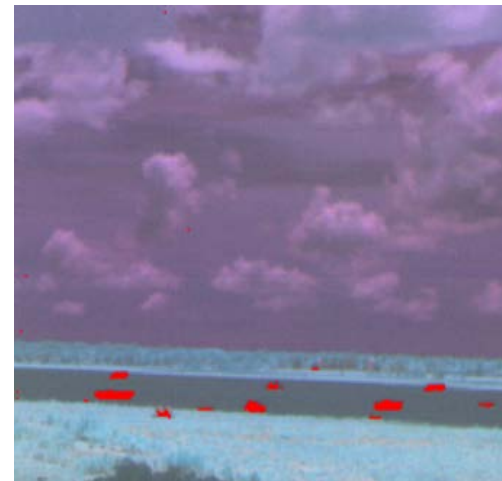
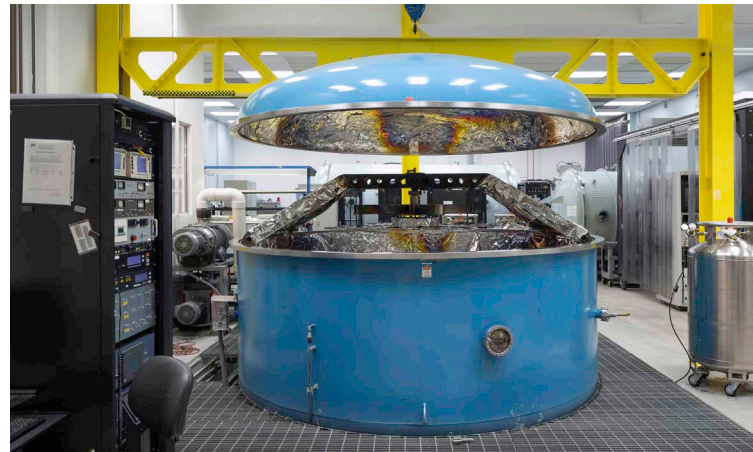
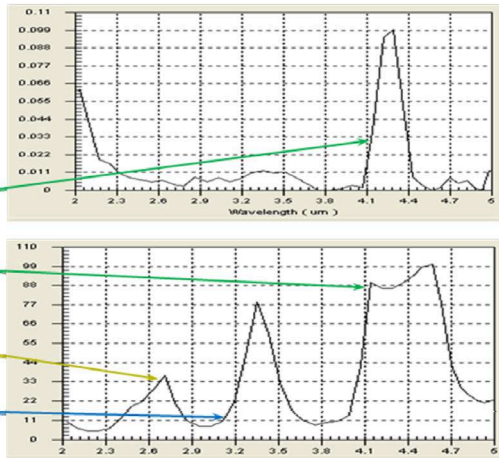
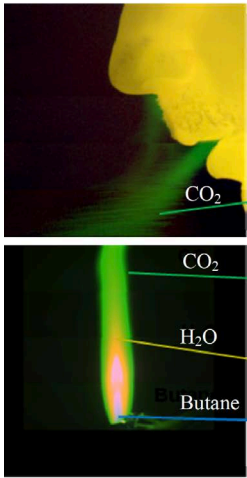




**SURFACE OPTICS**  
CORPORATION

# Company Brochure 2020



[surfaceoptics.com](http://surfaceoptics.com)

Bringing Solutions to Light



## About Surface Optics

Celebrating over 40 years as a global leader in technology for optical property characterization, Surface Optics Corporation (SOC) offers a single engineering and manufacturing source for solutions requiring analysis or control of optical properties. Founded in 1977 providing optical property measurement services, Surface Optics now specializes in advanced imaging systems and surface engineering solutions for the world's research, aerospace, defense, semiconductor, energy, and automotive companies.

To characterize optical properties is to define how light from the ultraviolet to the infrared will interact with the material in question. Understanding optical properties' effects and their relationship with a material's structural, morphological, electronic, and physical properties enables our team to create innovative products and our customers to solve challenging problems in a wide range of disciplines.

## Our Mission

To apply our expertise in optical property characterization, control and applications to design cost effective solutions for our defense, research and industrial customers.

## SOC Advantage

Surface Optics is a multi-disciplinary optical technology company with expert technical staff, state-of-the-art equipment, and a substantial manufacturing facility. With over 40 years in business and vertical integration of measurement, analysis, and design capabilities under one roof, we provide our customers with one-stop turnkey solutions and a proven ability to deliver.

## Our Customers

|                                                                                                                |                                                                                                                  |                                                                                                                   |                                                                                                              |
|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|
|  Sandia National Laboratories |  esa                            |  APPLIED MATERIALS®             |  JOHNS HOPKINS UNIVERSITY |
|  HARVARD UNIVERSITY           |  U.S. ARMY RDECOM               |  ThermoFisher SCIENTIFIC        |  leidos                   |
|  hp                           |  Los Alamos NATIONAL LABORATORY |  GE                             |  NORTHROP GRUMMAN         |
|  U.S. AIR FORCE               |  BOEING                         |  U.S. NAVAL RESEARCH LABORATORY |  NASA                     |
|  PPG                          |  3M                             |  Ball                           |  bp                      |

## Core Competencies

### VACUUM DEPOSITED COATINGS AND PIGMENTS

Development and application of coatings for thermal and signature control. Design of production of spectrally tailored pigments. One and three meter coatings chambers for large objects. Unique Roll-to-Roll, high volume coatings capability.

### OPTICAL PROPERTY MEASUREMENTS

Fully equipped optical properties measurement lab for characterization of the BRDF, HDR and emissivity of materials from 0.3 to 40 microns

### REFLECTOMETERS

Lab and handheld reflectometers that operate from 0.2  $\mu\text{m}$  to 40+  $\mu\text{m}$ . Measurements from SOC reflectometers are key to military coating developments, process control, maintenance of LO and other coatings, and ground-truth for remote sensing.

### SPECTRAL IMAGING SYSTEM DEVELOPMENT

Core expertise in Video Rate Multispectral (patented), Hyperspectral and Very High Speed Dual and Quad-Band Imaging Systems in the UV through LWIR spectral regions.





# Vacuum Coating Services

Large chambers and clean rooms, custom job environment, one-of-a kind hardware, significant space program heritage and on-site world class metrology.

Vacuum deposited coatings are manufactured using several different techniques standard in the coating industry: Resistively heated thermal evaporation, electron beam evaporation, and ion beam assisted deposition. 2,000 sq. ft. clean room (ISO Class 6) facility for cleaning, handling, and coating.

## TYPES OF COATING SERVICES

|                           |                           |                          |
|---------------------------|---------------------------|--------------------------|
| Large Area                | Visible Anti-Reflection   | Enhanced Aluminum        |
| Ultra High Reflectance IR | Vacuum Deposited Gold     | Protected Aluminum (VDA) |
| Low Observable / Stealth  | Thermal Control Coatings  | Diamond-Like Carbon      |
| UV Enhanced Aluminum      | Vacuum Deposited Aluminum | Roll-to-Roll             |

## SPECTRALLY TAILORED PAINT

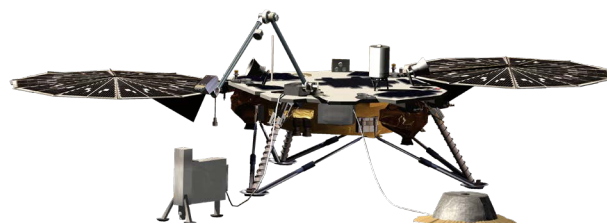
Superior optical design of multispectral paint including modeling of optical constants, micro-physical composition, analysis of diffusely scattering surfaces, and structured surface design for coating optimization and signature modeling for predicting paint performance. Releasable PVD thin film coatings are processed into spectrally tailored flake pigment and incorporated into paint or ink formulations with wavelength dependent reflectance/absorption and cure mechanics specifically tailored to customer end-use.

## SPACEFLIGHT PROGRAMS

After more than 20 years designing and delivering high precision coatings, Surface Optics has enjoyed collaborating on numerous space flight programs and contributing to the success of our customer's projects, including: Kepler space telescope, Chandra X-ray observatory, NuSTAR X-ray telescope, and the Surface Water Ocean Topography satellite.

### InSight Mars Lander

After a successful landing in November 2018, InSight's mission is to probe the surface of Mars to study its early geological evolution. The SOC Coatings Lab applied a protective thermal control coating to the lander's seismometer components using physical vapor deposition in the lab's 3-meter vacuum chamber.



# Optical Properties Measurement Services

Specializing in measurement of reflectance, transmittance, solar absorptance, emittance, BRDF scatter and index of refraction.

Our lab performs optical property characterization on a wide range of materials, including paints, coatings, optical materials, and structural materials, as a function of wavelength from the ultraviolet to the far-infrared. Established in 1977, over 40 years later, we continue the lab's mission to provide accurate, repeatable, and traceable optical property measurements to our customers. Deep technical expertise and a robust quality assurance program ensures high-quality testing from the moment samples arrive at our AS9100 certified facility through data reduction and delivery.

## HEMISPHERICAL DIRECTIONAL REFLECTANCE (HDR)

Measures the fraction of the light incident on a sample at a given angle that is reflected back into the hemisphere. Typical HDR measurements are made out to 25  $\mu\text{m}$ . We measure HDR as a function of reflected polar angle, polarization, wavelength, temperature, and provide both the specular and diffuse components.

## BIDIRECTIONAL REFLECTANCE (BRDF)

The bidirectional reflectance (BRDF) of a surface is defined as the ratio of the luminous radiance reflected into a unit solid angle to the total incident radiance. Bidirectional reflectance measurement capabilities span the range from 0.3  $\mu\text{m}$  to beyond 14  $\mu\text{m}$  with a full four degrees of angular freedom (incident polar and azimuthal angle, and reflected polar and azimuthal angle). BRDF measurements fully quantify not only how much a sample reflects, but also exactly where the reflected energy goes. These measurements are typically made broadband, or at a series of customer specified wavelengths.

## EMISSION

From reflectance measurements (and transmittance where necessary), we generate emittance data of three types: Near-normal emittance, when reflectance has been measured at near-normal incidence ( $\theta = 20^\circ$ ). Angular emittance, when reflectance has been measured at any incidence angle other than near-normal. Total hemispherical emittance, when reflectance has been measured over a sufficiently wide range of incidence angles to permit integration over the hemisphere.

## TRANSMITTANCE

A transmissive material may transmit electromagnetic radiation in one of the following ways: first, as a collimated beam of light propagates through the material it may be scattered into a hemisphere of 2 steradians upon exiting the material (Scattered Transmittance /  $T_s$ ). Secondly, if the transmitted beam is parallel to the incident beam across the width of the entire beam, the transmittance is referred to as Collimated Transmittance ( $T_c$ ). Transmittance measurements can be made from the UV out to the very long IR.

# Instrumentation Products

## **SOC-100 HEMISPHERICAL DIRECTIONAL REFLECTOMETER**

Coupled to the Thermo Scientific™ Nicolet™ iS50 FTIR Spectrometer, the SOC-100 provides polarized, angular diffuse reflectance measurements from 8° to 80° incident angles, for the entire spectral region covered by the FTIR. The spectral region is nominally 2.0 to 25.0  $\mu\text{m}$  using the standard FTIR optics, and can be extended to 200  $\mu\text{m}$  using mid-/far-IR optics.

## **SOC-210 BIDIRECTIONAL REFLECTOMETER**

The SOC-210 BDR (Bidirectional Reflectometer) is a 4th generation, state-of-the-art precision laboratory instrument designed for mapping bidirectional reflectance distribution functions (BRDF) of surfaces, paints, coatings, liquids, and particles. The SOC-210 BDR provides full hemispherical bidirectional reflectance (BRDF) and Bi-directional transmittance distribution function (BTDF).

## **SOC-410 SERIES HANDHELD REFLECTOMETERS**

The SOC410 Series Reflectometers are portable contact measurement devices designed to take precise, accurate reflectance and emittance measurements. Made with an ergonomic power-drill design, the SOC410 Series lets you easily take measurements in-the-field or around the lab—no cords or external batteries necessary. The world's biggest defense, aerospace, and energy companies rely on SOC410 data.

## **SOC-710 SERIES HYPERSPECTRAL IMAGING SYSTEMS**

SOC is a leader in the design and manufacture of hyperspectral imagers operating from the ultraviolet through infrared spectral regions. The SOC-710 Series pushbroom hyperspectral cameras deliver high spectral resolution, in a compact, portable, user-friendly system. Unique internal scanning design eliminates external stages and makes the SOC710 the most flexible hyperspectral camera on the market.

## **LIGHTSHIFT™ SNAPSHOT SPECTRAL CAMERAS**

LightShift™ Snapshot Multispectral Cameras employ a novel plenoptic spectral imaging design to capture, calibrate and process datasets at videorates. LightShift™ is ideal for real-time inspection, monitoring and tracking in dynamic scenes. Customizable spectral filters and/or polarizers optimize each system for the particular application's region of interest. Research models and OEM camera development available.

## **SOC-750 MIDWAVE INFRARED HYPERSPECTRAL IMAGER**

The SOC750 is used in demanding applications like gas leak detection, spectral signature measurements, and chemical species identification and quantification. Comprising a very high-speed, high sensitivity MWIR array, imaging spectrometer, integrated scanning system and vector processor, the SOC750-HB can acquire and process spectral imagery at a rate of 11 cubes (256 x 240 pixels x 42 bands) per second at 14-bit resolution.

## **DUOCHROME**

Two-band SWIR/MWIR imaging system designed specifically for radiometric measurement in two selectable bands. Out of the box, the DuoChrome-SM can be used in demanding analysis, quality control and detection work either locally or over a network.

## **SOC-760**

The SOC760 is a portable dual-band, single field-of-view system that provides coverage from 0.4 microns to 2.5 microns and captures 650 bands registered images into a single data cube. Each spectral image is 640 pixels along the slit of the spectrometers and 2048 pixels along the scan direction. The optical system consists of a whiskbroom scan mirror that directs light to a dichroic beam splitter that reflects the NIR and transmits the SWIR radiation. Each channel has its own fore optic and transmission grating spectrometer.

# Custom Engineering Services

Surface Optics works with our customers to understand their applications and identify when optical property characterization is the key to unlocking a new solution.

## MODELING AND ANALYSIS

Optical phenomenology, analytical modeling for coatings design, thermal analysis, visible, infrared, and radar signature simulation. Spectral data collection and reduction for imaging system optimization.

## OPTOMECHANICAL DESIGN

Full mechanical design, fabrication, sub-assembly, electronics development, algorithm, and software design.

## MANUFACTURING

Production unit delivery, including system assembly, alignment, calibration, integration, and testing. Scalable processes.

# Research Programs

**Awarded our first SBIR Phase I contract in 1986, since then Surface Optics has consistently turned SBIR R&D efforts into market-ready solutions.**

The Small Business Innovation Research (SBIR) program is a highly competitive program that encourages U.S. small businesses to engage in Federal Research and Development that has the potential for commercialization. Ranked a Commercialization Achievement Index of 90, Surface Optics has won over 35 Phase II SBIR awards and generated 3x as much commercialization revenue ("Phase III") as received for combined Phase I & II efforts.

## RECENT SBIR RESEARCH EFFORTS

### Phase II - Air Force - Miniature Video Camera for Turbine Engine Inspection

Expected completion Q1-2021

### Phase II - Air Force - Dual Band Focal Plane Array

Completed Q3-2020

### Phase II - Air Force - MWIR Seeker-Sensor for Strap Down Weapon/SUAS applications

Completed Q2-2020

### Phase I - Air Force - Efficient Evaluation of Fiber Coatings

Completed Q3-2019

### Phase I - Navy - Internal Antireflection Coatings for Aerodynamic Missile Domes

Completed Q2-2019

### Phase II - Army - Enhanced Targeting Sensor Technology

Completed Q2-2019

### Phase I - Office for Chemical and Biological Defense - MicroLens Hyperspectral Imager for Standoff Chemical Detection

Completed Q2-2018





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Surface Optics Corporation is an engineering and manufacturing firm headquartered in San Diego, California, specializing in optical property characterization and associated technologies. Capabilities include coatings and pigments for thermal and signature control, precision optical measurement services, reflectometers, spectral imaging systems and custom engineering services.