This story dates back to the summer of 1998, when I reported for duty at Naval Air Station Valkenburg. At the time I had just graduated mathematics at Groningen University and began my first job as a naval research officer. Leaving behind the academic practice of lemma, proposition and mathematical proof, I found myself in the operational world of naval aviation.

Valkenburg housed the Centre for Operational Data and Analysis (CODA) where I was introduced to the silent world of passive sonar. The acronym SONAR stands for SOund Navigation And Ranging, but I was soon told to forget these words, as passive sonar is something completely different from what these words suggest. Naval Air Station Valkenburg was the home of thirteen P3C Orion Maritime Patrol Aircrafts (MPAs), of which the main task was Anti-Submarine Warfare (ASW). The aircraft were able to drop sonobuoys that radio-transferred underwater sounds back to the plane. The centre was responsible for maintaining handbooks with acoustic signatures and the yearly advanced course for sonar operators.

At first things were overwhelming and new to me, but I am still thankful to Ir. Bert Houtman for taking me on board and explaining the practical side of signal processing. After five years of mathematics at the university, I finally came to enjoy the beauty of Fourier transformation in practical applications. I also owe much thanks to LCDR Jan Bakker and LT Jaap Viergever (ret.) for learning me the tricks of the trade of classifying ships by their acoustic signatures. We had many good times during our trips abroad, and we analyzed and discussed many weird underwater sounds. I also have good remembrance of the many Friday afternoons in the lab when we operated that big orange machine called FTAS. There in that cinematic setting of the “inner sanctum”, we replayed old tapes from the archives and used new analysis techniques to discover “things” never seen before. To me, the centre was an inspirational place, and in close contact with many petty
officers I was able to develop the sonar analysis tool GramReader. I remember our participation in an ASW exercise that was flown from Naval Air Station Kevlavik, Iceland, once the “ASW capital of the world”. We had a laptop computer with our own software tied to a table next to the galley, and managed to analyze underwater sounds in parallel with the ageing equipment of the Orion. Shortly after that the sad news came that Valkenburg was to be closed, and the Orions to be sold. Submarine hunting was said to belong to the times of the Cold War and today both air stations Valkenburg and Kevlavik have been abandoned.

In 2004 I moved on to the Royal Netherlands Naval Academy. I thank Prof. Dr. Ir. Frans Absil who offered me the position of assistant professor in underwater systems that I held unto 2008. I also like to thank Dr. Herman Monsuur and Dr. Theo Hupkens for their friendship, advice and support in various matters. After six years of applied R&D at CODA, Prof. Absil gave me the opportunity to do scientific research in the Rapid Environmental Assessment (REA) project. I thank Dr. Jean-Pierre Hermand for his good suggestion to start working on metaheuristic optimization techniques and geoacoustic inverse problems. I thank Prof. Dr. Kevin B. Smith for scientific and personal friendship, both during and after his time at the college as a visiting professor from the U. S. Naval Postgraduate School in Monterey. As this thesis testifies, the scientific research with Hermand and Smith turned out to be quite successful in terms of journal articles, conference papers and reports.

The years I spent as teacher and researcher at the naval college were hectic. The college was reorganized into the Netherlands Defence Academy and all those years there were concerns about the research budget. Nevertheless we managed to pull off two sea trials: a small scale expedition to the Saba bank in 2006 and the much larger NATO sea trial Battlespace Preparation 2007 (BP07) in the Mediterranean sea. Both sea trials featured the deployment of hydrographic survey vessel HNLMS Snellius.

A special word of thank is for the commanding officers of HNLMS Snellius, LCDR Diederik van der Plas (2006) and CDR Ir. Robert-Jan van den Oord (2007), the hydrographers LCDR Onno Grefen and LT Suzanne Duineveld and the crews of HNLMS Snellius in 2006 and 2007. Another word of thank is to LT Jurriën van Kasperen and his Very Shallow Water team for the deployment of the REMUS vehicles. I am convinced that the participation of LCDR Drs. René Dekeling was an important factor in making BP07 a scientific succes. René, thank you for your invaluable support in organizing workshops and sea trials, for sharing laughter and disappointments, and not to forget sharing remarkable recordings of Killer Whales and other underwater sounds that impressed our colleagues and other audiences.

A special word of thank is to LT Tjarda Wilbrink. Apart from being an appre-
ciated colleague, you might be the only one among my friends to really understand what my current and previous jobs are about.

In the summer of 2008 I moved on to the Planning and Decision Support (PADS) department at the Centre for Automation of Mission Critical Systems, CAMS-Force Vision. The centre is a software house that is part of the Defence Materiel Organisation, and as such is responsible for the operational software on her majesty’s ships. I was to replace CDR Dr. Ir. Fok Bolderheij and carry on with his work on sensor management. Fok, I’m very happy with your involvement and the strong team that we are part of. A word of appreciation to those who are or were members of the PADS team: Dr. Ir. Rick van der Meiden, LT Dr. Ir. Wilbert van Norden, LT Krispijn Scholte, Michiel Scholten, LT Ir. Tanja van Valkenburg-van Haarst, and Ir. Mark Zijlstra. It is thanks to the cheerfulness and dedication of you guys that “we do the weird stuff.”

I further like to thank Theun van Dijk and Drs. Marc van Velzen, heads at CAMS Force Vision, for giving me the opportunity to finish my research in acoustics and optimization techniques, and reporting about it in this thesis.

I thank Prof. Dr. Ir. Frans Groen and Prof. Dr. Drs. Leon Rothkranz for acting as my promotor and co-promotor, and for your vigilant remarks on the draft of this thesis. I further owe thanks the promotion committee, for reading and commenting this thesis. Your contributions are being much appreciated.

Thanks to my friends and family, for your love and attention, friendship, and just for being there. I owe special thanks to my English sister-in-law Catherine, for proofreading this dissertation. And the final word is to my dearly loved wife San: thank you for your patience and all. I don’t know how, but somehow you manage to live with me, and accept all of my noisy or expensive hobbies. Now this one has come to an end... what shall I do next?

Franeker       Vincent van Leijen
Spring 2010.