

Sandia Labs

Looking to the future

Albuquerque, New Mexico

A CARTOON circulated recently at Sandia National Laboratory shows a wizard complete with pointed hat gazing intently into a crystal ball; a sign on the door in the background reveals the location to be the head office of the Future Options Group (FOG) an 8-man team of defence scientists which spends its time trying to do just that. Glenn Kuswa, manager of the FOGs (as they are known) for the past 10 months, admits that the mysterious-sounding group of futurists that he leads is a fair target for cartoonists, but he insists that the group is taken perfectly seriously by Sandia's senior management. In a national laboratory with primary responsibility for defence, future-gazing is a serious business.

FOG was formed to advise on long-term planning at Sandia only three years ago, but has already had a significant impact on both the weapons development and the basic science at Sandia. Its concern about the importance of high-speed computing, for example, led to a new laboratory division devoted to computer architectures. Sandia, in addition to carrying out contract research (mainly for the Department of Energy), is charged with anticipating future defence needs, and several of its major research efforts, such as sub-micrometre semiconductor technology, were initiated by the laboratory management.

While the laboratory's primary mission is still research into nuclear weapons, the scope of this work has broadened considerably in recent years, so much so that the laboratory recently had to be reminded by Washington that biological research, at any rate, could not be considered part of its mandate. More and more projects are carried out in collaboration with commercial companies, and the number of staff has grown to match. Sandia now employs more than 8,000 people, a figure that is not expected to increase further.

FOG is the creation of an informal group of laboratory managers seeking a mechanism for looking beyond the normal course of events, pondering how Sandia should anticipate the future.

The group started by concentrating on strategic defence, and gave advice on the subject to the White House long before President Reagan's famous star wars speech of March 1983. Missile defences continue to take up a large part of the FOGs' time. Electrothermal guns might, according to Kuswa, be capable of accelerating projectiles to even greater velocities than the rail guns now being intensively investigated for the Strategic Defence Initiative: the physics of impacts at extremely high velocities and their implications for weapons design are one focus of

the FOGs' attention.

So far, most of FOG's divinings have been delivered as briefings to Sandia's senior management, with some informal contacts with outside bodies such as the Congress's Office of Technology Assessment. Kuswa thinks FOG has played an important, if little-known, role in fostering communications between different factions at Sandia, and wants to see it move towards producing more formal written reports in future.

Not surprisingly, the successful maintenance of nuclear defence is counted the group's primary objective. The issues tackled range from the particular — for example, hypervelocity guns — to the general — brainstorming and arranging training courses in global security issues such as the world's energy supply.

Kuswa has thought about how the "nuclear winter" hypothesis might affect deterrence, but FOG is not yet committed to studying the topic in earnest. By and large FOGs just think, rather than do experiments, and Kuswa thinks that the group should wait until there are more data on nuclear winter before addressing it.

FOG can see further into the future of photonics and fibre optics, which might lead to revolutionary advances in computing speeds and which Kuswa says will certainly have important implications for the way high-speed data are recorded. Such matters are crucial for the strategic balance of power, and Kuswa believes computing is important enough to warrant at least one FOG member permanently tracking it. Such is the speed of progress that Sandia boasts that it has recently produced an experimental computer nick-

named the "VAX in a lunch box".

Software engineering is another topic FOG is studying; Kuswa is alert to the possibility that, despite what many see as a disappointing track record so far, artificial intelligence research could yet rock the strategic boat. In one attempt to make the future come a little sooner, Kuswa's group recently sought to apply expert systems, a spin-off of artificial intelligence research, to some of the laboratory's work. A retired employee had his expertise on the electrical wiring and connectors of nuclear warheads programmed into an expert system for the laboratory's future use. Kuswa hopes to persuade Sandia to make further use of expert systems for similar tasks in future.

A related subject is the likely availability of custom integrated circuits. Whereas circuit design is today still the province of the expert, the increasing sophistication of computer-aided equipment suggests that before too long the design and manufacture of a high-performance integrated circuit engineered for a specific task will be within the reach of most engineers. Contrary to FOG's usual approach, the group recently staged a demonstration of the production of specific integrated circuit.

Kuswa would like ultimately to establish a database of all military hardware, as a resource for studies of what the Department of Defense's shopping list is likely to look like in future (future bombing "platforms", including unmanned ones, are the subject of a current study). This, however, has proved difficult and is unlikely to be accomplished soon. In the meantime, there are plenty of other subjects to think about, and Kuswa can apparently see far enough into the future to know that FOGs are going to be in continuing demand. "We have," he says, "earned our keep."

Tim Beardsley

Cell lines jump US customs

Washington

THE US Department of Agriculture (USDA) has agreed to simplify and streamline its quarantine rules for the import of cell lines. Biotechnology companies have been complaining of delays of as much as a year while tissue cultures and tissue-culture products await testing at USDA's Plum Island quarantine facility. Industry sources say they hope the new procedures will cut that time to two months.

USDA's quarantine rules apply to imports of any materials that could contain foot-and-mouth disease virus and other livestock diseases not already present in the United States. Thus cell lines prepared with bovine serum or the enzyme trypsin (which is derived from cows and pigs) come under the quarantine. The safety test involves inoculating a steer, waiting 4-6 weeks and analysing a blood sample.

During negotiations between USDA and

representatives of the biotechnology industry on speeding up the process, it became clear that most of the delays were bureaucratic. Companies would, for example, be sent a bill for a test that had to be paid before testing would begin. Under the new procedures, companies will be able to establish deposit accounts with USDA so that the tests can be run as soon as products arrive at Plum Island.

The new rules will not, however, provide exemptions from the strict testing requirements that the industry had been seeking in respect of materials to be used only in clinical applications or *in vitro* diagnostics. The industry argues that so long as such materials are disposed of properly, there is virtually no chance of livestock being exposed. USDA officials say that discussions with the industry on this issue will continue.

Stephen Budiansky