

MSSL – the future

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This summer we celebrate 40 years of MSSL. While MSSL continues to be the UK's largest university-based space science organisation we are not an institution! MSSL's future is not assured merely because it has survived 40 years. Indeed, we must avoid at all costs the institutional dangers of complacency and introspection. Rather, MSSL's future is assured because of its intrinsic quality and a culture of adaptive evolution - meeting the needs and challenges of our community. MSSL is primarily and foremost a science research organisation. We have an exceptionally strong science team that are addressing national and international scientific priorities.

Of course MSSL's trademark characteristic is that its science programme is strongly underpinned by a technological and operational capability that involves almost all aspects of the space research lifecycle. Moreover, these two facets of the laboratory are well integrated.

I'll now look forward and outline for you some of our plans and aspirations for the future development. In the broadest sense I am convinced that MSSL will continue to play a pivotal role in UK space science, and so remain a major international player in the field.

MSSL is of course, part of University College London – we are a research department in the faculty of Mathematical and Physical Sciences. Apart from the benefits of UCL's name and prestige, it also offers us opportunities to work closely with sister departments such as Physics and Astronomy, Earth Sciences, Mathematics and the Engineering faculty. We will continue to build on these opportunities. MSSL's geographical separation from UCL has some disadvantages (and advantages) – but curiously it is one of the most connected departments within UCL hosting the Centres for Advanced Instrumentation Systems and Systems Engineering, and we are at the heart of the Benfield Hazard Centre, and Centre for Planetary Sciences.

Although our focus is research we will continue to develop our education programme at all levels, from outreach to schools, through industrial training to postgraduate training and research. Our Master of Science programme is set for a relaunch in 2009.

At present there seems to be in an upsurge in space science. Public interest in the subject is growing, coverage in the media seems more and more frequent. Internationally we see 'vision' and 'exploration' from ESA, rebirth within NASA, and an explosion of activity from countries such as China, India, and even Brazil. Even the Science and Technology Facilities Council seems to have its heart in the right place. It is well known that a common imperative stimulates a country's innovation. We've had enough of wars so why not look to fundamental science research – and what more inspiring than space science. Indeed, in the next 40 years the world should see some amazing discoveries: an understanding the nature of Dark Matter, the detection of gravitational waves, the observation of objects at the very edge of the

universe at red-shift of $z > 10$, measurement of the atmospheric constituents of Earth-like extra-solar planets, an exploration of the oceans below ice-covered solar system bodies, and to stand again on the surface of the Moon and maybe Mars.

Let's be specific about MSSL.

Our science programme will of course, build on our strengths. MSSL is involved in 16 of the recent Cosmic Vision proposals, and although much depends upon ESA's final selection, I feel sure we will be very well placed whatever they are.

Our programme of galactic evolution and dynamics research is set to take-off with the upcoming launches of GAIA and Herschel and the recent appointment of two new lecturers in this field. Our interests in gamma-ray burst sources, enabled through our involvement in the highly successful Swift mission, will no-doubt grow, both as interesting objects in their own right, and also as probes of the early universe. When LISA finally flies we can expect to be part of a programme of gravitational wave astronomy, another tool in our study of compact objects.

UCL has great ambitions for planetary science and MSSL is at the heart of those ambitions. We will build upon: our involvement in the ExoMars rover; the application of Earth Remote Sensing tools and techniques to Mars; the development of innovative planetary exploration technologies; and, of course, our studies of solar system bodies and their interaction with the solar wind. These initiatives and others will create vibrant Planetary Science team here at MSSL and as part of the Centre for Planetary Sciences, within UCL.

While the mutually agreed transfer of some of our Earth Remote Sensing activities to the Earth Sciences Department has naturally reduced the volume our NERC related science we continue to provide underpinning software expertise in a spirit of interdepartmental collaboration. Moreover, our Climate Extreme group will, without doubt, continue its high profile activities, and offer innovative research and award-winning products to benefit the prediction and monitoring of tropical storms worldwide, European extreme weather and global drought.

In many ways space plasma physics has been too successful. Arguably, the subject has moved beyond the study of interesting phenomena in magnetospheres, to become a study of fundamental physical processes such as magnetic reconnection and plasma oscillations. Consequently, it is less accessible than other space science disciplines to the layman (and not just the layman) – perhaps it's lost its sex appeal. But becoming more mature should not be seen as a bad thing, in fact I believe it is what science is really all about. We must turn around a sense that space plasma physics is an 'old' science and give it the respect it deserves – as a discipline in which the most basic physical processes can be studied.

Solar Physics in the short term is very exciting indeed given the recent launches of Hinode and Stereo and with NASA's Solar Dynamics Observatory coming soon. MSSL is well placed to exploit all of these missions, addressing some of the so far intransigent mysteries of this enigmatic object. Surely an understanding of the heating and dynamics of the Solar Corona is not far away now. In the medium term we are enthusiastic supporters of ESA's Solar Orbiter mission, a spacecraft that will pass

well within the orbit of Mercury and finally trace the link between phenomena seen on the surface of the Sun and disturbances seen in the Solar Wind.

This naturally brings us to the Sun-Earth Connection. In part as a recognition of the synergies between the Solar and Space Plasma groups, and the need to understand the Solar System as a System, our interests in the Sun-Earth Connection continue to grow. Future missions such as the Chinese KuaFu, for which we hope to provide instruments, are an exciting prospect. With Solar Orbiter and KuaFu we will be able to understand the life history of Coronal Mass Ejections, from their origin in magnetic reconfigurations on the Sun, to their effects on the Earth's magnetosphere.

I see little evidence that space science instrumentation will be available as 'off-the-shelf' in the foreseeable future – they will surely continue to be bespoke, optimised, and need to compete with the best in the world. Our engineering teams have a vital and exciting future – but a future which must continue to adapt, being cognisant of developments in other fields, coherent with the aspirations of industry and recognising the financial constraints of our paymasters.

We've recently had a million pound injection in new facilities (and that's not including the new building). On the 'detector' front while our focus is changing, the principle of supporting our science programme remains. In the future we can expect to see miniaturization particle detectors, imaging, optics and cryogenics at the forefront. It was also great to see the first project in many years to develop Earth Remote Sensing instrumentation kick-off at MSSL last week – I'm sure there will be many more in the future.

Our technological capability is an asset, both to us and to UCL. This is evident in the new building on site, designed in part to provide laboratory space for the development of particle physics instrumentation in collaboration with staff in the Physics and Astronomy Department. Indeed, we now have a number of technology projects supporting particle physics, and a growing interest at MSSL in neutrino astronomy.

In recent years we have created a technology management group, providing a focus for much of our Knowledge Exchange activities and a home for CAIS and the Centre for Systems Engineering. Building hardware which operates reliably in a hostile environment, delights its users, and comes in on budget (more-or-less) and time is a no mean feat. In my frequent interactions with managers and engineers from other domains I see almost universal admiration and often envy for what we seem to take almost for granted. I often say that we should strive to be excellent in everything we do, seek to improve practices all the time, and teach others (after all we are part of UCL). The Technology Management group is the outward looking manifestation of these principles applied to our technology programme.

Significant expansion on this site is not really an option, and we're full. We need to make better use of the space we have and rather than expand our numbers. In the future we will enhance this site to ultimately improve our scientific productivity. That productivity is a result of the dedication and commitment of our staff. Something that we must not forget and so we must always seek to provide an environment that is appropriately conducive. Next on our list of improvements planned will be to develop Ariel House ground floor so that we can more efficiently run small international

workshops, seminars, training events and team meetings. In recent years we have had several very successful hands-on, very focussed workshops – there's another one next week. I believe MSSL should deliver a regular programme of such workshops in an environment that is geared to their success.

I hope everyone has enjoyed the gardens, thanks to the enthusiasm and sheer competence of our gardener they have been significantly improved in recent years and I'm sure will continue to do so.

I have the privilege of directing an excellent team. We're all in this endeavour together, and my respect goes not only to the scientists and technologists but to all of the support staff without whom simply nothing would happen.

However, my final thanks goes to the sometimes long suffering families of our staff. Space science demands extraordinary commitments but the rewards are extraordinary too – albeit not in a financial sense. The cost can be a lot of stress at home. Speaking to those family members here, I'm sure you are as proud of them as I am.

So at last a toast to MSSL, may she enjoy at least another 40 years of prosperity.