HOLCIM, IMERLET, HBI BIOMASA, CORPORACIÓN BONIMA , SWEET´S , TEXTUFIL , PRODEPT y CATECO**

SETISA realizó Análisis de Emisiones de Gases de Combustión en las siguientes empresas: PLYCEM, HOLCIM, IMERLET, HBI BIOMASA, CORPORACIÓN BONIMA, SWEET´S, TEXTUFIL, PRODEPT y CATECO utilizando un nuevo Analizador de Gases modelo E6000 de la marca E-Instruments, la cual representamos. El nuevo instrumento mide los parámetros de combustión de los siguientes gases: *Oxígeno (O<sub>2</sub>), Monóxido de Carbono (CO), Óxidos de Nitrógeno (NO<sub>x</sub>), Dióxido de Azufre (SO<sub>2</sub>), Temperatura del flujo de los Gases, Temperatura de Aire de Alimentación, Opacidad u Hollín (Soot)*. Además el servicio incluyó el cálculo de Dióxido de Carbono (CO<sub>2</sub>),



*El E6000 es un NUEVO analizador de gases de combustión y gases de combustión industrial que cuenta con seis sensores de gas. El E6000 es un innovador monitor de emisiones portátil para mediciones precisas de gases de chimenea de procesos de combustión que incluyen calderas, quemadores, motores de gas y diesel, turbinas, hornos, hornos, calentadores y análisis de laboratorio.*



*Fundada en 1979 como una empresa de ropa íntima para el mercado centroamericano. Nuestras raíces y nuestros corazones siempre han estado cerca de los segmentos de prendas de vestir y textiles. A lo largo de los años, merlet se ha convertido en una compañía de fabricación global integrada verticalmente que suministra ropa a las principales marcas y minoristas en los Estados Unidos y el mundo.*



*TEXTUFIL se fundó en 1972 para vender productos en el mercado local, así como en América Central. En el año 1990, se iniciaron procesos de expansión tecnológica para vender en el mercado estadounidense. Hoy en día, exporta el 95% de producción a ese mercado*

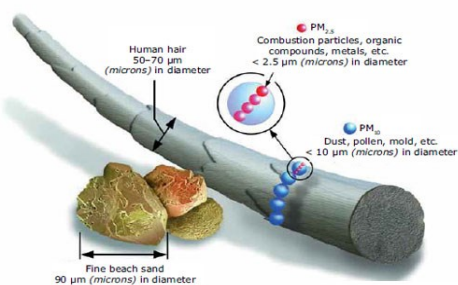
## **Análisis de Partículas PM<sub>2.5</sub> y PM<sub>10</sub> en Plantas HBI BIOMASA-SOCK -SEW, INE, INTRADESA, TEXTUFIL, APPLE TREE, TEXTILES LA PAZ , AVX , PRODMIN, MIDES, PRODEPT y CATECO**



SETISA realizó análisis de Material Particulado para determinar la concentración de dichas partículas, y de ser necesario establecer controles que ayuden a mejorar las condiciones de trabajo y a la vez a proteger la salud de los trabajadores. También se realizaron mediciones de Gases de Combustión en cuatro calderas y cuatro Scrubber para medir los parámetros de combustión. Los gases analizados fueron: *Oxígeno (O<sub>2</sub>)*, *Monóxido de Carbono (CO)*, *Óxidos de Nitrógeno (NO<sub>x</sub>)*, *Dióxido de Azufre (SO<sub>2</sub>)*, *Temperatura del flujo de los Gases*, *Temperatura de Aire de Alimentación*, *Opacidad u Hollín (Soot)*, y además el servicio incluyó el cálculo de *Dióxido de Carbono (CO<sub>2</sub>)*, *Eficiencia de Combustión* en los equipos y *Exceso de Aire*.

Fundado en 1982, con raíces profundas en la industria textil desde 1921, INTRADESA ha crecido en una empresa vertical manufactura que provee ropa casual de calidad y ropa interior a los detallistas más grandes en Estados Unidos, México y Canadá. En INTRADESA, acreditamos nuestro crecimiento y éxito a nuestros fuertes valores y principios de negocios sólidos. Con calidad como prioridad, nosotros estamos comprometidos a desarrollar soluciones innovadoras y eficientes para las necesidades de nuestros clientes. Mientras nos movemos hacia adelante, la integridad de nuestro trabajo continua para cultivar relaciones solidas y de confianza con nuestros clientes.

Figure 2.1 Illustration of PM<sub>2.5</sub> and PM<sub>10</sub> particle size



Las partículas finas tienen un diámetro menor a 2,5 micrómetros y se denominan PM2.5.

Las partículas más grandes son visibles como humo y caen relativamente pronto, mientras que las partículas más pequeñas pueden permanecer suspendidas en el aire largos períodos de tiempo y son las más dañinas para la salud porque pueden penetrar profundamente en los pulmones.

El Analizador utilizado para el Análisis de Partículas Totales Suspensas utiliza como Referencia el Método de Filtro (RFM) en cumplimiento con la Agencia de Protección Ambiental de los Estados Unidos (US EPA); y con el documento "Ambient Air Monitoring" publicado por la Agencia de Protección Ambiental, Código de Registro Federal (CFR) 40 Partes 53 y 58.



## Análisis de Compuestos Volátiles Orgánicos (CVO's) en SUNCHEMICAL

SETISA realizó Análisis de Emisiones de Gases de Combustión en SUNCHEMICAL, se determinó las concentraciones de Compuestos Volátiles Orgánicos en las Plantas. El análisis se llevó a cabo por medio de una bomba manual de detección puntual de gases Dräger accuro 2000, la cual conduce la muestra de aire a través del tubo colorimétrico, permitiendo realizar mediciones en lugares de difícil acceso, además de controlar que el volumen de aire que pasa a través del tubo sea el correcto; proporcionando así mediciones fiables, rápidas para diferentes compuestos orgánicos volátiles.

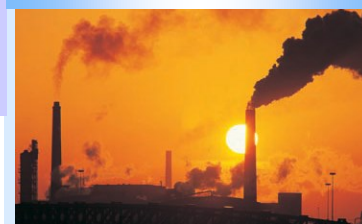


# SunChemical®

a member of the DIC group



Color & Comfort



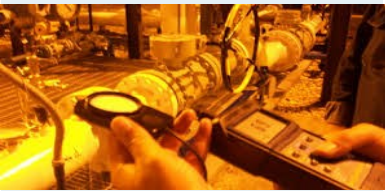
*Los compuestos orgánicos volátiles (CVO's) se emiten como gases de ciertos sólidos o líquidos. Los CVO's incluyen una variedad de productos químicos, algunos de los cuales pueden tener, a corto y largo plazo, efectos adversos para la salud. Las concentraciones de muchos compuestos orgánicos volátiles en interiores son consistentemente más altas (hasta diez veces mayor) que en el exterior.*

*Los CVO's son liberados por la combustión de productos como gasolina, diesel, madera, carbón o gas natural. También son liberados por disolventes, pinturas y otros productos*





*La fatiga visual se ocasiona si los lugares de trabajo y las vías de circulación no disponen de suficiente iluminación, ya sea natural o artificial, adecuada y suficiente durante la noche y cuando no sea suficiente la luz natural.*



Advanced Technology in Fiber Cement

*Plycem pertenece al consorcio mexicano Elementia, sólido grupo que cotiza en la BMV (Bolsa Mexicana de Valores) y que reúne a las compañías más importantes del sector construcción. Elementia cuenta con más de 30 plantas de producción en toda la región, las cuales fabrican productos de fibrocemento, cemento, polietileno, estireno, cobre y aluminio.*

## **Análisis de Iluminación, Ruido Ocupacional y Estrés Térmico en plantas de PLYCEM, INTRADESA y SHERWIN WILLIAMS.**

El análisis se realiza en áreas y tareas visuales de los puestos de trabajo. Se recabó y se registró información de las condiciones de iluminación. El equipo medidor se colocó sobre el plano de trabajo, aproximadamente a 0.85 mt con respecto al nivel de suelo. Posteriormente se tomaron diferentes lecturas y mediante el software HD450 se obtuvo el nivel promedio de luxes (lx). Luxómetro Digital Data Logger Marca EXTECH, modelo HD450. Este instrumento de medición permite medir simple y rápidamente la iluminancia real y no subjetiva de un ambiente. La unidad de medida es Lux (lx). Contiene una célula fotoeléctrica que capta la luz y la convierte en impulsos eléctricos, los cuales son interpretados y representados en una pantalla con la correspondiente escala de luxes.

Para la comparación de los resultados, utilizamos lo establecido en la **NORMA Oficial Mexicana NOM-025-STPS-2008, “Condiciones de Iluminación en los Centros de Trabajo”**, debido a que en nuestra legislación, el **“Reglamento General de Prevención de Riesgos en los Lugares de Trabajo”** así lo establece.

Alrededor del mundo, millones de personas están expuestas a niveles de ruido que conducen a la pérdida inducida de la audición, un efecto que reduce significativa su calidad de vida.

La mayoría de los países han implementado programas para la preservación de la audición los que generalmente están regulados por legislaciones y estándares locales, nacionales según regulaciones establecidas en El Reglamento del MINTRAB.



## Ruido Ambiental efectuado en CORPORACIÓN BONIMA, INTRADESA, HBI BIOMASA, SHERWIN WILLIMS, POLYBAG y CATECO

Se denomina Ruido Ambiental al exceso de sonido que altera las condiciones normales del ambiente en una determinada zona. Si bien el ruido no se acumula, traslada o mantiene en el tiempo como las otras contaminaciones, también puede afectar la calidad de vida de las personas si no se controla adecuadamente.

*Es necesario, además de realizar mediciones de la concentración de los contaminantes antes mencionados, evaluar su comportamiento en el espacio y el tiempo, asociándolo con los fenómenos meteorológicos, antropogénicos, composición química y origen, los cuales permitan orientar estrategias de control.* El estudio se realizó en noviembre en los perímetros internos de la Planta. con el objetivo de caracterizar adecuadamente el ambiente acústico en las colindancias de la Planta (Denominada Fuente Fija), a modo de verificar el



cumplimiento de la actual normativa contenida en la Norma **NSO 13.11.02:01 “Emisiones Atmosféricas, Fuentes Fijas”**, que exigen en exteriores de plantas industriales niveles máximos.

Equipos utilizados: Sonómetro digital Marca Extech modelo HD600. Los datos obtenidos se comparan con las siguientes normas nacionales vigentes y el Reglamento General sobre Seguridad e Higiene Ocupacional en los Centros de Trabajo según el Ministerio de Trabajo.

Medio receptor de ruido	Máximo permitido (horariamente en dB(A))
	<i>Diurno 07:00 – 22:00</i>
Residencial, Institucional, Educacional	55
Industrial, Comercial	75

*Los niveles de Ruido no deberán superar los valores de 115 dB(A) durante un periodo de 15 minutos y un valor de 140 dB(A) durante un lapso no mayor a un segundo.*



*Fundado en 1982, con raíces profundas en la industria textil desde 1921, INTRADESA ha crecido en una empresa vertical manufactura que provee ropa casual de calidad y ropa interior a los detallistas más grandes en Estados Unidos, México y Canadá. En INTRADESA, acreditamos nuestro crecimiento y éxito a nuestros fuertes valores y principios de negocios sólidos. Con calidad como prioridad, nosotros estamos comprometidos a desarrollar soluciones innovadoras y eficientes para las necesidades de nuestros clientes.*



## Servicios del Área de Energía

### Período Mayo – Agosto 2019

• <b>HOLCIM EL SALVADOR</b>	Mantenimiento y Soporte de Sistemas ILS
• <b>PLYCEM</b>	Análisis de Vibraciones y Balanceo Dinámico
• <b>HBI BONAVENTURE</b>	Análisis de Vibraciones y DGA
• <b>COCA COLA</b>	Mediciones de Red de Tierra
• <b>OPP FILM</b>	Análisis Análisis Físico Químico en Transformadores y Venta de equipo DigivibeMX M30.

## Servicios Ambientales y Seguridad e Higiene Ocupacional

### Período Mayo– Agosto 2019

• <b>PLYCEM</b>	Análisis de: Ruido Ocupacional - Iluminación - Estrés térmico - Ruido Ambiental - Material Particulado PM 2.5 y PM 10 - Dosimetría de Ruido– Gases de Emisión
• <b>HOLCIM</b>	Análisis de: Ruido Fuentes Móviles –Opacidad Fuentes Móviles
• <b>CORPORACIÓN BONIMA</b>	Análisis de: Gases de emisión - Ruido Ambiental
• <b>INE</b>	Análisis de Material Particulado PM2.5 y PM10
• <b>IMERLET</b>	Análisis de Gases de emisión
• <b>APPLE TREE</b>	Material Particulado PM 2.5 y PM 10
• <b>GRUPO MONTERREY</b>	Modelaje de Dispersión

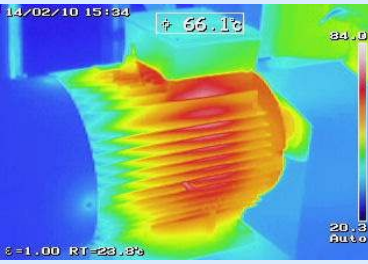
## **Servicios Ambientales y Seguridad e Higiene Ocupacional en este período**

• <b>HANES BRANDS SOCK</b>	Análisis de Material Particulado PM2.5, PM10 y PTS
• <b>HANES BRANDS SEW</b>	Análisis de Material Particulado PM2.5, PM10 y PTS
• <b>HANES BRANDS BIOMASA</b>	Análisis de: NO2- Material Particulado - Ruido Ambiental - Gases de Emisión - Modelaje de Dispersión
• <b>INTRADESA</b>	Análisis de: Ruido Ocupacional - Iluminación - Estrés térmico - Ruido Ambiental - Material Particulado PM 2.5 y PM 10 - Mapa de Ruido.
• <b>SHERWIN WILLIAMS</b>	Análisis de: Ruido Ocupacional - Iluminación - Material Particulado – Ruido Ambiental - Estrés Termico.
• <b>TEXTUFIL</b>	Análisis de Gases de emisión
• <b>SWEET SEI</b>	Análisis de: Gases de emisión
• <b>TEXTILES LA PAZ</b>	Análisis de Material Particulado PM 2.5 y PM 10
• <b>POLYBAG</b>	Análisis de: Ruido Ocupacional - Ruido Ambiental - Iluminación
• <b>SUNCHEMICAL</b>	Análisis de COV,s
• <b>PRODMIN</b>	Análisis de Material Particulado PM 2.5 y PM 10
• <b>AVX</b>	Análisis de Material Particulado PM 2.5 y PM 10
• <b>Beneficios de Arroz Los Ángeles</b>	Análisis de Material Particulado PM 2.5 y PM 10
• <b>LA FABRIL</b>	Análisis de Iluminación
• <b>MIDES</b>	Análisis de Material Particulado PM 2.5 y PM 10
• <b>PRODEPT</b>	Análisis de Gases de Emisión
• <b>CATECO</b>	Análisis de: Material Particulado PM 2.5 y PM 10 - Gases de Emisión –Ruido Ambiental
• <b>R&amp;M</b>	Análisis de Gases de Emisión

# Keysight Technologies Cámara Termográfica



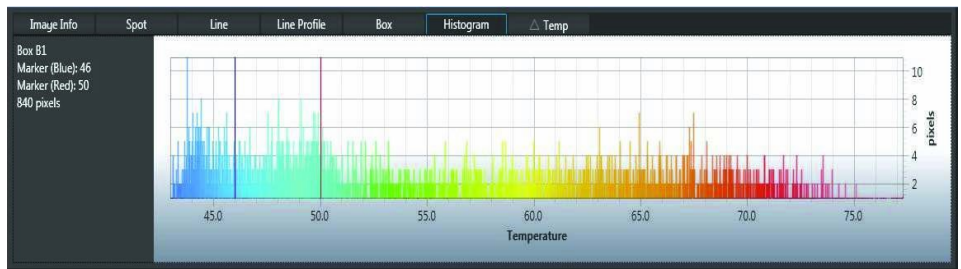
Mantenimiento Predictivo en Sistemas Eléctricos y Mecánicos.



**SETISA es distribuidor exclusivo de KEYSIGHT Technologies para El Salvador, Guatemala, Costa Rica y Honduras.**

Este equipo puede utilizarse efectivamente en Programas de Mantenimiento Predictivo ya que recoge imágenes termográficas de puntos calientes en motores, bombas, tableros, interruptores y otros puntos de interés para anticipar y corregir problemas potenciales.

También es de mucha utilidad para identificar puntos anormalmente calientes en tarjetas electrónicas.





# KeySight Technologies. Medidores Portátiles



Unlocking Measurement Insights for 75 Years



*Diseño y troubleshooting más rápido con instrumentos robustos y funcionales y aplicaciones de software enfocadas en la industria que eliminan la complejidad de investigación y tareas repetitivas.*



*Conocimiento más profundo de nuevas formas de prueba y nuevas oportunidades para optimizar el desempeño; todas basadas en la ciencia de la medición líder en el*



*Confianza y tranquilidad en sus resultados de medición gracias a las interfaces de usuario cuidadosamente diseñadas y una clara presentación de resultados y especificaciones que reflejan condiciones reales.*



Desde principios de 1996 SETISA representó en las áreas de Electrónica y Química Analítica a Hewlett Packard, empresa emblemática de Silicon Valley fundada hace 75 años. En 1999 la marca Hewlett Packard fue asignada a la fabricación y venta de PC's y servidores, asignándose la marca Agilent Technologies a productos de Electrónica y Química Analítica.

A partir del 1° de Agosto próximo la marca Keysight Technologies será asignada exclusivamente a productos y servicios en las áreas de Electrónica, Telecomunicaciones y Energía. Dentro de la línea Orange que ya está en circulación para el área de energía, próximamente contaremos con medidores de aislamiento y Termografía. Presentamos a continuación varios productos de la Línea Orange:

## *DMMs Portátiles*

- \* Display OLED de alto contraste con un ángulo de visualización de 160° (U1273A y U1253B)
- \* Modo de baja impedancia, filtro pasa bajos y Smart Ohm para lecturas más precisas (Serie U1270)
- \* Encuentre los detalles que importan con hasta 50,000 conteos y precisión DCV básica de 0.025%, mediciones AC precisas RMS verdadero (Serie U1250)
- \* Profundice con rangos de  $\mu\text{A}$  bajos y  $\text{M}\Omega$  altos, mediciones de índice de armónicos en fuentes AC y mediciones de temperatura dual/diferencial (Serie U1240)
- \* Trabaje más rápido y más seguro con la linterna LED, la función de detección de voltaje sin contacto  $V_{\text{sense}}$ ; pantalla con luz de fondo para alerta visual en áreas ruidosas y más (Serie U1230).
- \* Protección contra sobre voltaje CAT III 1000 V y CAT IV 600 V (Serie U1240, U1250 y U1270)

## *Medidores de Gancho Portátiles*

Incluye funcionalidades de DMM—resistencia, capacitancia, frecuencia y temperatura.

- \* Mide corrientes tan bajas como 0.01A (Serie U1210)
- \* Gancho de 2" con alta capacidad de medición de hasta 1000 A para AC, DC o AC+DC (Serie U1210)
- \* Luz LED, separador de cables y un gancho para separar y sujetar el cable correcto (Serie U1190)
- \* Alerta *Flash* para continuidad y condiciones de riesgo (Serie U1190).
- \* Función  $V_{\text{sense}}$ —detección de voltaje sin contacto (Serie U1190)



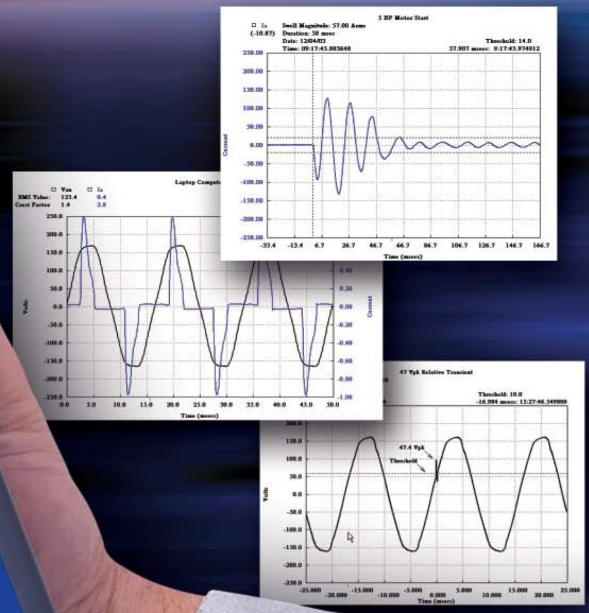


**SETISA cuenta con la representación de estos equipos especializados para análisis de “Calidad de Energía”**

# PowerSight®

**PS4500**  
Power Quality Analyzer

*Smallest, Safest,  
Easiest to Use*



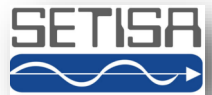
SD Card Capable to 2GB  
Backup of valuable data.



*Everything you need for comprehensive single and three-phase power analysis in one instrument. Power Quality, Energy and Harmonics!*

AC and DC measurements | 400Hz and VSD-capable | PC Report Writer Software

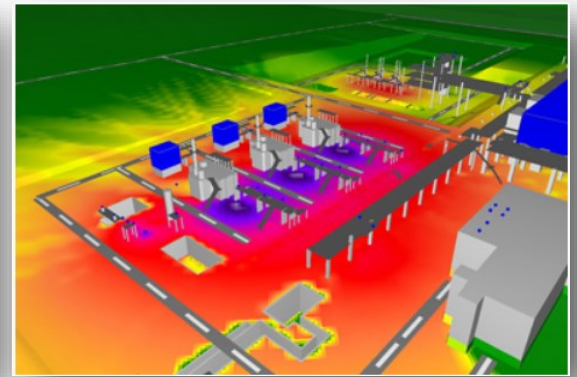
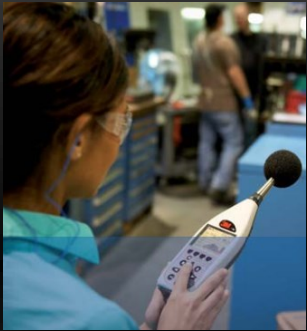
# Mapas de Ruido Ocupacional



SETISA es pionera en elaboración de Mapas de Ruido en industrias y plantas de energía. Las ventajas de contar con un mapa de ruido son:

- Identificar sitios de riesgo de exposición a niveles de ruido que puedan alterar la salud del personal.
- Se identifican niveles de ruido de equipos de producción, a fin de tomar medidas de reducción de vibraciones mecánicas, a través de mantenimientos programados o balanceos dinámicos.
- Identificar equipos con mayor emisión de energía acústica para la instalación de pantallas de aislamiento.

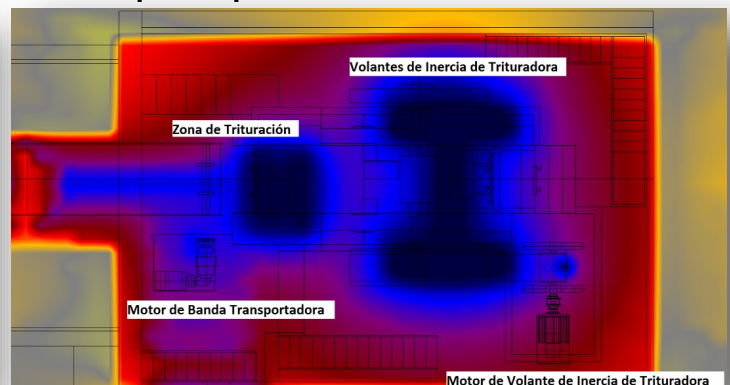
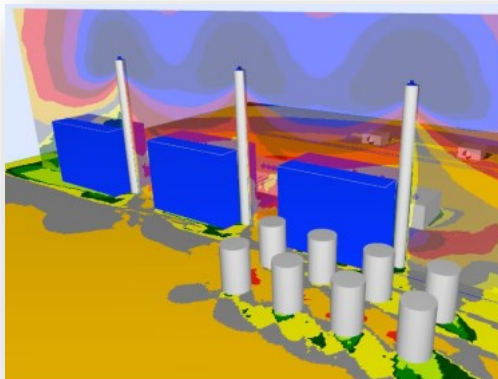
Mediante un mapa de ruido se identifican los niveles de presión sonora de las diversas áreas de una industria o planta de generación con el fin de tomar medidas de prevención tanto para el personal como para equipos de producción.



**Cadna A**<sup>®</sup>  
State-of-the-art  
noise prediction software

**CadnaA** es el software líder a nivel mundial de modelización, cálculo y gestión del ruido ambiental mediante la elaboración de mapas de niveles de presión sonora en 2D y 3D. El programa es aplicable para varios tipos de emisión sonora como tráfico terrestre y aéreo, así como ruido industrial.

Para aplicaciones industriales y de energía se identifican los niveles de ruido a los que está operando cada equipo mediante un muestreo en campo, con las especificaciones de los equipos se ingresan dichos niveles a la base de datos del software para completar el mapa respectivo.



SETISA tiene Registro Legal como Empresa Prestadora de Servicios Ambientales por el MARN además de poseer una Certificación como Empresa Asesora en Seguridad e Higiene Ocupacional por el MINTRAB y Certificación de Acreditación de Ensayos de Laboratorio por la OSA



Código de Registro:

RPJSEA-003

**MINISTERIO DE TRABAJO Y PREVISIÓN SOCIAL**  
EL SALVADOR  
UNAMONOS PARA CRECER

Numero de Registro:

EASHO-001-16



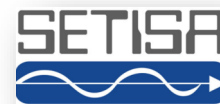
Numero de Acreditación:

LEA-04:16

*Entre nuestros clientes tenemos:*

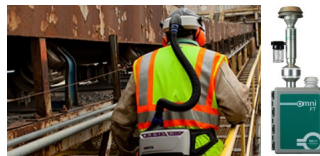
HOLCIM EL SALVADOR, SHERWIN WILLIAMS, INTRADESA S.A. DE C.V., CORPORACIÓN BONIMA, LABORATORIOS LÓPEZ, INDUSTRIAS LA CONSTANCIA, EL DIARIO DE HOY, AVX EL SALVADOR, YKK, OPPFILM, APPLE TREE, PLYCEM, HARISA, HANES BRANDS EL SALVADOR SEW, TEXTILES LA PAZ, MIDES, ALDECA, R&M S.A DE C.V, PRODEPT, BAYER, REASA S.A. DE C.V., POLYBAG S.A. DE C.,V., HANES BRANDS SOCK, SUNCHEMICAL, TEXTUFIL, entre otros.

## Servicios de Mediciones, Análisis de Seguridad e Higiene Ocupacional (SHO)



SETISA es pionera en realizar servicios de consultorías de Seguridad e Higiene Ocupacional (SHO) además de Ambientales para la Industria Salvadoreña. A continuación los servicios de mediciones que ofrecemos:

- **Análisis de material Particulado PM<sub>10</sub>, PM<sub>5</sub>, PM<sub>2.5</sub> y PTS Ocupacional**



- **Medición de Compuestos Orgánicos Volátiles (CVO'S)**



- **Estudios de Iluminación y Estrés Térmico**



- **Análisis de Ruido en Fuentes Móviles, Ruido Ocupacional y Ambiental, Dosimetrías de Ruido y Mapas de Ruido Ocupacional**



SETISA tiene Registro Legal como Empresa Prestadora de Servicios Ambientales por el MARN además de poseer una Certificación como Empresa Asesora en Seguridad e Higiene Ocupacional por el MINTRAB y Certificación de Acreditación de Ensayos de Laboratorio por la OSA



Código de Registro:

RPJSEA-003



Numero de Registro:

EASHO-001-16



Numero de Acreditación:

LEA-04:16

**Entre nuestros clientes tenemos:**

HOLCIM EL SALVADOR,  
SHERWIN WILLIAMS,  
INTRADESA S.A. DE C.V.,  
CORPORACIÓN BONIMA,  
LABORATORIOS LÓPEZ,  
INDUSTRIAS LA CONSTANCIA,  
EL DIARIO DE HOY, AVX EL SALVADOR, YKK, OPPFILM,  
APPLE TREE, PLYCEM,  
HARISA, HANES BRANDS EL SALVADOR SEW, TEXTILES LA PAZ, MIDES, ALDECA, R&M S.A DE C.V, PRODEPT,  
BAYER, REASA S.A. DE C.V.,  
POLYBAG S.A. DE C.V.,  
HANES BRANDS SOCK,  
SUNCHEMICAL, TEXTUFIL,  
entre otros.

## Servicios de Mediciones y Análisis Ambientales

SETISA es pionera en realizar servicios de consultorías de Seguridad e Higiene Ocupacional (SHO) en las Industrias Salvadoreñas. Se presentan a continuación los servicios de mediciones y análisis ambientales que ofrecemos:

### • Análisis de material Particulado Ambiental $PM_{10}$ , $PM_5$ , $PM_{2.5}$ y PTS



### • Análisis de Gases de Combustión en Calderas (AG)



### • Análisis de Dispersión de Contaminantes Atmosféricos mediante AERMOD



### • Medición de Calidad de Aire (Inmisiones de $NO_x$ y $SO_2$ )

### • Medición de Ruido Ambiental



# NOTAS ESPECIALES

## This 3D Printing Technique Is 100 Times Faster Than Standard 3D Printers

The process involves two types of LEDs and a specially engineered chemical resin

By Mark Anderson- IEEE Spectrum Jan/31/2019

A new 3D-printing technique could render a three-dimensional object in minutes instead of hours—at up to 100 times current speeds. The experimental approach uses a vat of resin and some clever tricks with UV and blue LED lights (no lasers needed) to accelerate the printing process.

The technique looks almost like a time-reverse film loop of an object dissolving in a reservoir of acid. But instead of acid, this reservoir contains a specially-designed resin that hardens when exposed to a particular shade of blue light. Crucially, that hardening (the technical term is *polymerization*) does not take place in the presence of a certain wavelength of UV light.

The resin is also particularly absorbent at the wavelengths of both the blue and UV light. So the intensity of UV or blue light going in translates directly to the depth to which light will penetrate into the resin bath. The brighter the light beam, the further it penetrates and the further its effects (whether inhibiting polymerization in the case of UV light, or causing it in the case of blue light) will be felt in the bath along that particular light path.

Timothy Scott, associate professor of chemical engineering at the University of Michigan, says the way to get a 3D-printed object out of this process is to send UV light through a glass-bottomed basin of resin. Then, at the same time, through that same glass window, send patterns of bright and dim blue light.

If this printing process used only the blue light, it would immediately harden the first bit of resin it encounters in the basin—the stuff just inside the glass. And so each successive layer of the object to be printed would need to be scraped or pulled off the window's surface—a time-consuming and potentially destructive process.

"We use the [UV] wavelength to prevent the resin from polymerizing against the projection window," Scott says. "But we can change the intensity of the inhibiting wavelength, that in turn can thicken up...the region that doesn't polymerize. We can go to hundreds of microns comfortably, approaching or even exceeding a millimeter, so that's getting quite thick. We can do that across not only the entire region of our bath, but we can do it selectively. By, again, patterning the intensity that we're projecting into the vat."

Which is why the UV light, perhaps the key innovation of the new research, potentially streamlines the entire light-resin 3D-printing process, also called 3D stereolithography.

To be clear, other 3D-stereolithography printing processes and even startup companies are out there in the world. What's new with the Michigan group's research (published in Science Advances earlier this month) is the UV light inhibitor that not only prevents the hardened resin from sticking to the window but also can be used in concert with the blue light to sculpt 3D surfaces and contours of hardened resin in the bath.

In a sense, Scott says, the new stereolithography process is really one of the very first truly 3D printing processes—in that it prints not just a series of single 2D layers but rather entire 3D wedges of material in one pass.

"That is straight-up unique, the ability to pattern a volume," Scott says. "Patterning in 2D is easy, patterning in 3D is nontrivial."

Another advantage of the process, which Scott says his group is now trying to patent, is the relatively low-tech (and inexpensive) equipment needed to make one of these 3D-stereolithographic printers. Both the UV and blue light can come from off-the-shelf LEDs. In fact, Scott says, the guts of a PowerPoint projector work in a pinch—for the blue light source, at least.

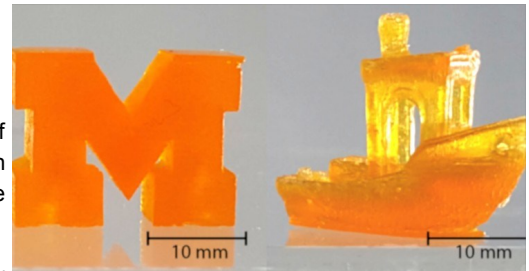
You would, of course, still need the resin—a proprietary concoction developed by Scott and his collaborators. And you'd need a tray with a glass bottom to hold the resin. Last, you would need a stage to draw the 3D-printed object out of its resin bath. The current printer at the group's Ann Arbor lab just uses a simple piece of wood for its stage.

Scott says his group has been able to produce 2 meters of 3D-printed material per hour, contrasted to a typical 3D print speed for stereolithography in the range of 25 millimeters per hour.

The process is fast in relative terms, but it's not going to supplant mass production injection molding or other high-speed conventional manufacturing technologies. However, it could show promise for one-off custom-printed objects like, for instance, dental or medical appliances that must be fit to a person's teeth or body.

The commercial partners and production processes that Scott's group is considering are under wraps for the moment. But Scott says that he'd like for some of his group's customers to have printed products in their hands by the end of this year or the beginning of next.

"Our two differentiators are the materials we can use and speed," he says. Plastic resins aren't the only materials they can work with, either. Ceramic particles can also be added to the resin such that when the resin hardens, it can be baked off in an oven to leave only the ceramic behind—molded to the same shape as the resin from which it came.



## Mayhem, the Machine That Finds Software Vulnerabilities, Then Patches Them

The machine triumphed in DARPA's Cyber Grand Challenge, where teams automated white-hat hacking

By David Brumley professor of Electrical and Computer Engineering at Carnegie Mellon University, in Pittsburgh- IEEE Spectrum February 2019

### The Future of Cybersecurity Is the Quantum Random Number Generator:

Back in 2011, when the venture capitalist Marc Andreessen said that “software is eating the world,” it was still a fresh idea. Now it's obvious that software permeates our lives. From complex electronics like medical devices and autonomous vehicles to simple objects like Internet-connected lightbulbs and thermometers, we're surrounded by software.

And that means we're all more exposed to attacks on that software than ever before.

Every year, 111 billion lines are added to the mass of software code in existence, and every line presents a potential new target. Steve Morgan, founder and editor in chief at the research firm Cybersecurity Ventures, predicts that system break-ins made through a previously unknown weakness—what the industry calls “zero-day exploits”—will average one per day in the United States by 2021, up from one per week in 2015.

It was to solve this problem that my colleagues and I at Carnegie Mellon University (CMU), in Pittsburgh, spent nearly 10 years building technology that would make software safe, automatically. Then, in 2012, we founded ForAllSecure to bring our product to the world. The one thing we needed was a way to prove that we could do what we said we could do, and we got it in the form of a prize competition.

My team is huddled in a hotel ballroom in Las Vegas, chewing our fingernails and fairly sure that we had just lost a competition we'd spent thousands of hours preparing for. It was the DARPA Cyber Grand Challenge (CGC), one of several such events—like the one for self-driving vehicles back in the early 2000s—staged by the U.S. Defense Advanced Research Projects Agency to stimulate technological breakthroughs for national security. The CGC grew out of DARPA's recognition that the United States might one day find itself without the manpower or the tools to fend off cyberthreats.



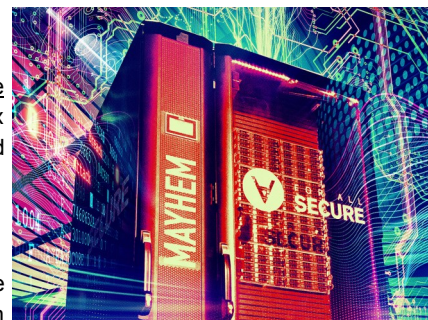
The cybersecurity battleground is populated by hackers who are technically skilled and, at the highest levels, creative in exploiting weaknesses in software to penetrate an organization's defenses. The criminals who do this for their own gain are commonly called black hats, and they often create tools that legions of amateur “script kiddies” can use to unleash havoc, like the IoT botnets that in 2016 launched a massive attack on the Internet after gaining control over minicams and video recorders in people's homes. In contrast, “white hats” use their skills to thwart such attacks. But there simply aren't

enough white-hat hackers to protect all the software proliferating in the commercial world, let alone the common infrastructure and the military platforms vital to national and global security.

In 2014, DARPA announced the Cyber Grand Challenge as a two-year project with the goal of testing whether it was possible to develop AI systems that could find, verify, and patch software weaknesses. In 2015, some 100 teams entered the prequalification stage. In 2016, the top seven advanced to the grand championship finale, where they'd need to enter a full cyber-reasoning system—one that would not merely notice a problem but could also infer its nature. The champion would win US \$2 million, and the second- and third-place finishers would get \$1 million and \$750,000, respectively.

After DARPA released details about its competition, it dawned on my colleagues and me that this was a great opportunity to demonstrate that the automated cybersecurity we'd developed was no mere theoretical game. After spinning out ForAllSecure, we'd consistently faced skepticism about how practical our solution could be. We figured that we'd better win the DARPA competition, given that we'd been working on this for a decade.

Our research at CMU had begun with a simple premise: People need a way to check the software they're buying and ensure that it's safe. Coders will, of course, make a due-diligence effort to flush out security flaws, but their main concerns are always more basic: They have to ship their product on time and ensure that it does what it's supposed to do. The problem is that hackers will find ways to make the software do things it's not supposed to do.



Today's state of the art for software security involves using special tools to review the source code and to flag potential security weaknesses. Because that process produces a lot of false positives—flagging things that in fact are not weaknesses—a human being must then go through and check every case. To improve the bug-finding rate, some companies rely on white-hat hackers to do a one-time analysis or to participate in “bug bounty” programs, which pay them according to the number and the severity of the bugs they find. But only the most profitable companies can afford the strongest testing of their software. The issue grows more complex as finished software includes ever more components from open-source projects and other third parties.

The system we entered in the competition, Mayhem, automated what white-hat hackers do. It not only pointed to possible weaknesses, it exploited them, thus proving conclusively that they were in fact weaknesses. This was also a key part of the CGC, as demonstrating a proof of vulnerability with a working exploit was part of how your machine scored points. And because Mayhem was a machine that could be scaled up across hundreds or thousands of nodes, the analysis could proceed at a speed no human could match.

**To build Mayhem**, we began with the first software-analysis system we developed at CMU, which is based on the formal analysis of a program. This method can be likened to creating a mathematical formula that represents every path a software program might take, thus producing an ever-branching tree of analysis. Such a tree can quickly get too big to manage, but we have found smart ways to collapse some of the paths, pruning the tree down to just a few branches. We are then able to explore the remaining branches more deeply.

Symbolic execution builds an equation to represent all the logic in a program—for example, “ $x + 5 = 7$ ”—and then solve the equation. Contrast this strategy with another method of software analysis known as fuzzing, in which you feed random permutations of data into a program to crash it, after which you can determine the vulnerabilities that were at fault and how they might be exploited in a more deliberate attack. Fuzzing keeps putting in random data until a particular string of data makes the equation true, finally determining that  $x = 2$ .

Both approaches have their strengths, but for many years fuzzing had the advantage because it was easier to implement and much faster at trying new inputs. Symbolic execution, meanwhile, held out a vast, untapped potential to whoever could learn to tame it. In the Mayhem system we started building in 2010, we were able to accomplish this feat by combining the two approaches.

Fuzzing is like making intelligent guesses at lightning speed about which inputs might trigger the program to engage in some new behavior, then keeping track of those inputs that actually do so. Symbolic execution is like asking a mathematician to try to formally figure out what inputs may exploit the program. We found that some bugs are best found by rapid guessing, others by the mathematical approach. So we decided to run both methods in parallel. Symbolic execution would reason about one part of the program deeply, coming up with an input to trigger that region of code. The system could then hand off that input to the fuzzing program, to rapidly hammer on that same region and shake out a vulnerability.

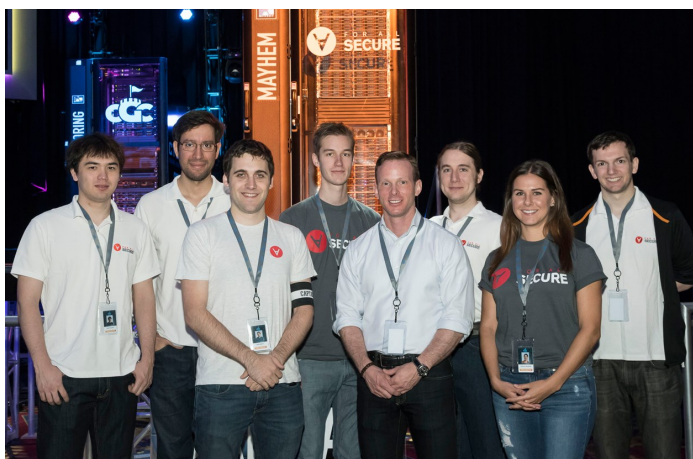
Another feature of Mayhem is that it can work directly on binary code, as opposed to human-coded text files—that is, source code. That means the system can analyze a program without the help of the person who developed it, which matters greatly for programs that incorporate third-party components for which the source code may no longer even exist. But reasoning about binary code is tough because, unlike source code, it has no functions, no local variables, and no data abstractions. Binary code has one big memory region and fixed-length bit vectors—a data structure that stores bits efficiently. You'd have to be a machine to work with such code, and indeed it required significant engineering to build a machine that could work under these constraints.

After Mayhem identifies a vulnerability, it generates a working exploit—that is, code of the sort a black-hat hacker might use to break into a program. The point is to demonstrate that the exploit can be used to obtain privileged, or root, access to the operating system. The result is that Mayhem identifies vulnerabilities with absolute certainty, rather than merely flagging possible problems, as most code-analysis tools do.

In 2014 we ran a test of the Mayhem technology on every program in the Debian distribution, a popular version of Linux that's used on desktops and servers throughout the world. Mayhem found nearly 14,000 unique vulnerabilities, and then it narrowed that list down to 250 that were new and therefore deserved the highest priority. The entire test was done in less than a week by scaling Mayhem across a large number of servers in the Amazon cloud, with practically no human intervention. We submitted the more important findings to the online Debian community. One of the reasons we've spun off our research into a company is to be able to work at this scale with developers as we analyze thousands of programs with enormous numbers of vulnerabilities.

**DARPA The Mayhem Team:** Engineers from ForAllSecure pose with their creation, Mayhem, at the closing ceremony. Author David Brumley is in the front row, third from the left.

On 3 June 2015, the 100-plus competitors entered the qualifying round and were given 131 unique purpose-built challenges, each one containing software security vulnerabilities. The seven teams with the highest security score (based on discovering vulnerabilities and patching them) made it into the Cyber Grand Challenge final event—and ForAllSecure scored more than twice as high as the next-best semifinalists. A temporary moment of joy was quickly succeeded by the realization that the pressure was really on now!





Taking the core Mayhem technology and building a fully autonomous cyber-reasoning system was a massive undertaking. We were able to do it in part because DARPA gave all seven finalists enough funding for a year of development work. Our core components included a tool set that translates executable programs into a language that's relatively easy to understand and analyze, as well as offensive tools for finding and exploiting the vulnerabilities, defensive tools for automatically patching the defective binary code, and a program to coordinate the work efficiently.

In preparing for the final round, we faced two big challenges. First, although we were happy with how well Mayhem found vulnerabilities, we didn't think the patches were efficient enough. In the competition, as in real life, you don't want to install a patch that adds more processing power than solving that one problem is worth. We therefore spent a good deal of time building automated patching for vulnerabilities that had between 0 to 5 percent overhead—in the common case.

Second, we needed a strategy for playing and winning the game. Let's say you find a vulnerability and make a patch for it. You may not want to field the patch right away if that would mean adding so much overhead that you slow the program down to a crawl. Instead, sometimes it's better to wait, and patch only when absolutely necessary. We developed an expert system to decide when to patch.

When our team walked into the Las Vegas ballroom for the final competition on 5 August 2016, we saw seven hulking racks with blinking lights sitting atop a huge stage, below which were 180 tons of water to keep each team's computers cool. Participants had set up the machines the previous night, before the competition began, and then DARPA had cut off all access to them. The machines were air-gapped—they had no connections to the outside world. All we could do was watch Mayhem toiling away, observing the power usage and system temperature stats reported by each system's rack. Mayhem was consistently working the hardest of the seven competitors—a good sign, or so we hoped.

During nearly 100 rounds of competition, new programs were given to the competing systems, each of which had mere minutes to analyze the code for vulnerabilities and quickly issue patches to protect itself. Each round was scored based on the machine's ability to find and prove vulnerabilities and on the performance of the patches.

***A Comfortable Win:*** *Mayhem managed to build up a huge margin before suffering from a crash after the 40th round. That margin went unreported during the competition, leaving the team members in the dark until the very end.*

To make the final CGC event more exciting for spectators, the competition organizers had decided to report the scores only at the very end, in a play-by-play summary. That meant we didn't really know if we were winning or losing, just that Mayhem was making submissions of vulnerabilities it had found. However, several hours into the competition, after round 40, we could tell that Mayhem had simply stopped submitting. The program had crashed.

**Our stomachs lurched** as our worst nightmare seemingly came true. We asked the organizers for a reboot, but they wouldn't allow it. With half the competition still remaining, we began to contemplate the humiliation of defeat.

The play-by-play commentary started as the final round wrapped up, with fancy visualizations illustrating how each team's machine had found and fixed security flaws in seconds, compared with the months or years a human team would have taken. The audience numbered over 5,000, and the guest commentators—an astrophysicist and star hackers—got them riled up. We braced ourselves to see our defeat announced and confirmed onscreen.

However, as we watched the scores come in with each new round, it occurred to us that Mayhem's lead was great enough to keep it in first place, even though it had stopped playing after round 40. As the final rounds were announced, the weight was lifted from our shoulders. We had won.

Mike Walker, the DARPA program director, said that the event's demonstration of autonomous cyberdefense was “just the beginning of a revolution” in software security. He compared the results to the initial flights of the Wright brothers, which didn't go very far but pointed the way to transcontinental routes.

Right now, ForAllSecure is selling the first versions of its new service to early adopters, including the U.S. government and companies in the high-tech and aerospace industries. At this stage, the service mostly indicates problems that human experts then go in and fix. For a good while to come, systems like Mayhem will work together with human security experts to make the world's software safer. In the more distant future, we believe that machine intelligence will handle the job alone.

## Power From Commercial Perovskite Solar Cells Is Coming Soon

By Jean Kumaqi - IEEE Spectrum Feb/2019

### Oxford PV's tandem silicon-perovskite solar modules aim to beat the best panels on the market

At a factory on the outskirts of Brandenburg en der Havel, Germany, bunny-suited technicians are manufacturing the future. The shiny, thin squares they're assembling into flat modules promise to outperform the best solar panels on the market.

The pilot factory is owned by Oxford PV—a spinout from the University of Oxford, in England—which since 2012 has worked on commercializing solar cells made from a type of crystal known as a perovskite. The first perovskite solar cells were announced just 10 years ago, by the research team of Tsutomu Miyasaka at Toei University, in Yokohama, Japan. But those early lab prototypes were incredibly unstable and had an efficiency of just 3.8 percent.

Since then, researchers and manufacturers have made steep gains in efficiency, and they've also addressed the devices' stability and scalability. In December, for example, Oxford PV posted its latest efficiency milestone of 28 percent. By contrast, the current record for silicon PV is 26.7 percent, and commercial silicon panels are far less efficient.

Now the company is getting ready to introduce the world's first commercial tandem silicon-perovskite solar modules, which combine a thin-film layer of perovskite material with a silicon solar device. The solar modules look and behave very much like traditional silicon solar panels, says Chris Case, Oxford PV's chief technology officer. The main difference is that they produce more power.

What makes these developments so remarkable is that just seven years ago, the perovskite solar industry didn't even exist. Now, dozens of firms are vying to bring the technology to market. And hundreds of researchers worldwide are studying new perovskite materials and processing methods and refining their understanding of how the devices work. At press time, the number of academic papers on perovskites was on track to top 5,000 for 2018, Case says (although that number also includes reports on perovskites as photodetectors, X-ray detectors, and LEDs).

And in just 10 years, perovskites have gone from fussy, low-efficiency experimental devices to commercial-grade products that meet or exceed the performance of conventional solar cells. No other solar PV technology—not OLEDs, dye-sensitized or quantum-dot solar cells—compares.

"We're at a disruption point in history," Case says. "Right now, in most places in the world, solar PV without subsidies is cheaper than any other form of electrical generation." Perovskites will ensure solar power's conquest, he says.

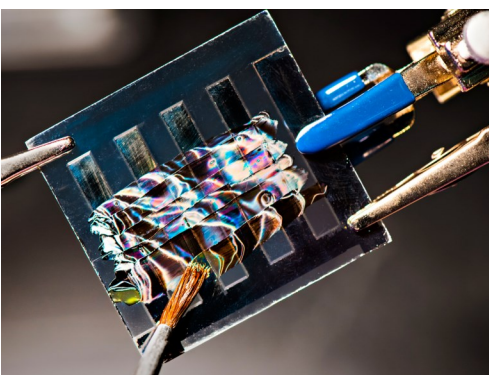
"You can't stop it. You can be the largest oil company in the world, but you can't stop this."

What makes perovskites so attractive is that the materials are much better than silicon at converting photons into electricity.

"One of my colleagues likes to say that if you were looking for the ideal material for solar, you would never pick silicon," says Joseph Berry, who leads the perovskite solar team at the National Renewable Energy Laboratory (NREL), in Golden, Colo. "The reason [silicon] has become such a dominant material has everything to do with the total R&D dollars that have been spent on silicon," for integrated circuits as well as solar.

"Silicon has to be pure and perfect to have the characteristics we covet," Berry says. "Perovskites are defect tolerant. We can handle the material poorly and still get a competitive device efficiency." Perovskites also lend themselves to a variety of low-cost production methods, including spin coating and roll-to-roll printing. NREL researchers have even developed a perovskite ink that can be painted on.

Berry predicts that constructing a gigawatt-scale factory for perovskite solar modules will eventually cost about a tenth of what it now costs to build a comparable silicon solar panel factory. The end product can be flexible and nearly transparent, so experts envision using them as window glazing and as spray-on coatings for buildings.



Perovskite originally referred to a mineral containing calcium, titanium, and oxygen, first discovered in 1839. The word has since come to encompass a large class of compounds that have the same crystal structure as the mineral. Their chemical composition is described by the shorthand  $AMX_3$ , where A is typically an organic molecule, M is a metal (such as lead or tin), and X is a halogen (such as iodine or chlorine). Miyasaka's group, at Toei University, used the compound methyl ammonium lead triiodide for its first perovskite cell. But there are hundreds of thousands of compounds that can form that crystal structure, according to Oxford PV's Case.

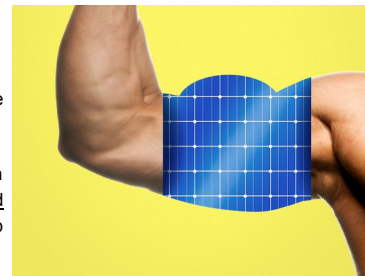
Regardless of the chemistry, any perovskite solar cell has to meet three basic criteria for commercialization: stability, efficiency, and scalability. Case says his company has addressed all three by combining thin films of silicon and a perovskite into one "tandem" cell that can be produced using the same manufacturing methods used for today's solar panels.

Back in 2012, when the company began working on perovskites, Oxford PV targeted pure-perovskite products that could be coated on glass and used as windows and other components of buildings. "That's still a great idea, but we realized that the path to commercialization could be 5 to 10 years," Case says. "We're focused on delivering on a shorter horizon."

When sunlight enters Oxford PV's tandem cell, photons pass through a transparent electrode layer and then hit the perovskite layer, which absorbs at shorter wavelengths than silicon does, toward the blue end of the spectrum. The photons that aren't absorbed then pass through a thin junction layer and encounter the silicon layer, which absorbs at somewhat longer wavelengths. The net result is that more of the available light is absorbed by the cell.

"To make a tandem cell that's 26 or even 30 percent efficient, you only need a perovskite layer that's in the range of 15 to 17 percent, plus a normal silicon layer that's 20 percent efficient," Case explains.

Oxford PV is far from alone in pursuing tandem perovskites. Other players include Toshiba and Panasonic in Japan and the Stanford spin-off Tandem PV. Meanwhile, a number of companies continue to bet on pure-perovskite solar cells: Poland's Saule Technologies, China's Wonder Solar and Microquanta Semiconductor, and the U.S. startup Energy Materials Corp. (EMC).



EMC didn't set out to be a perovskite solar company. "Initially, we were based in Atlanta, developing something called optical antennas, which are a different way to convert light into electricity," says EMC cofounder and CEO Stephan DeLuca. About three years ago, he says, "we realized that the path to commercialization was going to be long." At that point, EMC switched to solar perovskites.

The startup's focus is on commercializing roll-to-roll processing for its perovskite cells. "If you want to make these things low cost to compete with silicon, you have to do it fast," DeLuca says. "Our target is to use a 1.5-meter-wide roll running at 50 meters a minute. That's the kind of speed you need to scale up."

Using vacuum deposition, as Oxford PV and other companies are doing, means "you need to cook the film for half an hour, so scaling up is more challenging," DeLuca claims. Building a perovskite solar factory based on roll-to-roll processing should be significantly cheaper than one based on traditional silicon technology, he adds.

A couple of years ago, EMC relocated to Rochester, N.Y., to take advantage of the contract manufacturing facilities offered by Eastman Kodak. At present, EMC's devices have five layers, which the roll-to-roll machine lays out in one pass.

EMC's perovskite cells are based on a device architecture developed by Jinsong Huang and his team at the University of North Carolina at Chapel Hill. "Most people in this field use what's called a NIP structure," Huang says, referring to a device in which a layer of negatively doped (or *n*-type) material sits on top, with a layer of undoped "intrinsic" material in the middle and positively doped (or *p*-type) material at the bottom. One downside to NIP structures is that they require manufacturing temperatures of about 200 °C, which adds to their cost and limits the methods that can be used to make them.

EMC's devices are PIN structures, with *p*-type material on top. "We find they work much better and can be fabricated using room-temperature processes," including roll-to-roll printing. "It's definitely the fastest approach you can think of," Huang says. "There are already so many providers to make things like polymer thin films. You don't have to reinvent every piece of equipment."

Despite the enormous gains and intense activity, though, some solar researchers remain skeptical about the potential of perovskites. In a recent interview for PV Magazine, the Australian solar pioneer Martin Green noted that "there are all kind of instabilities that must be addressed," including sensitivity to moisture, oxygen, and even light.

"It is very hard to see a silicon manufacturer adopting a product that is more efficient but doesn't have the same stability as its baseline product—because no manufacturer wants to get a bad reputation regarding stability; in fact, it could be fatal," Green was quoted as saying.

EMC's DeLuca says that not all perovskites have that flaw. "The reporting of instabilities in certain perovskite formulations and device stacks has been important to the understanding of the materials but has also resulted in a misconception that perovskites as a class of materials all act the same—that is, they are all unstable," says DeLuca. The misconception may spring in part from the fact that methyl ammonium lead triiodide, which is still widely used by academic researchers, is one of the unstable compounds. "The right choice of the perovskite material and the other layers making up the device stack yields stable devices." Case says that Oxford PV's cells have been engineered to be stable and have passed every major accelerated lifetime test used for standard PV modules. The company will field the first modules in 2019, and it's working with an as-yet-unnamed "major manufacturer of silicon solar cells and modules."

In September, the company launched a £5 million (US \$6.4 million) five-year joint research program with the University of Oxford aimed at reaching 37 percent efficiency. If the program succeeds, the result will be solar modules with nearly twice the power-converting ability of today's commodity panels. And even if Oxford PV doesn't hit that mark, another company probably will.

For his part, NREL's Berry says it's important not to rush the technology by bringing products to market that haven't been fully vetted.

"When we started, I wasn't a true believer," Berry says. "I was of the opinion that if there's a fatal flaw, let's kill it and move on. Four years in, I think there is a real opportunity for this technology to change the world. That's not an opportunity you get every day, and you certainly don't want to mess it up."

## Our Shared Future: Autonomous and Intelligent Systems to Advance Sustainable Development

By Elizabeth D. Gibbons- IEEE Spectrum May 2019

The challenges of ethical development and the deployment of autonomous and intelligent systems (A/IS) are so broad and complex that no one organization could possibly facilitate all the necessary conversations or tangible outputs. IEEE is one of several organizations around the world working in a network-of-networks effort to increase understanding of the evolving A/IS domain.

And yet, the [IEEE document “Ethically Aligned Design: A Vision for Prioritizing Human Well-being With Autonomous and Intelligent Systems, First Edition \(EAD1e\)”](#) is unique. Produced by an open, global community of the [IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems](#), EAD1e is designed for and by academics, engineers, policymakers, developers, and users to ensure that A/IS align with explicitly formulated human values around human rights, well-being and environmental sustainability. EAD1e sets forth scientific analysis and resources, high-level principles, and actionable recommendations to provide guidance for standards, certification, regulation, and legislation.

Many A/IS principles released in the past few years have been geographically focused (and understandably so, given that they are intended for citizens within a particular region), but EAD1e is global in both its process and scope. The IEEE initiative involves more than 2,000 participants from around the world, representing tremendous diversity of professional disciplines. Consequently, the document doesn’t present a framework based on Western ethics only; it looks at Shinto ethics, Ubuntu ethics, and others. The authors drew on more than 3,000 years of scientific and faith-based ethics systems, including secular philosophical traditions, to address human morality in the digital age.

Another important way that EAD1e is different is that it was fundamentally a bottom-up creation. The committees that drafted the work were—and continue to be—open to anyone to join. Moreover, they chose the topics they would address. So, for example, participants in the global and multidisciplinary committee that developed the A/IS for Sustainable Development chapter—from the business community, academics in multiple fields, robotics engineers and development practitioners—were drawn specifically to the EAD1e effort to provide ethical guidance for A/IS that benefit humanity by advancing sustainable development.

## IDENTIFYING ISSUES, FINDING PRACTICAL RECOMMENDATIONS

The document's sustainable-development chapter has as its central premise that, to be ethical, AI applications must benefit humanity:

*A/IS offer unique and impactful opportunities as well as risks both to people living in high-income countries (HIC) and in low- and middle-income countries (LMIC). The scaling and use of A/IS represent a genuine opportunity across the globe to provide individuals and communities—be they rural, semi-urban, or urban—with the means to satisfy their needs and develop their full potential, with greater autonomy and choice. A/IS will potentially disrupt economic, social, and political relationships and interactions at many levels. Those disruptions could provide an historical opportunity to reset those relationships in order to distribute power and wealth more equitably and thus promote social justice. They could also leverage quality and better standards of life and protect people's dignity, while maintaining cultural diversity and protecting the environment.*

The chapter has five sections, each providing background information and identifying issues, and each offering actionable recommendations. For example, the first section, A/IS in Service to Sustainable Development for All, identifies an issue that current A/IS roadmaps “are not aligned with or guided by their impact in the most important challenges of humanity,” as defined in the 17 United Nations Sustainable Development Goals (SDGs).

Our committee could have spent all our discussion time defining what constitutes “benefit to humanity.” Instead, we chose the U.N. goals because every country had the chance to participate in their development—via government, the private sector, youth groups, and other organizations—and answer the question, “What is the future we want?” The goals were the result of a multiyear process and multi-stakeholder dialogue, all structured around human well-being, and ultimately adopted in the U.N. General Assembly by 193 countries.

The global participatory process and the countries' almost universal adoption in 2015 made the SDGs a suitable proxy for measuring A/IS' benefit to humanity. A key consideration of the SDG agenda is that pursuit of the goals should “leave no one behind.” The committee was aware that A/IS have the power to accelerate or reduce global inequality, and it developed its recommendations to further the contribution the technology can make to improve the lives of people in LMIC, as much as those in HIC.

EAD1e's sustainable-development chapter includes several actionable recommendations such as identifying and promoting A/IS technologies that have the most relevance to the SDGs (such as big data for agriculture and medical telediagnosis and geographic information systems for emergency planning and disease monitoring); analyzing and proposing strategies for publicly providing Internet access for all (as a means of diminishing the gap in potential benefit of A/IS to humanity, particularly between urban and rural populations); researching sustainable energy to power A/IS' computational capacity, and integrating the SDGs into the core of private-sector business strategies and key performance indicators.

Among other issues receiving comprehensive treatment in the chapter are the impact of A/IS on workers and the job market, education, social relations, and culture, with recommendations to facilitate a positive impact.

## FROM PRINCIPLES TO PRACTICE

The sustainable-development chapter of EAD1e is optimistic about the potential that A/IS have to benefit humanity and advance the SDGs—and hopefully manage the risks.

The endeavor of creating the document was an optimistic one, predicated on the hope that everyone involved in producing A/IS applications will be motivated to do so in an ethical way that respects human rights and benefits humanity. The document’s human-centric, technology-for-humanity approach is intended to inspire academics, engineers, policymakers, developers, and users around the world to advance ethical implementation of A/IS from principles to practice.

One of the reasons I am optimistic is because I learned that, in working on EAD1e, so much of what the SDGs are about is already inspiring designers of many nascent technologies.

Being part of the document’s development was an amazing opportunity to interact with thoughtful professionals, each of whom, from their diverse perspectives, contributed innovative ideas in our shared effort to help shape an ethical future for A/IS and sustainable development. I’m hopeful that EAD1e will ignite further inspiration for ethical applications that advance humankind.

*Elizabeth D. Gibbons chairs the A/IS for Sustainable Development Committee for “Ethically Aligned Design: A Vision for Prioritizing Human Well-being With Autonomous and Intelligent Systems, First Edition (EAD1e),” which can be downloaded at no charge She is a senior fellow and director of the Child Protection Certificate Program at the FXB Center for Health and Human Rights, part of Harvard’s T.H. Chan School of Public Health.*