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PRESIDENTS, EXPERTS, AND ASTEROIDS

ILLUSTRATION: ALLAN M. BURCH

SIR ARTHUR CLARKE, *a graduate of King's College, London, is the author of numerous works of science and science-fiction, including his well-known collaboration with Stanley Kubrick on the movie* 2001: A Space Odyssey. *He is presently Chancellor of the International Space University and Chancellor of the University of Moratuwa, Sri Lanka, where he has lived for 30 years.*

For every expert, there is an equal and opposite expert.
(Late 20th-century folklore)

For more than a century science and its occasionally ugly sister technology have been the chief driving forces shaping our world. They decide the kinds of futures that are possible. Human wisdom must decide which are desirable.

It is truly appalling, therefore, that so few of our politicians have any scientific or engineering background. Yet while *some* scientific training should be a requisite for anyone making policy decisions, it is clearly not sufficient. Herbert Hoover and Jimmy Carter, two U.S. presidents with engineering backgrounds, were probably as perplexed as anyone when faced with making policy decisions involving science or technology.

Even the wisest and best science-educated of politicians may have difficulty making good decisions when, as is often the case, "experts" disagree. There are some hilarious examples of this in the history of science—for example, Lord Kelvin's declaration that x-rays must be a hoax, and Ernest Rutherford's even more famous dismissal of atomic energy as "moonshine."

Politicians now are wrestling with the matter of human cloning, perhaps the most notable controversy now facing science and society. Any developments that concern biology—especially human biology—are liable to arouse passions, as witnessed in the debates over abortion, euthanasia, and evolution. I have encountered a few "creationists" and because they were usually nice, intelligent people, I have been unable to decide whether they were *really* mad, or only pretending to be mad. If I was a religious person, I would consider creationism nothing less than blasphemy. Do its adherents imagine that God is a cosmic hoaxer who has created the whole vast fossil record for the sole purpose of misleading humankind? And, although I do not necessarily agree with the paleontologist Teilhard de Chardin's advocacy of evolution as a major proof of the glory of God, de Chardin's attitude is both logical and inspiring. A creator who laid the foundations for the entire future at the beginning of time is far more awesome than a clumsy tinkerer who constantly modifies his creations and throws away entire species in the process. Even the Vatican, while firm in its declaration that the human soul is divinely created and not subject to process, has stated that the theory of physical evolution is more than just a hypothesis (1996).

Science and society can also clash in the area of military security. I was involved in the debate over the Strategic Defense Initiative (SDI, a.k.a. Star Wars) from its inception 15 years ago this spring. My attitude then, as now, was that although it might be possible to construct local defense systems at vast expense that would let through "only" a few percent of ballistic missiles, the much-touted idea of a national umbrella was nonsense. Luis Alvarez (winner of the 1968 Nobel Prize in physics), perhaps the greatest experimental physicist of this century, remarked to me that the advocates of such schemes were "Very bright guys, with no common sense."

Now, looking into my often cloudy crystal ball, I suspect that a *total* defense might indeed be possible in a century or so, but the technology required would produce, as a by-product, weapons so terrible that no one would need any longer bother with anything as primitive as ballistic missiles.

If I might hazard another prediction, I suspect that President Reagan's 1983 "Star Wars" speech outlining his idea of an umbrella defense system consisting of armed space satellites to protect America against attacks by nuclear-armed ballistic missiles, will one day be regarded as a work of political genius. However shaky SDI's technological foundations, it may well have contributed to the ending of the Cold War. Yet its technology may come to be useful in ways unanticipated at its inception. The projected SDI armory of lasers and interceptors could one day be used to save not only the United States, but indeed the entire human race from the threat of comets and asteroids.

The scientific establishment has only slowly understood that the history of this planet, and perhaps of civilization itself, has been modified in important ways by physical impacts from space. We have come a long way since President Jefferson remarked, "I would sooner believe that two Yankee professors lied, than that stones fell from the sky," for now we know that mountains can indeed fall from the sky. And here we have perhaps the most perfect example of the quotation that opens this essay. Volumes of statistics have been amassed on either side of the question: How much effort should be devoted to a danger that is probably remote, but that may sterilize our planet? In my estimation we need to embark on serious study on the probability of comet or asteroid impactors on the planet Earth. The cost would be quite trivial, and the results should be of great astronomical

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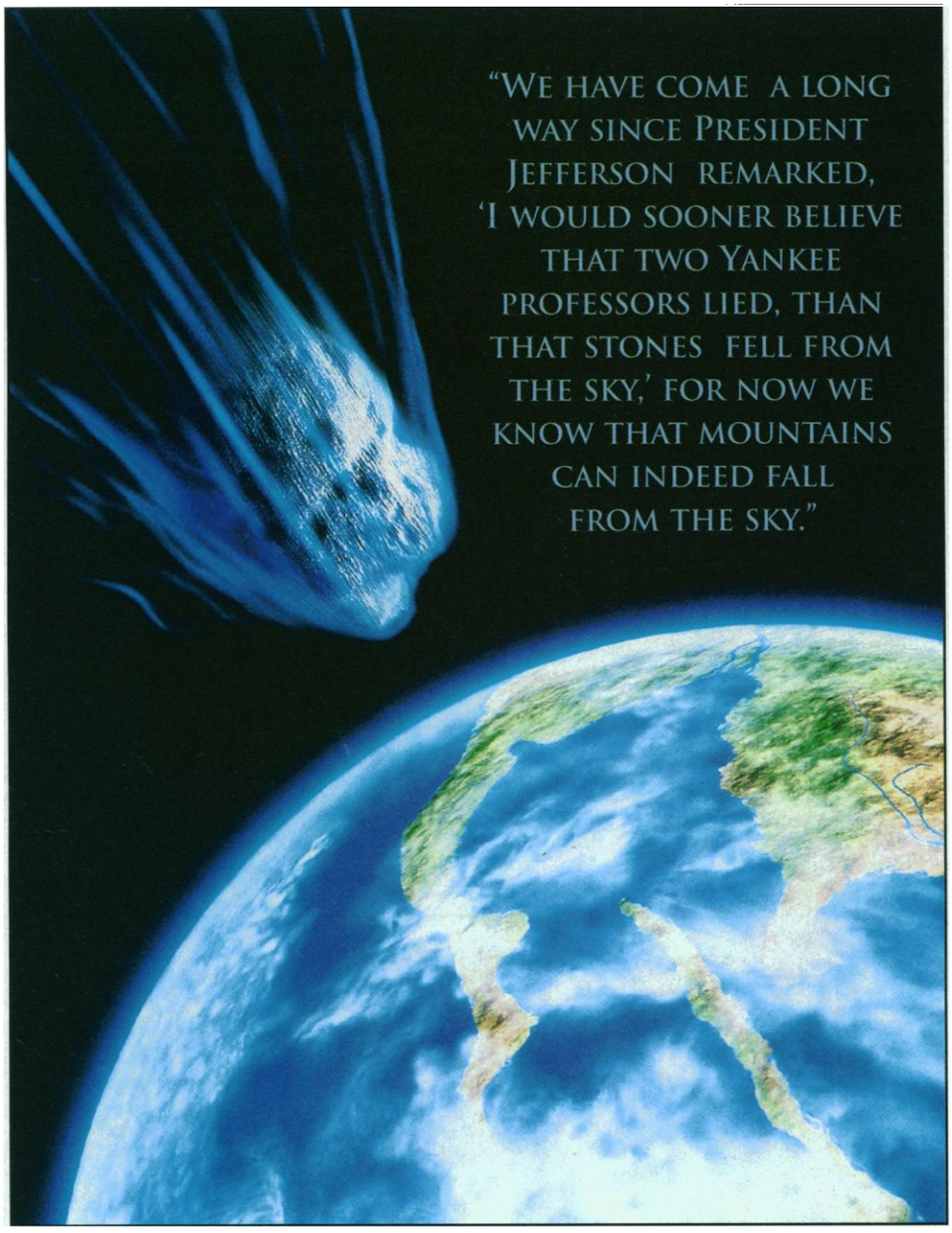
*Will and Ariel Durant, *The Story of Civilization*, vol. 1 (Simon and Schuster, New York, 1935).



value, based on our experience of comet Shoemaker-Levy's impact on Jupiter. And what a tragedy Gene Shoemaker's untimely death was! Gene, some of whose ashes are now on the moon, would have been amused by the embarrassment that his unusual internment caused at NASA and the Jet Propulsion Laboratory in Pasadena, California.

Even more controversial than the threat of asteroid impacts is what I would call perhaps one of the greatest scandals in the history of science, the cold fusion caper. Like almost everyone else, I was surprised when Pons and Fleischmann announced that they had achieved fusion in the laboratory; and surprise changed to disappointment when I learned that most of those who had rushed to confirm these results were unable to replicate them. Wondering first how two world-class scientists could have fooled themselves, I then forgot the whole matter for a year or so, until more and more reports surfaced, from many countries, of anomalous energy production in various devices (some of them apparently having nothing to do with fusion). Agreeing with Carl Sagan's principle that "extraordinary claims require extraordinary proofs" (spoken in connection with UFOs and alien visitors), I remained interested, but skeptical.

Now I have little doubt that anomalous energy is being produced by several devices, some of which are on the market with a money back guarantee, while others are covered by patents. The literature on the subject is now enormous, and my confidence that "new energy" is real slowly climbed to the 90th percentile and has now reached the 99% level. A Fellow of the Royal Society, also originally a skeptic, writes: "There is now strong evidence for nuclear reactions in condensed matter at low temperature." The problem, he adds, is that "there is no theoretical basis for these claims, or rather there are too many conflicting theories."

Yet recall that the steam engine had been around for quite a while before Carnot explained exactly how it worked. The challenge now is to see which of the various competing devices is most reliable. My guess is that large-scale industrial application will begin around the turn of the century—at which point one can imagine the end of the fossil-fuel–nuclear age, making concerns about global warming irrelevant, as oil-and-coal-burning systems are phased out.

Global warming is another area where politicians cannot be blamed for being confused. Although most scientists agree that warming is occurring, some, such as Fred Singer, who headed the U.S. meteorological satellite program, do not. We may need global warming, after all, as the current interglacial period draws to a close. As Will Durant said many years ago, "Civilization is an interlude between ice ages."* If this is true, the cry in the next millennium may be "Spare that old power station—we need more CO_2!"

Finally, another of my dubious predictions: Pons and Fleischmann will be the only scientists ever to win both the Nobel and the Ig Noble Prizes.

ILLUSTRATION: TERESE WINSLOW