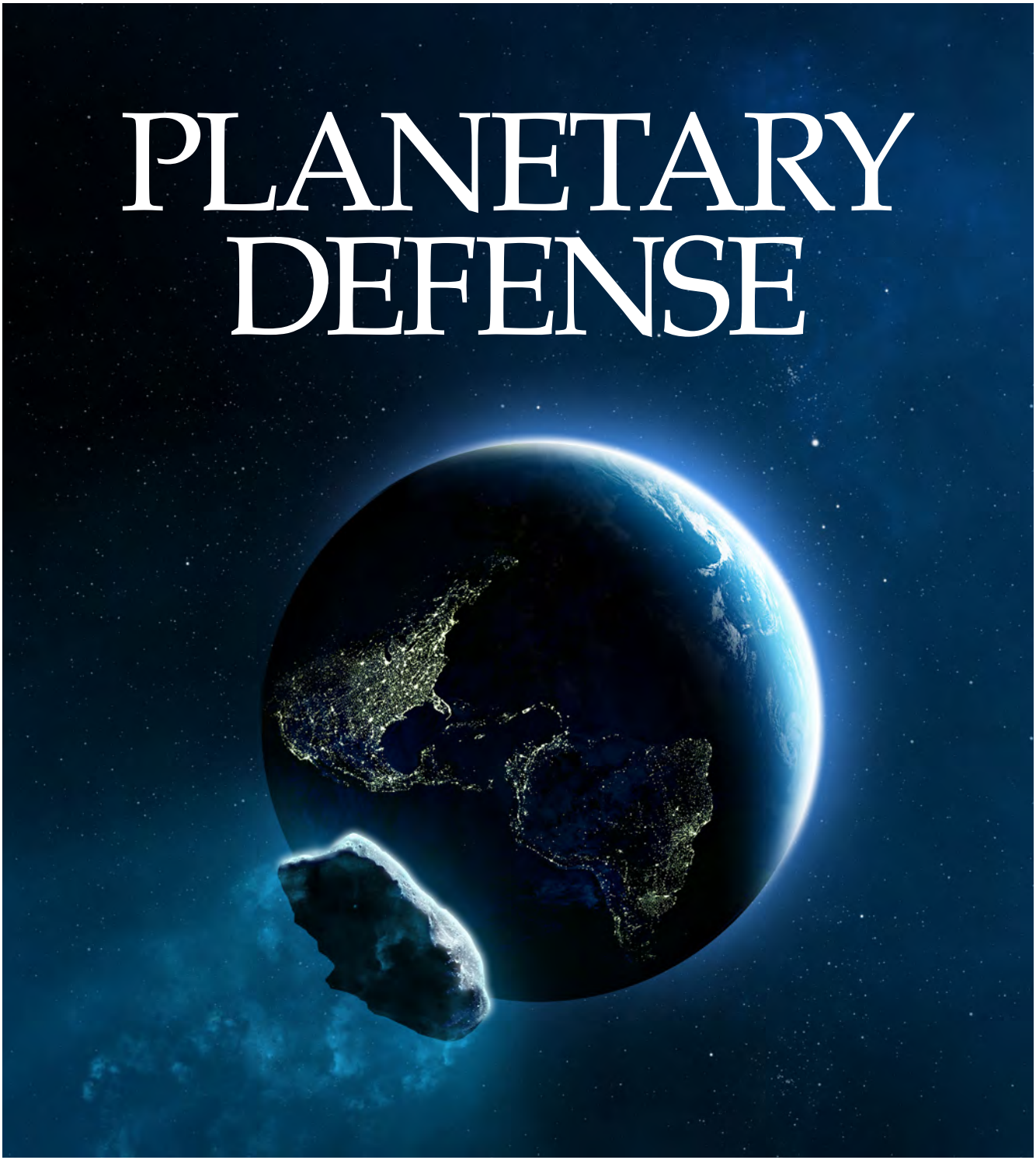
# PLANETARY DEFENSE



## Introduction

*By Jason Ross*

This double issue of *21st Century* has a large set of feature articles on the theme of planetary defense and mankind's place in the Solar System and the universe. The treatment of this broad-ranging subject here encompasses everything from detecting precursors to extreme weather, volcanoes, tsunamis, and earthquakes (see also our Winter 2011-2012 issue), to detecting and deflecting incoming asteroids and comets, to the required social outlook to make these missions a

reality, to developing the nuclear technologies of fission and fusion propulsion required for efficient access to the Solar System and increased control over heavenly bodies.

Leading our coverage of this topic is an article on the International Global Monitoring Aerospace System (IGMASS) concept, "Toward Collaboration in the Defense of Mankind." This article reports on the proceedings of a fall conference held in Yevpatoria, Ukraine, "Space and the Global Security of Humanity." Discussions at the conference covered the main topics in this feature report as a whole: a global organization for integrating various monitoring systems, located both on the ground and in space, to provide a unified real-time capability to monitor the planet and its environs to forecast a broad range of potential threats to life on Earth. Seismic forecasting, new techniques for observation, rocket design, and political and scientific structures for data sharing were among the topics.

A three-part development of the specific features of planetary defense follows. The first addresses the terrain: some half-million near-Earth objects (NEOs) are estimated to exist, of various sizes, ranging from those which would destroy an entire metropolitan area, to those large enough to eliminate all human life on the planet. Among these hundreds of thousands of bodies, a scant 10,000 have been discovered as this issue goes to press. After a survey of the estimated NEO population and a review of various studies of the effects their impacts on Earth would generate, the topic of observation and detection is treated in the second article. As recent cases of asteroids whose discovery preceded their near-Earth flybys by only a few months attest,[1] our ability to detect such bodies leaves much to be desired. Proposals for additional observatories, including the benefit of observing from the orbit of Venus, are discussed.

The third article concludes with a brief summary of the methods that could be used to stop future impacts from occurring, either by deflecting or destroying a threatening object. Existing options, limited by current technological constraints, are discussed, but a unique emphasis is placed on investigating the areas of scientific and technological advancement which will fundamentally improve our ability to defend the Earth from these threats.

Several interviews provide insights from the research and policy-making communities. Professor Bong Wie (Iowa State University) and Brent Barbee (NASA Goddard Space Flight Center) discuss their proposals for high-speed interceptors with thermonuclear explosives used to disrupt and shatter an incoming NEO. Roscosmos chief Vladimir Popovkin speaks on government initiatives for global planetary defense, and Professor Claudio Maccone, Technical Director of Scientific Space Exploration of the International Academy of Astronautics, presents an overview of the capabilities required to defend the Earth, and steps required to bring those capabilities online.

### The Extraterrestrial Imperative

We are then treated to an article on Krafft Ehricke and his concept of the "Extraterrestrial Imperative." Ehricke proposed that space exploration is not simply a set of missions, but the fulfillment of an imperative, which is guided by man's "power of reason" and the "wisdom of the moral law within himself." Space, to Krafft Ehricke, is not a place, but a scientific and cultural challenge which will determine mankind's future. His vision encompassed the extension of mankind's use of near-Earth space, all the way to how our species will continue to grow and evolve perhaps three billion years from now, when the Sun no longer allows the Earth to serve as an abode for life.

### Energy Flux Density

A variety of factors serve to measure our scientific capabilities with respect to the challenges of transportation and power for action in space, but the most all-encompassing is that of energy-flux density. Taking a longer historical-economic perspective, it is shown that the development of successively higher forms of power becomes one of the most significant factors in expanding mankind's reach into the universe. This currently presents mankind with the imperative to develop fission and fusion transportation and power systems in space, with an eye towards the great potential of matter-antimatter reactions.

Again, several interviews serve to fill out this concept. Dr. Stanley Borowski discusses U.S. plans for follow-up design studies on fission rockets. Professor John Slough discusses his design for a fusion-powered rocket, which would make the trip to Mars faster, safer, and easier. Academician Anatoly S. Koroteyev, General Director of Russia's Keldysh Research Center, responds to questions on the status of Russia's Nuclear Power Propulsion System, intended to develop the first ever nuclear-electric space propulsion system by 2018.

I hope you will enjoy the exciting contents of this package, and use it to sharpen your advocacy efforts!

1. Asteroid 2012 XE54 is a case in point. It passed halfway between the Earth and the Moon on December 11th, having been discovered only two days earlier! Its estimated diameter of 25-50 meters puts it in a similar size range to that hypothesized to have caused the 1908 Tunguska event.