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## Gyroscopes

Since 1962, USD has designed and built form, fit and function equivalents to the Honeywell, AIS, BAE, Condor Pacific, Northrop, Timex and Humphrey families of rate and rate integrating gyroscopes. We have manufactured over 100 different models for the U.S. Navy, U.S. Air Force, Raytheon, General Dynamics, Thales, L-3 Communications and many others with excellent field history. They are currently used in programs that cover the performance and environmental requirements typically encountered by aircraft, missiles, vehicles, ships and tanks. Applications include attitude control, aided navigation, heading and attitude reference, antenna and seeker stabilization, mid-course guidance, and turret and sight stabilization. They are currently used in a great number of major U.S. military and foreign programs such as F15, F16, F18, A6, V22 Osprey, Tow Cobra, Phalanx, Paveway and Standard Missile.

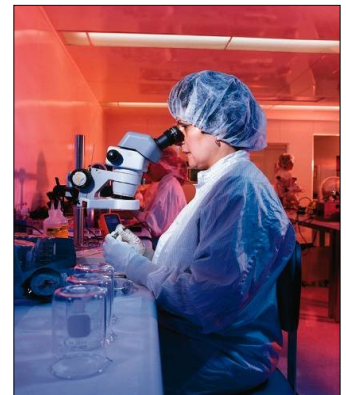
## Design, Repair, Manufacture and Test



**Precision Assembly**



**Extensive Testing**



**Clean Room Environment**

USD's families of gyroscopes can be easily interchanged with many other manufacturers' gyros. Whether it's a drop-in replacement or an application that requires slight mounting changes, USD will work with the customer to achieve a painless solution in keeping your legacy system alive. This eliminates the unnecessary system design activity and re-qualification for the end user and avoids many costs associated with re-designing the system for a different type of gyro. With this in mind, we can guarantee the life of your legacy system for many years to come.

USD's gyroscopes can be configured to accept many different input excitations and designed to whatever output parameters are necessary to perform flawlessly in your system. Utilizing our expert engineering staff, we can design and build many different mounting brackets with the gyro aligned in the bracket to 1 milliradian or better. This enables the customer to bolt down the gyro and just plug it in for a quick, easy, low cost integration of a superior performing gyro.

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# Types Of Gyroscopes

- **Rate Integrating Gyroscopes**

The center of our rate integrating gyro manufacturing program is the USD 446 Series of gyroscopes. All of the gyros in this family have been qualified as a form, fit and function replacement by either the U. S. Government or the original specification holder. The 446 Series replaces the GG1111, GG1163, GG250 and the GI-G6 gyros.

- **Rate Gyroscopes**

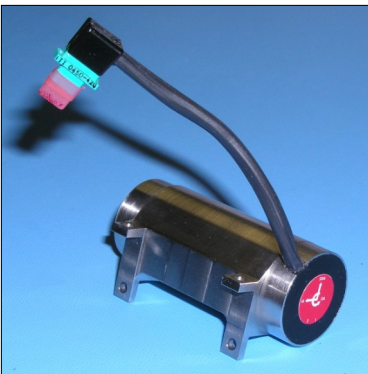
USD's 475 Series of rate gyroscopes are a low cost, high performance series of gyros that performs reliably and accurately in severe environments. USD has designed this series of gyroscopes from the ground up inserting all of the latest technology. These gyros have also been qualified as a form, fit and function replacements by either the U. S. Government or the original specification holder. The 475 Series replaces the GG440, GG445, GI-G5 and the GR-G5 gyros.

- **Stored-Energy Gyroscopes**

USD's FG Series of stored-energy 2-axis free gyroscopes are a low cost, spring wound solution for ground and air launched missile and bomb applications. Once energized, useful output data is obtained within 100 milliseconds of activation.

- **Rate Sensor Packages**

USD can provide complete rate sensor packages using combinations of the 446 and 475 gyros along with accelerometers, demodulators, closed loop torquer servos, amplifiers, high precision power and frequency generators.



**Rate Gyroscopes**



**Rate Integrating Gyroscopes**



**Gyro With Integrated Electronics**

USD can quickly and economically meet your gyroscope needs with a form, fit, function or designed-to-spec replacement. Specifications, drawings and Request For Quotes can be emailed to:  
[sales@usdynamicscorp.com](mailto:sales@usdynamicscorp.com)

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# Types Of Gyroscopes

- **MEMS Based Gyroscopes**

USD offers a number of MEMS based solutions that can easily be integrated into new or retrofit applications. The MEMS based system offers long life, lower power, and the robustness of a solid-state system. Since each application is somewhat unique, USD engineers each MEMS replacement to meet the specifications of the target application.

- **MRG-Legacy Series (MEMS Angular Rate Sensor)**

The USD *MRG-Legacy Series* gyros are direct form, fit and function rate gyro replacements for legacy systems currently using spinning mass rate or rate integrating gyroscope technology. The MRG Series targets applications where obsolescence and/or the maintenance of the legacy spinning mass rate gyro becomes problematic.

Example applications for our solutions include the CN 1552 and SAS rate gyros applicable to the Blackhawk Helicopter. In addition to these applications, various inputs and outputs such as DC in-DC out, DC in-AC out or AC in-AC out are obtainable along with customizable mounting and connecting. Consult U.S. Dynamics Corporation for specific needs.

*Basic specifications include:*

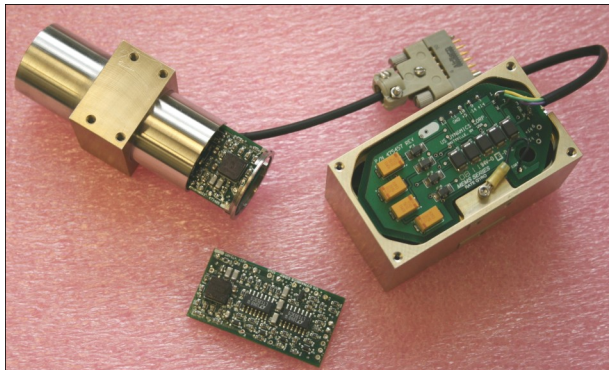
- Rate Sensing Capability to  $\pm 300^\circ/\text{sec}$
- Bias Stability  $< 15^\circ/\text{hr}$
- Angular Random Walk  $< .6^\circ/\text{root Hr.}$
- Sensing Bandwidth to 100Hz

- **MRG-Miniature Series (MEMS Miniature Angular Rate Sensor)**

The USD *MRG-Miniature Series* gyros are small form-factor, single supply (+5VDC), analog output angular rate sensors in a 0.750" dia. X 1.030" lg. cylindrical housing with a 0.800" square mounting flange. The miniature, robust package and single supply make this single axis unit one of the smallest, low noise rate sensors available.

*Basic specifications include:*

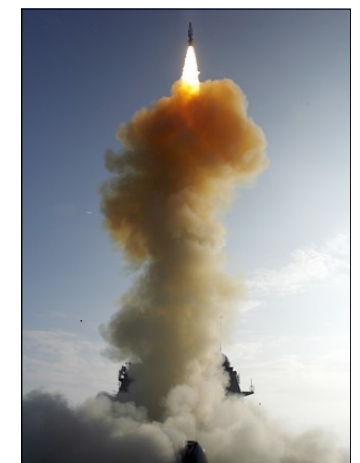
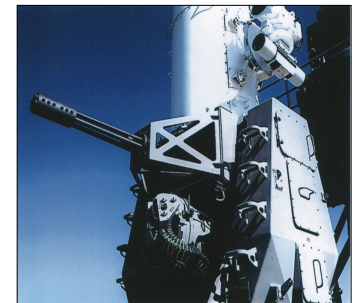
- Rate Sensing Capability to  $\pm 300^\circ/\text{sec}$
- Bias Stability  $< 10^\circ/\text{hr}$
- Angular Random Walk  $< .4^\circ/\text{root Hr.}$



# Sample Gyroscope Applications

## 446 Series Rate Integrating Gyroscopes

Program	Application	Comments
A-4	Aircraft	Radar Stabilization
A-6	Aircraft	Target Recognition
AAQ-15 and AAQ-17	Aircraft	FLIR
F-15	Aircraft	Radar Stabilization
F-16	Aircraft	Radar Stabilization
F-16	Aircraft	Heads Up Display Rate Sensor
F-18	Aircraft	Radar Stabilization
P-3	Aircraft	FLIR
Standard Missile	Missile	Seeker Head
Tow Cobra	Missile	Sight Stabilization
Aegis	Shipboard	Gun Fire Control
Seawolf	Submarine	Missile System
M60A3	Tank	Fire Control
K1	Tank	Fire Control
Phalanx	Weapon System	Gun & FLIR Stabilization
V22 Osprey	Aircraft	HNVS Stabilization



## 475 Series Rate Gyroscopes

Program	Application	Comments
Phalanx	Weapon System	Radar Stabilization
F-15	Aircraft	Radar Rate Stabilization
F-16	Aircraft	Heads Up Display Rate Sensor
Standard Missile	Missile	Autopilot
AN/APQ-150A	Aircraft	Tracking Radar
SATCOM	Shipboard	Antenna Stabilization
AN/APQ-150	Aircraft	Radar System
F-16	Aircraft	Flight Control
F-4	Aircraft	Radar Stabilization



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# Value Added Engineering

## Reliability

- Extended Life of Spin Motor Bearings
- High Temperature Lubricants
- Proprietary Plasma Cleaning Process
- Temperature Screening

## Interchangeability

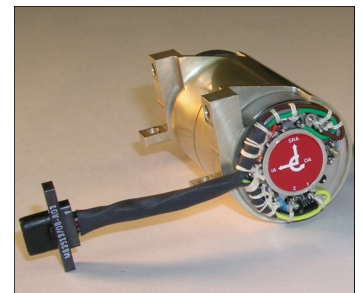
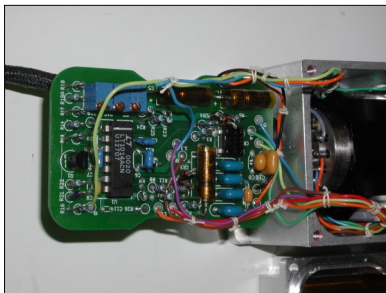
- USD's gyroscopes can be easily interchanged with the Honeywell GG1111, GG250 and GG445 family of gyros. We also provide drop-in replacements for the Atlantic Inertial Systems / Condor Pacific / Northrop / Timex GI-G5, GR-G5 and GI-G6 gyroscopes, all benefiting from over 40 years of continuous improvement.
- USD has developed a drop-in replacement for the Humphrey / Rosemount / Goodrich FG series of stored energy gyroscopes. Since 2011, over 4,500 gyros have been produced for a Laser Guided Bomb guidance application.

## Value Added Support

- U.S. Dynamics Corporation can also design and fabricate all the associated electronics necessary to achieve optimum performance
  - Servos and Demodulators
  - Motor, Pickoff and torquer driver cards
  - Packaging of multiple gyros with electronics

## Long Life Gyroscope

- USD has developed a long life version of its spinning mass rate and rate-integrating gyroscopes. Under development and test for over ten years, USD has succeeded in extending the life of its gyros from a typical 4,000 hours to a minimum of 12,000 hours. The long life components can be added to any of our rate and rate-integrating gyroscopes which include all of the form, fit, function, drop-in replacements for the Honeywell GG1111 and the Atlantic Inertial Systems GIG6, GIG5/GRG5 gyros.



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## In-House Environmental Test Facility

In-house environmental test facility can verify operation for:

- Altitude Up to 150,000 ft
- Humidity Up to 99%
- Temperature -55° C to +125° C
- Vibration Linear and angular vibration
- Centrifuge 100 g's

Typical equipment includes:

- Russels RBH-35-10-10-A/C, 27 cu ft Temperature/Altitude Chamber (0 to 150,000 ft)
- Tenney 12ST100/350, 12.5 cu ft Temperature/Altitude Chamber (0 to 60,000 ft)
- Thermotron F-62-CHV-25-25/ECA, 61 cu ft Temperature Chamber
- Thermotron S16 MiniMax, 15.5 cu ft Temperature Chamber
- Associated HK-5108, 8 cu ft Temperature/Humidity Chamber
- LDS Model V810 Vibration Table
- Contraves Angular Vibration Table
- Assorted High Precision Rate Tables

USD can design and fabricate any fixtures that would be required for testing. We can also build test equipment to run operating tests during environmental testing.

