SURE-FLAT™ is a precisely engineered, ultra-flat, modular test platform designed for ease of use and excellent repeatability. Its primary feature is a flat and uniform T-slot mounting platform that allows quick and reliable setups for a variety of material testing modules. It is the result of more than a decade of system development and process optimization. Test modules for high strain rate compression and tension, direct impact, quasi-static and dynamic hardness can be setup side-by-side on the same platform. After REL performs the initial installation, the system never has to be leveled, aligned or straightened again. Precision keyed components can simply be lock onto the platform with confidence as they will be in perfect alignment and ready to test. The SURE-FLAT™ system is expandable to any desired system length and can be upgraded with a variety of modules and accessories that mount to its universal linear rail system. This insures the system can be outfitted to accommodate future testing requirements as the need arises.

EQUIPMENT HIGHLIGHTS

- Modular design can scale to any length (20-foot standard)
- Ground, keyed & leveled surface plates for repeatable setups & bar alignment (0.001 in./ft flatness)
- Integrated T-slot grooves for secure attachment (1/2"-13 T-nuts)
- Parallel work tables for multiple setups and test configurations
- Double side mounted linear accessory rails facilitate mounting of work stations, camera, lighting and environmental features while maintaining alignment with test sample
- Box section main beam for maximum rigidity during high energy tests
- Power and data connections prewired at 10-foot intervals for convenient wire management

1/ Interchangeable stand stands are keyed to easily slide on the platform and can quickly be bolted to the mounting surface.
2/ T-nut insert windows provide quick mounting access to different sections over the entire length of the platform and greatly simplify module installation.
3/ REL’s SURE-FLAT™ platform base and frame sections house electronic systems and route wiring connections.
SURE-Launch™ is a series of premium gas launchers used to consistently accelerate striker bars to precise velocities for dynamic test events. These launchers are modular in design and can precisely accelerate a range of striker sizes for tension and compression testing. Currently there are three launcher size ranges to impact bars up to three inches in diameter.

Launchers are fully automated for charging and firing with precise pressure regulation. Test velocities can be controlled and repeated to within 1% accuracy. Launchers can be packaged with custom bar sets, tension grips and momentum traps to tailor load pulses for a wide variety of materials and test configurations.

**EQUIPMENT HIGHLIGHTS**
- Standard: 1”, 2” and 3” maximum striker diameter (Larger by custom order)
- Compressed gas powered (Nitrogen, helium and air to 300 psi)
- Custom barrel lengths available for high speeds
- Modular for use in tension and compression testing
- Fully automated option for charge & fire control with digital pressure and velocity feedback

**3” DIA. GAS LAUNCHER**

**2” DIA. GAS LAUNCHER**

**1” DIA. GAS LAUNCHER**

1/ 2” SURE-LAUNCH™ gas launcher shown with REL’s microcontroller. User-friendly remote gives operator mobility.

2/ REL striker bars are made from precision ground steel, aluminum or polymet. All striker bars include a taper lock bushing system that aligns the striker with the incident bar as it exits the barrel.
TAILORED LED LIGHTING FOR HIGH SPEED IMAGING

SURE-Bright™ is a tailored lighting system designed for direct sample lighting during high strain rate testing. The very high intensity focused LED light source is configured for high speed imaging up to 5 million frames per second at a continuous duty cycle. No flash duration or delay calculations are needed. The output is dimmable from 0-100% to accommodate any exposure, sample reflectivity or lens configurations.

The light system is designed to focus a high power LED array through specialty TIR lenses onto a fixed focal point while the mounting frame allows coaxial alignment with any camera system and quick adjustments for tilting and panning. Fine lead screw adjustments are also integrated for individual camera and lighting focal distance. The high intensity continuous light source combined with the ease of adjustment and focusing ensures quick setups and consistent image acquisition. SURE-Bright™ is compatible with multi-camera setups from various manufacturers.

EQUIPMENT HIGHLIGHTS

- High intensity fixed focal point light source (10 Mlux peak intensity)
- 100% duty cycle at maximum output
- Low IR with minimal sample heating
- Illumination for up to 5M frames per second in many configurations
- Variable output level (0-100%)
- Shadow-free image with concentric lens design
- Quick adjust rail mount system for reliable tilt, pan and focus setup

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1) REL’s adjustable microcontroller offers operator convenience with simple On/Off and dimming functions.

2) REL’s SURE-Bright™ design allows the operator to tilt the camera and lighting in one step (up to 35 degrees).

3) SURE-Bright™ provides minute adjustments to the focal distance of the light ring (up to 12 inches). This ensures proper specimen lighting during high speed imaging.
SURE-Servo™ is a servo driven testing module designed to complement high strain rate Split-Hopkinson Pressure Bar and direct impact testing. The system mounts horizontally on any SURE-FLAT™ platform and can conduct testing in compression or tension. The servo mechanical drive system generates very consistent load profiles in a compact, efficient package. System load capacity can be adjusted with precision gear reducers and linear actuators to perform at low to medium strain rates while maintaining maximum power input.

**EQUIPMENT HIGHLIGHTS**

0-50 inch/s velocity (+/- 1% accuracy)
5000 lb standard load capacity
Utilizes the same grips and sample fixtures as high strain rate modules for comparison
Precise and programmable load curves
Displacement or load control capable

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Digital imaging can easily be performed on test samples mounted to the SURE-Servo™ module

1/ Dynamic 3-point bend testing of steel bars.
2/ Foam sample under compression testing.
3/ Aluminum sample under tension testing. SURE-Servo™ test module uses identical grips and sample fixtures across all SURE-TEST Systems™ modules.
4/ SURE-Servo™ module shown adjacent to a high strain rate test module. The versatility of the SURE-FLAT™ platform allows for parallel test setups at virtually any point along the length of the bar.
SURE-Speed™ is a precisely packaged, highly accurate speed sensor for velocity measurement of striker bars during testing. Velocities up to 1000 feet per second can be measured reliably and accurately for consistent energy input. The sensor interfaces directly with REL's SURE-FLAT™ platform and is adjustable for all common launcher heights and diameters. Setup is simplified with a one-hand locking mechanism to facilitate rapid adjustments as system setups change.

SURE-Speed™ can be powered directly or operated from an internal battery when power is not accessible. Each module also includes an auxiliary output trigger circuit to use when triggering high speed cameras and data acquisition systems.

**EQUIPMENT HIGHLIGHTS**

- Up to 1000 ft/s velocity measurement (+/- 1% full scale)
- IR optical gate measuring system (1 μs minimum gate time)
- Built-in metric unit conversion
- Internal rechargeable battery (4-hour run time)
- Adjustable for all SURE-Launch™ bar and barrel sizes
- Large on-screen gate indicators for easy setup and positioning
- On-screen directional control for reverse projectile direction
- Trigger output to BNC connector

1. The SURE-Speed™ velocity sensor is infinitely adjustable for dialing in sensor height to specific projectile features.

2. A simple user interface includes selectable direction, units, and large gate status indicators for quick setup. The large, 4.3” screen display offers easy readability and instant touch response.
COMPLETE DATA ACQUISITION SYSTEM FOR HIGH STRAIN RATE DATA COLLECTION

SURE-DAQ™ is a carefully selected set of data acquisition components designed to collect high strain rate test data in an efficient, repeatable manner. The system is packaged on a rail mounted cabinet assembly that facilitates simple transitions between stations on a SURE-TEST™ platform. The system includes strain gauge amplifiers, a digital oscilloscope, computer, cables, connectors, gauges and ancillary tools.

SURE-DAQ™ contains everything required to mount strain gauges and collect strain signals for multiple channels. The work cabinet also supplies a convenient storage place for spare tools, cables and supplies when not in use.

EQUIPMENT HIGHLIGHTS

- Desktop or laptop computer
- Strain gauge signal conditioners (Up to 8 channels)
- Multi-channel digital PC oscilloscope
- Strain gauges, signal cables and connectors
- Strain gauge and SURE-FLAT™ tool kits
- Locking work station cabinet
- Conveniently mounts to SURE-FLAT™ accessory rail to move between test locations

1. SURE-DAQ™ includes two signal conditioning amps, but it can accommodate up to eight amplifiers.

2. All SURE-DAQ™ systems come standard with a computer workstation that is pre-loaded with REL’s proprietary data analysis software. Options exist for either a Macintosh® or Windows®-based desktop or laptop computer.
SURE-Temp™ modules are a series of non-contact specimen heaters and coolers with integrated controls that mount directly to any SURE-FLAT™ linear rail system. Heating modules can heat a specimen efficiently and consistently up to 1000°C. Cooling modules can cool samples down to -100°C while hybrid models can heat and cool from -40°C to 150°C. SURE-Temp™ modules are designed to interface seamlessly with SURE-TEST™ Systems and can be quickly removed when not required.

**EQUIPMENT HIGHLIGHTS**

- Multiple configurations for heating or cooling from -100°C to 1000°C
- Standard infrared heater up to 600°C
- Rail mounted for ease of setup and repeatability
- Slides away for high speed imaging
- Designed for tension and compression testing

**1/** SURE-Temp™ specimen heater shown retracted away from a high strain rate test sample. The chamber can easily be moved in and out on two travel rails.

**2/** The design of the non-contact module allows the specimen to be completely enveloped and heated or cooled while mounted to the bar. This feature quickly prepares the sample, saving time and resulting in more accurate test data. The SURE-Temp™ module can be used on bars under 2" in diameter.
COMPLETE ANALYSIS SOFTWARE FOR RAPID PROCESSING OF HIGH STRAIN TEST DATA

REL's open source SURE-Pulse™ software suite is a data collection and analysis software package designed to simplify processing of mechanical test data. It streamlines the raw data input and conversion process while allowing for a wide variety of signal types and sources to be used. User-defined file interpreters can be selected to automate the import procedure for repetitive tests of the same type using common gauges and sensors. Custom configurations can also be created and saved for quick reference. Once the data files are interpreted and trimmed using the simple graphical interface they can be saved and analyzed quickly or exported to other formats (Excel, CSV, etc.).

SURE-Pulse™ makes quick work of displaying, editing and filtering data sets in a large, high contrast chart format. Comparisons between multiple tests can be shown or hidden quickly on the same graphs and regions of interest can be selected for populating statistical parameters. SURE-Pulse™ was developed for demanding high strain rate test environments and has proven itself as an efficient universal tool for all types of mechanical testing.

SOFTWARE HIGHLIGHTS

- Intuitive graphical interface
- Workspace organization system
- Configurable results graphs
- Quick sample comparison menu
- Automatic statistical calculations over region of interest
- Load/Displacement, Stress/Strain, Time Domain and Strain Rate outputs
- Export to common text or Excel® file formats
- Free and open source

REL, Inc.
57640 North Eleventh Street | Calumet, Michigan 49913
906.337.3018 t 906.337.2930 f rel@relinc.net

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REL's proprietary SURE-Pulse™ Image Correlation (I.C.) software is designed to simplify displacement and strain data collection from high speed imagery. It can be used for both 2D strain mapping and discrete target tracking. SURE-Pulse™ I.C. was developed for high strain rate material testing applications and works very well for all types of mechanical testing where mechanical displacement sensors are impractical or inaccurate.

SURE-Pulse™ I.C. streamlines the process of importing images, selecting regions or targets of interest, calibrating pixel size and exporting displacement and strain data. From simple quasi-static tension testing to foam impact to high strain rate SHPB testing, SURE-Pulse™ software makes your data processing tasks quick, reliable andrepeatable.

SOFTWARE HIGHLIGHTS

2D strain maps with graphic color overlay
Discrete target tracking of multiple features
High contrast tracking features of any size or shape
Exports strain, displacement or velocity data for analysis
Recognizes all major image formats
Built-in smoothing and filtering algorithms for noisy images
User-friendly Digital Image Correlation for demanding applications
Compatible with Windows, Macintosh, and Linux computer operating systems

SURE-Pulse™ Digital Image Correlation software tracks 2D speckled strain fields for high speed tension testing.

1 Three-point metal bend test at 40 ft/sec. SURE-Pulse™ Image Correlation tracks target X (and Y) coordinates during the test for relative displacement.

2 Foam compression test at 150 ft/sec. SURE-Pulse™ Image Correlation tracks target X (and Y) coordinates for relative displacement and velocity.