



**SEEING IS  
BELIEVING**

**Modal Amplified**  
Accelerating time to insight

# We are RDI Technologies

RDI Technologies® is the global market leader in Motion Amplification® solutions. Since 2015, we have supported government and corporate customers with camera-based vibration analysis solutions, helping them optimize reliability and asset performance, while reducing risk and cost.

- 🌀 **INNOVATION:** Inventor of Motion Amplification® technology; pioneer of the camera as the industrial sensor
- 🌀 **EXPERIENCE:** 200+ years vibration solutions and industry experience
- 🌀 **SOLUTIONS:** Non-contact, camera-based Monitoring, Measurement, Robotic and High-speed camera solutions
- 🌀 **INVESTMENTS:** Acquired Fasted Imaging, Inc., 2022



58+

COUNTRIES

38+

INDUSTRIES

650+

CORPORATE CLIENTS

2300+

CERTIFIED ANALYSTS

# Modal Amplified™

Accelerating time to insight

Bringing the power of **Motion Amplification®** to **Modal Testing**.

**MODAL TESTING IS A TIME-INTENSIVE, COMPLEX PROCESS REQUIRING RE-WORK AND A HIGH LEVEL OF EXPERTISE.**

When designing, prototyping, certifying or qualifying structures and materials, you need to find the inherent natural vibration properties of a structure to understand/analyze the structural dynamics and limits of a structure when subject to different forces and loading. This allows you to predict and identify issues or weakness in the design before it goes to market.



**MODAL AMPLIFIED CHANGES THE GAME WITH MOTION AMPLIFICATION TECHNOLOGY**

Modal Amplified allows you to get Modal results in a matter of minutes all the way from capture to visualizing the modes shapes, complete with dozens, even hundreds of sensors measured across the structure.



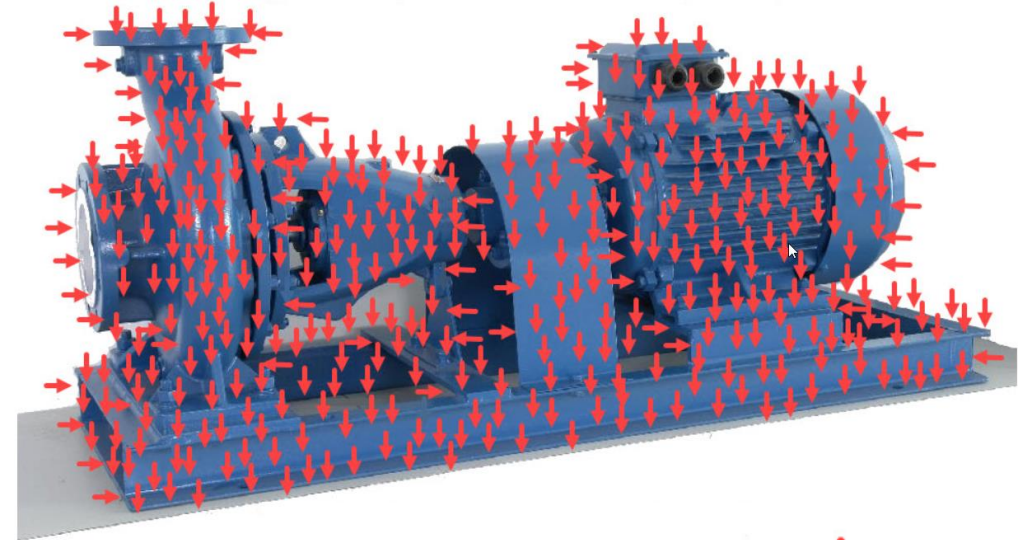
# Modal Amplified™

Uses Motion Amplification technology - See what you've been missing - Measure movement NOT VISIBLE to the human eye

**Modal Amplified is a camera-based solution that uses Motion Amplification technology** to detect subtle motion and make it visible to the naked eye in order to understand the interrelationships and causes creating the motion.

## THIS MEANS...

- Over 2M pixels become a virtual motion sensor
- You can cover 100% of an asset, large, small and inaccessible. Every point is measured and quantified. No guessing between points
- Results are immediate and easy to see in a standard video



*Vibration Measurement Locations* ↓

## **Motion Amplification sees it all; 2.5m data points**

- Non-contact measure
- Simultaneous data
- 360° full field of view vibration

# Modal Amplified™

The power of **Motion Amplification in Modal Testing.**

**Get Modal results in a matter of minutes all the way from capture to visualizing the modes shapes**

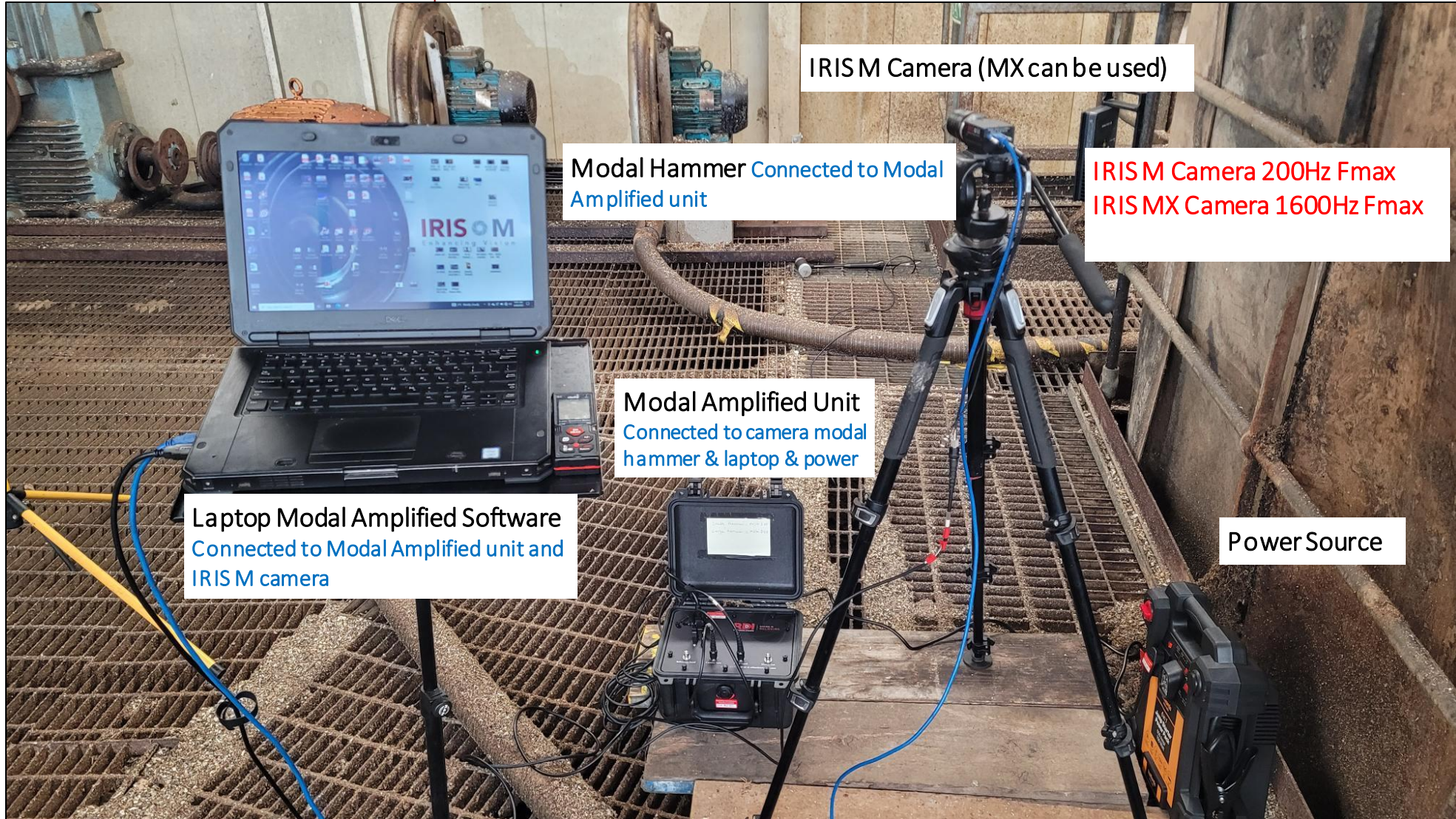
- Leverage simultaneous measurement of the force input with the response measured directly from the camera.
- Immediately visualize the resulting modes shapes all the way from capture to visualizing the modes shapes, complete with dozens, even hundreds of sensors measured across the structure.
- Place dozens, even hundreds of sensors across the structure through virtual regions of interests.



**GET TO YOUR DATA FASTER**

# Modal Amplified™

The power of **Motion Amplification in Modal Testing.**



# Modal Amplified™

The power of **Motion Amplification in Modal Testing.**





Configure



Acquire



Stability



Analyze

Please create or open a project file

RECORDED WITH

SCREENCAST-O-MATIC



3°C Mostly cloudy

11:58 AM  
3/28/2023



Modal Amplified - Brake Disk.mdl

File Tools Help

Configure

Acquire

Stability

Analyze

**Recording Properties**

Default Distance: 3 ft

Focal Length (mm): 12.5

Acquisition Type: XY (Single Camera)

Input Mode: Impact

Input Sensor ID: Hammer

Input Window Type: Force

Averages: 2

Fmax (Hz): 640

Framerate (fps): 1280

Frame Size (WxH): 1024x576

Duration (sec): 3

Brightness (%): 100

Gain: None

Image Rotation: None

**Response Configuration**

Enable Reference Accelerometer

Response Window Type: Exponential

**Measurement Locations**

ID	X	Y	Distance
1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3
2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3
3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3
4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3
6	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3
5	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	3

Draw measurement locations on camera image above

# Why Use Motion Amplification® for Modal Testing?

## MODELING



Animation, not real recorded images.



Polygons determined by number of measurement points collected, data may be interpolated for more density.



Complex test subjects require complex modeling skillset. Difficult to capture aftermarket component characteristics.



Various levels of setup are required including sensor mapping, placement, fixation, wiring; DAQ setup and programming; Collect data.



May need to export data into visualization software (specifically vibration data collectors).

VS

## MOTION AMPLIFICATION®



Framing camera on subject instantly creates a real test model.



Measurement points equals number of pixels in frame (Full HD 2.3M points).



Collect data on objects too small or out of reach of physical sensors; captures real-life aftermarket structure, eliminating need to capture non-OEM parts.



Camera and lens selection based on field of view (non-contact measurement).



Review findings on same computer, software suite.

# Why change what works?

## Everyday challenges of Modal Testing

### TIME INTENSIVE PRE-WORK/POST MODELING

Projects involve a lot of pre-work, sketches, notetaking, and exploratory impacts (finding a single driving point that excites all modes of interest).

- 4-6 averages per testing
- Check for good coherence (> 80%)
- Animating, ODS data requires building models of the machine, specific knowledge.

### DIFFICULT TO RECORD SIMULTANEOUSLY

The analyzer must record the impact and response simultaneously and in its entirety for accurate data.

- With windowing turned off, a response that continues to "ring" and not go to zero will have leakage and thus a bad result. Triggering helps ensure impacts include a pre-trigger dead spot and the response the same.

### MISLEADING DATA TIME CONSUMING

Number of data points (or lack thereof) can create misleading data. Not uncommon to find mode shapes that seem to be inaccurate – they may just be very low amplitude Fn's (heavily damped) or otherwise false signals that can only be identified as false by viewing coherence, phase or the corresponding mode shape.

### EXTERNAL FACTORS

External vibration or noise can corrupt data (machine turns on unexpectedly).

### UNIQUE HAMMERS REQUIRED TO CAPTURE DIFFERENT FREQUENCIES

- Soft tip sets input energy in lower frequency range
- Hard tip, high frequency range
- Trying to only excite frequencies of interest
- Hammer size just for force

# Modal Amplified™

Adding Motion Amplification to Modal Testing and Analysis creates significantly improved changes to workflow for users

- With Modal Amplified, you can **collect simultaneous data** from an input device used to excite a structure like an impact hammer, modal shaker, and operational methods to not only measure the response but also **instantly visualize** the response.
- Supports SIMO, allowing you to perform measurement with a single excitation and any number of response channels.
- Draw regions of interest directly into the solution **without the need for animating structures**. Perform analysis within the software or export your data.



"There are some real benefits to using your software vs current visual engineering software packages. Mainly time and effort.

This is an incredible time and labor saver – just like traditional MA was compared to ODS. I imagine your software will replace most needs for visual engineering software, unless engineered solutions to resonance problems are required.

*Overall – very nice package!"*

**Matt Rubin – Field Operations Manager, 4X Diagnostics**

# Modal Amplified™

## Main Features/Value

- Leverages simultaneous measurement of the force input with the response measured directly from the camera
- See your structure respond real world vs model
- Test on small/large components
- Capture and analyze findings in one platform
- Automatically creates master lists of mode shapes
- Eliminates need to recapture data
- Non-contact; Test structure never altered or destroyed- Fast, easy set-up
- View data in platform, or export easily



**Automatically calculates mode shape measurements and filters video to the vibration frequencies that are of interest, instantly capturing mode shapes, natural frequency, associated dampening and movement the human eye and sensors cannot always detect, all within the software.**

# Modal Amplified™

Supports a number of critical measurement techniques/tests

## EMA

### Experimental Modal Analysis

Modal Amplified eliminates the need for dozens of sensors, protects against incorrectly placed sensors, and allows for experimental testing

## VCT

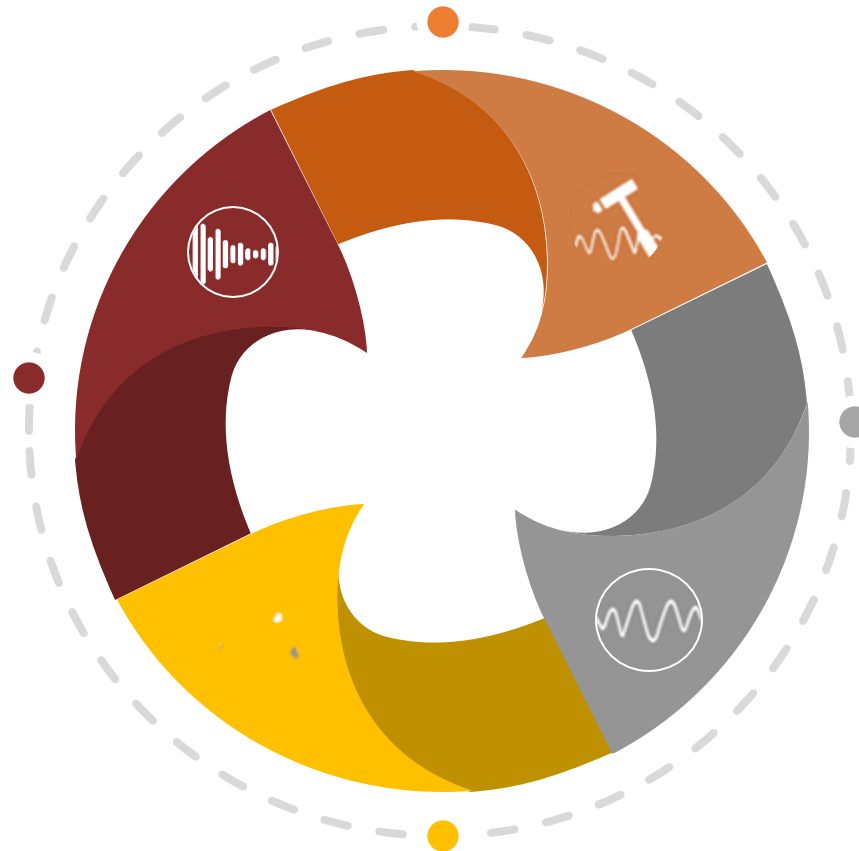
### Vibration Control Testing

Modal Amplified easily measures complicated event simulations like aircraft take-off/landing, rocket launch, and transportation over rough terrain. These tests screen for manufacturing defects and premature component failure.

## ODS

### Operating Deflection Shapes

Easily perform dynamic analysis and see how a machine or a structure moves within its operational conditions.



## SIMO

### Single Input Multiple Output

Modal Amplified is designed as a SIMO system, allowing you to perform measurement with a single excitation and virtually unlimited response channels.

## OMA

### Operational Modal Analysis

Modal Amplified is uniquely powerful for OMA as it can easily capture structural dynamics of a system in operation without the need for contact sensors or input force in this response-only technique.

## GVT

### Ground Vibration Testing

Modal Amplified reduces the need for multiple accelerometers mounted on an aircraft and sub-assembly components. Large sections of the aircraft are captured instantly without the need to model.

# Questions?



# First, what is Modal Testing and Analysis?

**Modal Testing and Analysis** is the process of finding the inherent natural vibration properties of a structure, primarily to understand/analyze the structural dynamics and limits of a structure when subject to different forces and loading. If the natural vibration states are known, much of the vibration behavior of a structure can be predicted to identify issues or weakness in the design.

A natural vibration state is defined by its mode shape, its natural frequency and the associated damping. Vibration modes of a structure can be either purely simulated, e.g. from Finite Element (FE) Models or can be derived out of physical measurement results by fitting a mathematical model to these results. This latter process is called experimental modal analysis.

## Several instruments are typically used to perform Modal Test and Modal Analysis:

- One or more exciters, such as modal shakers or an impact hammer
- Force transducers that acquire the input excitation signals
- Accelerometers that record force
- Non-contact laser vibrometer
- A data acquisition system (DAQ) device to record the test
- A computer with Modal Test and Analysis software to perform calculations, display the results and create reports

