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Planning orbiter science operations

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The scientific return from robotic missions is critically dependent on the quality of support for science operations. This paper summarises key lessons learned from science operations for existing orbiter missions (such as Mars Express) and explores how these lessons may be applied to future robotic orbiters. The most important lesson learned is to make a logical distinction between two key elements: (1) a planning element that establishes the science activities to be performed and ensures that the spacecraft can support those activities (e.g. in terms of power, data return to Earth, etc); and (2) a commanding element which converts the planning into the detailed commanding for uplink to the spacecraft. This second stage includes several elements critical to the quality of observations: e.g. detailed instrument configuration to match observing conditions, fine-tuning of instrument parameters in response to latest data on its performance. This paper will discuss key features of the planning and commanding processes including: (a) the value of iterative planning as a way of maximising the scientific return by taking account of how science activities can affect the spacecraft resources needed to run those activities, (b) the importance of understanding the planetary environment in which operations take place (which leads to constraints quite different to those of missions in low Earth orbit) and (c) the need for coordination between instruments on the same missions, with other missions and with lander activities (both science and communications). Finally we will present some requirements for introducing on-board autonomy to improve the scientific return.