PREFACE

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In 2015, the world is facing a formidable series of security challenges. These include the ongoing existence of nuclear arsenals, the recent use of chemical weapons, and the risks presented by an evolving biotechnology industry. They also include the illicit and uncontrolled spread of conventional weapons, terrorism, and instability caused by conflict, natural resource stress and disease. International tensions and uncertainties are mirrored at the new frontiers of cyberspace and outer space. Emerging technologies may provide novel solutions to these issues, but they will almost certainly present new challenges to international peace and security too.

The existing framework of international treaties and agreements provides a powerful tool for overcoming these challenges. The implementation, monitoring, and verification of these arrangements builds confidence and know-how, allowing the international community to work collectively toward mutual security. Innovative approaches to verification and implementation that draw on technical, legal, political and economic insights will help achieve this goal.

The opaque and uncontrolled spread of conventional and unconventional weapons around the world can lead to human rights abuses, fuel conflicts, encourage arms races, and foster instability between states. Demonstrating and supporting the implementation of initiatives that reduce these threats—such as the Arms Trade Treaty, the Biological and Toxic Weapons Convention, the Chemical Weapons Convention, and the Nuclear Non-Proliferation Treaty—provides states with the confidence they need to restrain their own defence activities and capabilities.

Mutual security also depends on sustainable development, and the maintenance of the complex natural resource systems on which states rely. Implementing the international initiatives that aim to repair or prevent damage to these resource systems, and demonstrating this through monitoring and verification, supports collective action by recognising states that are meeting their obligations and identifying those that are not. Moreover, monitoring systems in this field can provide essential information on the nature and extent of states' actions on the problem being addressed. They provide a feed-back loop allowing governments and citizens to review and revise their actions accordingly.

International treaties and agreements cover a diverse set of aims and issues, and the activities they control are therefore similarly diverse. That being said, most agreements revolve around similar principles of monitoring and verification. They also often

require, or encourage, parties to put in place a legislative framework that will provide domestic guidance on how their obligations will be met, and a legal backbone to support this.

Nurturing a wide range of technical, legal, political and economic tools will help the international community support cooperative approaches to shared security challenges. Tackling these challenges requires a sound appreciation of the interests of governments and other stakeholders, and how they interact with one another. It requires identifying the approaches that worked in the past and those that did not, and how verification and implementation systems should evolve to remain efficient and effective. And assistance must be made available to governments and other stakeholders who might otherwise struggle to participate in collective approaches to security to the extent they would like.

These issues are being addressed by a wide and multidisciplinary community of organisations and individuals committed to finding ways of galvanising and sustaining purposeful collective action toward a more peaceful and productive future.

In this context, VERTIC is re-launching its book series focusing on international agreements for global security and development. This publication presents an accessible set of essays, authored by leading practitioners and experts from the community, that explain and appraise the verification and national implementation mechanisms that make international arrangements work in practice. The essays also throw light on how emerging developments in technology, industry, business and society around the world may impact this field, both in terms of new risks to international agreements, and new opportunities to strengthen them. While the essays contained here typically take an interdisciplinary approach to their subjects, some turn their focus towards one particular perspective—be it legal, political, or technical.

We have made a number of changes to the previous book series. These include publishing every two years, rather than annually; renaming the publication as *Verification & Implementation;* and applying a peer review process to the chapters to complement our normal review procedures.

Readers of this publication will find practical analysis of verification and implementation issues that can assist them in addressing or researching current challenges faced by the international community. The series serves as a useful reference tool for a wide range of stakeholders including practitioners, political decision-makers, diplomats, government officials, scientists, lawyers, the media, students and the private sector.

Chapters one and two focus on a key international security event of recent times; the Joint Comprehensive Plan of Action (JCPOA) between Iran, the P5+1, and the EU—which was concluded in July 2015 after many twists and turns. The first chapter—'Iran and the evolution of safeguards' by Mark Hibbs—analyses how the evolving International Atomic Energy Agency nuclear safeguards system, which verifies states' non-

proliferation commitments, has coped with Iran's nuclear activities and argues that the deal's implementation will be a critical test case for multilateral nuclear verification and the nuclear non-proliferation regime more broadly. The second chapter—'Securing Iran's front end' by Andreas Persbo—complements the first by discussing how the verification goals and arrangements agreed under the deal address Iran's uranium mining and milling capacity (the 'front end' of the nuclear fuel cycle). It examines these arrangements in the light of potential diversion scenarios, discusses how specific verification methods could be applied—including by using novel technology—and how such methods may relate to the development of IAEA safeguards in the longer term.

Chapters three and four widen the scope of discussion on international nuclear agreements. 'In defence of the evolution of safeguards' by Craig Everton examines the 'state level concept' in the development of IAEA safeguards, and argues that while there is a perception that the processes underpinning this concept represents something fundamentally new, it is rather concerned with making more effective use of the adaptability already provided for. 'Organisational culture for safety, security and safeguards (3S) in new nuclear power countries' by Don Kovacic focuses on how states can improve efficiency and effectiveness by integrating the organisational cultures of nuclear safety, security and safeguards. It cautions that there is currently no widely accepted understanding of what is meant by a nonproliferation culture, and suggests that the international community, and in particular countries with mature nuclear power programmes, should collaborate with newcomer countries to tackle non-proliferation needs.

Chapters five and six move on from nuclear safeguards to concentrate on other forms of nuclear verification. 'Investigating multilateral verification of nuclear disarmament: fuel cycle modelling for simulations' by David Keir and Russell Moul presents a methodology for modelling nuclear fuel cycles in notional nuclear-armed states. These models will provide baseline data for the development of verification solutions and also educational simulations. 'Dealing with Objections to the CTBT' by Ed Ifft gives a US perspective on the political, legal and technical issues currently surrounding the Comprehensive Nuclear Test-Ban Treaty and addresses four objections to entry into force: verification, weapons stockpiles, relevance to non-proliferation and definitions.

The latter half of the publication moves away from the nuclear field to discuss important developments in international efforts to tackle chemical weapons and progress in implementing the Biological Weapons Convention. It also presents an analysis of the genesis of a major new conventional arms treaty and a broad discussion of security in the new domain of cyber space.

Chapter seven presents a record of a major undertaking of our time carried out by the Organisation for the Prohibition of Chemical Weapons (OPCW). 'Chemical demilitarisation in Syria: an overview' by Dominique Anelli and Mehran Rouzbahani provides an account of the demilitarisation process in Syria, through facts, figures and

official decisions. It details the types of chemicals involved, how they were processed, what equipment and vessels were used, and the involvement of several countries and commerical bodies in addition to the central role of the OPCW itself.

Chapter eight by Angela Woodward focuses on the 'Biological Weapons Convention: implementing legislation and compliance'. The chapter notes that, in the absence of a verification regime for the convention, proposals to enhance transparency and build confidence in compliance put national legislation in the spotlight. The chapter discusses the legislative implementation requirements of the convention, suggests that different models of legislative compliance will be necessary, and gives a précis of the confidence-building proposals in this area.

Chapter nine 'The Arms Trade Treaty: making a difference' by Jo Adamson OBE and Guy Pollard MBE provides the historical context for the treaty from events early in the last century, through to the Cold War, recent regional and domestic conflicts, to the present day. The chapter charts how the momentum for developing the treaty was built through a coalition of NGOs and champion states. It notes that its entry into force demonstrates the power of international cooperation and argues that if the treaty is properly implemented 'it has the capacity to lead to a better regulated international trade, choke supply to the illicit market and evolve over time to keep pace with new developments.'

The final chapter in this volume focuses on a new and influential domain of international cooperation and conflict: cyber space. 'Fundamentals of Cyber Security', by David Clemente provides a foundational examination of this domain and of the challenges and opportunities for international cooperation within it. The chapter discusses the roles and capacities of the public and private sectors in general, and also considers the divergent positions and interests of several governments across the world. The chapter highlights the problem of attribution online, and its impact on attempts to develop and verify international agreements in this area. It concludes by noting that there is still much work to be done to harness the opportunities of cyberspace while understanding and minimising its dangers.

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