

pretty well stripped of the dead wood that had been dragging them down. They fulfil just about every task their customers — that is, the EU bodies — set them, often with great success. The King report acknowledges, for example, that the biotechnology division has become the world leader in setting standards for detecting and monitoring genetically modified organisms in agriculture and food, while also playing a key part in the implementation of the controversial new Registration, Evaluation, Authorisation and Restriction of Chemical substances (REACH) regulations.

In the process of becoming customer orientated, however, the JRC lost its independent research activities. Does this matter, given that they were not highly regarded anyway?

Yes, it matters. The role of science in policy has become ever more important. Crucial decisions about climate, energy and the like rely on the highest quality of scientific information. JRC scientists need to be able to interact intelligently with cutting-edge research in the academic community, and to extend it appropriately.

But high-level scientists need an appropriate intellectual environment to work in, and this is where the JRC has had its hands tied. Right now, JRC researchers are running to stand still. As new tasks stream in from their demanding customers, research projects enthusiastically

started during a previous task are dropped — even if they might have had long-term value for policy. The scientists tend not to publish much in academic journals, as this has not been considered one of their ‘deliverables’. Most JRC science is written up in internal reports. These are not ideal conditions for attracting and keeping top, ambitious scientists.

This is why the King report’s proposal that a small proportion of the budget be directed into exploratory work is welcome, as are two other radical proposals, to some extent related.

First, the JRC needs to develop its own long-term strategies so that it can plan more rationally. Although it has 2,750 staff, the scatter-gun tasks required of it spreads them too thinly. So the strategies should also set out criteria for which tasks to accept so that critical mass can be achieved from limited human resources.

Second, the JRC needs more political responsibility. Given its accumulated knowledge and experience, and its close contact with the scientific community, it is well placed to see problems coming. Structures should be set up to allow it to advise, not just serve, its customers.

In short, the JRC needs to be allowed to grow up. Europe’s council, parliament and commission now need to shed their distrust and make the JRC an even more useful institution than it has already become. ■

Choosing a world

Titan is a slightly more appealing lunar target than Europa for the next outer-planets mission.

In just five decades, planetary spacecraft have provided an extraordinary wealth of discoveries: the oddly young surface of Venus, the ancient landscapes of Mars, the volcanoes of Io, the geysers of Triton, the lakes of Titan, the ocean of Europa. But two of the most sought-after things have not been discovered. One is life. The other is how to explore space cheaply.

The eye-watering expense of major missions imposes on the planetary enterprise a glacial tempo that is at odds with the drama of its discoveries. This is particularly so the further they get from Earth. The United States is currently deciding whether it should send its next ‘flagship’ outer-planets mission to Europa, an ice-covered moon of Jupiter, or Titan, the thick-atmosphered moon of Saturn (see page 366). The decision — in which Europe, as a partner in the mission, also has a stake — will shape the lives and interests of researchers through to the 2040s. But with total costs of more than US\$3 billion, only one mission can be afforded.

Until recently, Europa was widely tipped as the favourite. Its ice-covered ocean was one of the two most promising sites the Solar System offers for life beyond Earth. Indeed, it might have greater attractions than the other prime location, the subsurface of Mars; given that impacts can send meteorites flying between Mars and Earth, there is a real chance that any Martian life found would be related to that on Earth. Europa, which is much more isolated, is a better bet for an independent origin of life.

Unfortunately, to do full justice to such possibilities would require measurements from Europa’s surface, or even below it —

measurements that technology cannot yet offer. Instead, the proposed Europa mission would be an orbiter restricted to producing images in various wavelengths, including those from ice-penetrating radar. The data would bring some closure to arguments about the thickness of the crust (see page 384) and might identify places where the subsurface can be accessed most easily. But in the end, an orbiter would be only a precursor to the next act — a landing mission, perhaps with drilling capability — the *dénouement* of which may be half a century away.

A Titan mission, by contrast, would be unlikely to encounter life, but would be much more intimately involved with its environment. It would include a Titan orbiter with radar and other instruments to map the moon far more thoroughly than the Cassini mission’s ongoing fly-bys can; a European lander designed to float on one of the hydrocarbon lakes; and a hot-air balloon (or more accurately, a slightly-less-cold-air balloon) that would drift around the moon studying its hazy atmosphere and rich landscapes of channels, lakes and dunes.

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The Titan mission would also offer technological firsts, including the floating lander and that undeniably romantic hot-air balloon. Although floating on a lake is a skill for which there seems to be no further call in this Solar System, ballooning could be used to explore many other planets and their moons, and developing this capability could be seen as an investment in that future.

It is hard to do science when new data come in a splurge every few decades. Gifted people go elsewhere, those who remain get locked in irresolvable debate, hypotheses calcify into dogma. But at the moment there seems to be little that can be done to break the long, drawn-out rhythm of feast and famine. And if we must choose, then floating below the rings of Saturn seems marginally more appetizing than above the hard ice of Europa. ■