The recent Physics Nobel Prize 2012 for experimental breakthroughs in the field of Quantum Feedback Control makes very clear that work on a rigorous mathematical foundation for Quantum Control is now at least as timely as it was when we started this project in 2009. And in fact, in all the directions described below, work will continue after the end of the project.

The Principal Investigator, Dr Rolf Gohm, took a leading role in the development of connections between multi-variable operator theory and the theory of quantum processes, first for a model based on infinite tensor products, then by a detailed study of the important concept of a transfer function and finally (not yet published) in a very systematic interpretation of quantum processes as linear systems with non-commuting variables, as a basis for further progress. Dr Gohm also worked on establishing connections on a personal level between the rather separate communities of operator theory (mainly pure mathematicians) and quantum control (mainly theoretical physicists). by attending and contributing to a number of workshops and conferences. The work on transfer functions appeared in a proceedings volume of an IWOTA workshop which is the main meeting of the mathematical experts in this area and this may well have been the first opportunity for some of the operator theorists to take notice of this promising new field of applications. Scattering theory for quantum Markov processes, mentioned in the title of the project and the first indication of the connections investigated here, continued to play an inspiring role in particular in the very constructive discussions with the visiting researchers of the project, Prof. Kuemmerer and Prof. Maassen, and has developed into an ongoing collaboration on a problem of state preparation by repeated interactions.

The work of the Co-Investigator, Prof. John Gough, on extending the range of applicability for quantum filtering theory and in developing a systematic theory of quantum networks, has been taken up by the Quantum Control community as a valuable theoretical underpinning for the description of complex experimental designs. In particular he has organized an important meeting at the Kavli Royal Society International Centre on `Principles and Applications of Quantum Control Engineering' in December 2011 where many of the leading figures participated. The use of quantum stochastic differential equations, which is characteristic for this approach, fits very well with some of the more intuitive approaches of theoretical physicists and undoubtedly has a permanent place in the mathematical foundations of Quantum Control.

Jeff Smith, major project "Stability in Discrete and Continuous Time Systems" supervised by Dr Rolf Gohm. PhD-student Sebastian Wildfeuer, main supervisor Prof. Gough, second supervisor Dr Rolf Gohm.

We had the good fortune to have with Dr Claus Koestler an unusually highly qualified researcher as a research associate for the project who was able to push some additional directions on his own. In cooperation with the Principal Investigator and with other collaborators, he was at the centre of an emerging theory of quantum distributional symmetries in an operator algebraic context. One of the key features arising is the ability to derive factorization properties and non-commutative independence in situations which were inaccessible before. A promising avenue of research emerging from systematically taking these symmetries into account will be the possibility to treat completely new types of quantum processes in a mathematically rigorous way. Dr Koestler was also very engaged in distributing the new ideas in conferences, workshops and research visits and his excellent contacts contributed significantly to the successful LMS-Meeting and Workshop on `Quantum Probabilistic Symmetries` which we organized in September 2012 in Aberystwyth and which was a memorable final dissemination event in the grant period.