Technology Transfer Network

ASTRO.PO.S™

(Astrophysics Positioning System)

Navigation by stars has been the oldest and the most conventional way of navigating in the vast oceanic expanse. Technological advancements such as marine radars and ECDIS (Electronic Chart Display and Information System) might have enabled and provided far more pinpoint precision than star navigation contemporarily, but fact remains that celestial navigation was one of the highlights of the maritime era. Nowadays, marine navigation utilizes novel technologies in calculating a geographical position by relying on data resulting from a network of multiple satellites or/and terrestrial stations such as GPS (LORAN-C, DECCA and OMEGA), rendering them and in turn the user, dependent on the network and vulnerable to third parties (cyber threats) who may wish to alter the result. System degradation, electrical failures, satellite malfunctions are other reasons GPS might be rendered unusable on board a ship.

Our goal is to create an auxiliary device, which will independently and autonomously calculate the position, geographical longitude and latitude. By being independent and autonomous the user will not depend on any whatsoever external source (satellites, land based GPS) to calculate the geographical position. The device will calculate the position by observing natural phenomena without interacting with external technical sources.

ASTRO.PO.S™ is an earth coordinate finder system based on γ-ray imaging of celestial discrete sources in the low energy domain. Comparing the detected planar image with parts of the sky-map images originating from the available database, it delivers coordinates by interfacing with navigation maps.

ASTRO.PO.S™ uses existing proven technologies in an innovative way. Our unique innovation though is the algorithmic methodology of the system allowing it the ability to sense acceleration in three dimensions and the capability to detect gamma rays – which are considered rare – through several sources in the cosmos.

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ASTRO.PO.S™

The system consists of a high-resolution sensitive γ-camera, which detects the gamma rays emitted from well-known and accurately mapped sources in our galaxy. Composite planar images are then automatically compared with stored maps and the local coordinates of the imaging system are retrieved.

The γ-Camera is the main imaging system, which consists of a proper collimator and a sensitive scintillator material to transform the captured gamma rays into visible light, detected and amplified by a Position Sensitive Photomultiplier Tube. This γ-Camera system returns planar images of a given angular sky opening. In order to reduce unwanted motion effects of the imager and to compensate larger acquisition times, a 3D-Accelelerometer system is mechanically coupled to the camera system.

It can simultaneously record the three components of earth's acceleration and through a proper transformation, it can calculate the Euler angles θ, φ, which are further used as motion correction parameters to the recorded signals. Several such planar outputs are together combined to produce a larger image composite. A direct comparison of the recorded signals with a database containing all known gamma ray sources in celestial coordinates results in the accurate determination of the imager's location in earth coordinates.

Presently ASTRO.PO.S™ has surpassed the Prototype validation stage (TRL 5), during which the basic technological components have been integrated with reasonably realistic supporting elements. Currently our prototype is being demonstrated in a high-fidelity laboratory (TRL 6) of the Physics Department National and Kapodistrian University of Athens. Upon completion of the planned prototypes X 2 (end of Q3 2017), we will be in a position to demonstrate in a fully operational environment (marine industry) and to complete our system qualifications.