

# NASA TECH BRIEF

## *Marshall Space Flight Center*



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### A Simple Dead-Reckoning Navigational System

#### The problem:

A vehicle operating in remote locations, where it is not feasible to transport extensive equipment, may need a small and simple navigational system.

#### The solution:

A simple dead-reckoning navigational system was designed.

#### How it's done:

The dead-reckoning navigational system consists of four main components: a directional gyrocompass to establish an inertial direction, an odometer to measure distance, a signal processor which combines the measured distance and direction, and a sun compass to determine the initial direction.

The gyrocompass output comes from a 400-Hz synchronous differential transformer for finding and updating the initial reference heading.

The sun is used as the azimuthal reference. Sun sensors are mounted so that they are able to rotate around both a horizontal and a vertical axis and provide, by means of a prism system, a constant horizontal view of the sun regardless of the angular position of the vehicle (this device is known as a theodolite). Driving null-meters are used to determine the angle between the vehicle heading and the sun. The angle between the sun and north is determined from nautical almanac data, and the difference between these two angles gives the vehicle heading.

The odometer measurement is taken from the third fastest wheel. This permits two wheels to spin without introducing error, yet the odometer will continue to operate if the signal is lost from one wheel. This system gives a more accurate distance measurement than an arithmetic average of the four wheels.

An analog to digital converter encodes the analog signals from the various transducers into the digital format necessary for processing and display.

This system has been tested and shown to be able to follow a 30 km course over difficult terrain with less than a two percent error.

#### Note:

Requests for further information may be directed to:  
Technology Utilization Officer  
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#### Patent status:

No patent action is contemplated by NASA.

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