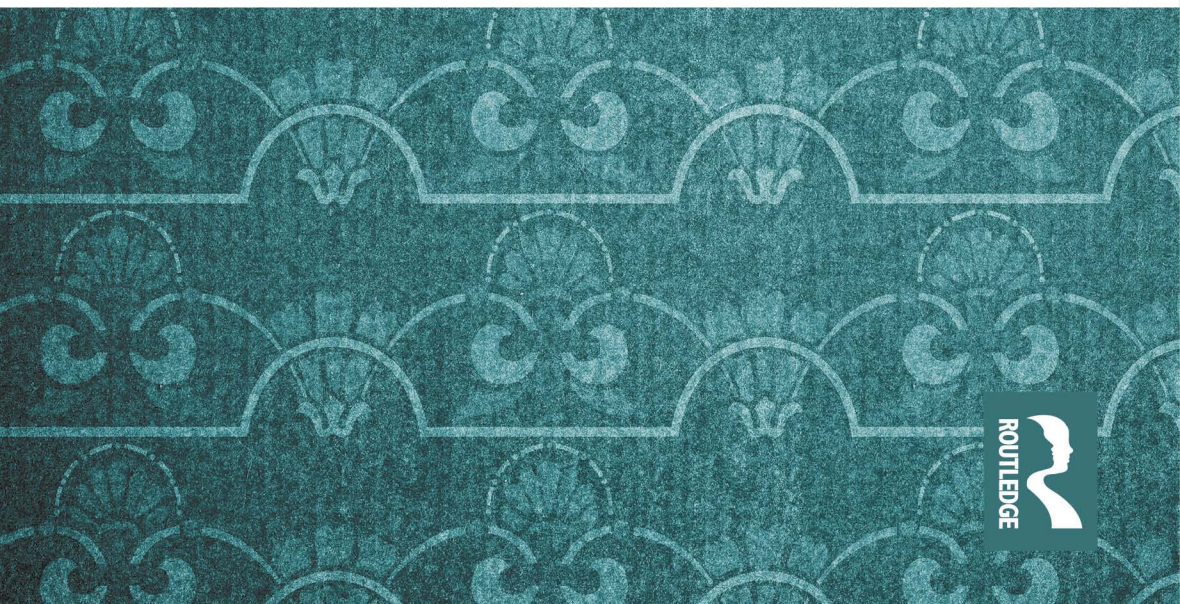
Routledge Global Security Studies

NUCLEAR COMMAND AND CONTROL NORMS

A COMPARATIVE STUDY

Salma Shaheen



Nuclear Command and Control Norms

This book offers a new analytical framework for studying nuclear command and control (C2), based on a comparative study of four nuclear weapons states (NWS).

The subject of nuclear operations management has long been shrouded in secrecy, and whilst the importance of nuclear C2 cannot be disputed, there are few academic studies into how and why states develop these systems. This volume includes a comparative study of the development of nuclear C2 by four different NWS (Britain, China, India, and Pakistan) and demonstrates that, despite several differences, there is a central set of factors that remain constant. The analytical framework used in this study identifies key factors that can potentially shape the evolution and stability of nuclear C2. These factors include geostrategic (threat) environment, international norms, leadership, and control of nuclear operations (civil-military control). The book also analyses the interaction among different stakeholders within the nuclear C2 enterprise. It recognises that politicians, the military and scientists all have key but different roles to play, and the way these stakeholders have learned to co-exist with each other is explored. This volume offers a set of dynamics that could form a global norm for nuclear C2, serving as a standard for new entrants into the nuclear club.

This book will be of much interest to students of nuclear proliferation, global governance, and International Relations in general.

Salma Shaheen holds a PhD in War Studies from Kings College London, UK.

Routledge Global Security Studies
Series Editors: Aaron Karp and Regina Karp

Global Security Studies emphasises broad forces reshaping global security and the dilemmas facing decision-makers the world over. The series stresses issues relevant in many countries and regions, accessible to broad professional and academic audiences as well as to students, and enduring through explicit theoretical foundations.

North Korea, Iran and the Challenge to International Order
A Comparative Perspective
Patrick McEachern and Jaclyn O'Brien McEachern

Stable Nuclear Zero
The vision and its implications for disarmament policy
Edited by Sverre Lodgaard

US Grand Strategy in the 21st Century
The Case for Restraint
Edited by A. Trevor Thrall and Benjamin H. Friedman

US National Security Reform
Reassessing the National Security Act of 1947
Edited by Heidi B. Demarest and Erica D. Borghard

Geo-economics and Power Politics in the 21st Century
The Revival of Economic Statecraft
Edited by Mikael Wigell, Sören Scholvin and Mika Aaltola

Nuclear Command and Control Norms
A Comparative Study
Salma Shaheen

For more information about this series, please visit: www.routledge.com/Routledge-Global-Security-Studies/book-series/RGSS

Nuclear Command and Control Norms

A Comparative Study

Salma Shaheen

Routledge
Taylor & Francis Group
LONDON AND NEW YORK

First published 2019
by Routledge
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

and by Routledge
711 Third Avenue, New York, NY 10017

Routledge is an imprint of the Taylor & Francis Group, an informa business

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging-in-Publication Data
A catalog record has been requested for this book

ISBN: 978-1-138-34929-2 (hbk)
ISBN: 978-0-429-43638-3 (ebk)

Typeset in Times New Roman
by Wearset Ltd, Boldon, Tyne and Wear

Contents

Abbreviations

AMS	Academy of Military Science
ATV	Advanced Technology Vessel
ANMCC	Alternate National Military Command Centre
ACDA Dte	Arms Control and Disarmament Affairs Directorate
AEC	Atomic Energy Commission
AWRE	Atomic Weapons Research Establishment
BMD	Ballistic Missile Defence
BMEWS	Ballistic Missile Early Warning System
BVR	Beyond-visual-range
BARC	Bhabha Atomic Research Centre
BJP	Bharatiya Janata Party
BNDSG	British Nuclear Deterrent Study Group
CCS	Cabinet Committee on Security
CND	Campaign for Nuclear Disarmament
CMC	Central Military Commission
CJSC	Chairman Joint Chief of Staff Committee
CJSOC	Chairman of the Joint Chiefs of Staff Committee
CAS	Chief of Air Staff
COAS	Chief of Army Staff
CDS	Chief of Defence Staff
COS	Chiefs of Staff
CCP	Chinese Communist Party
CEP	Circular Error Probability
C2	Command and control
C3I	Command, Control, Communication & Intelligence
C4I	Command, Control, Communication, Computers and Intelligence
C-in-C	Commander-in-Chief
CIRB	Comprehensive Investigation and Research Bureau
CTBT	Comprehensive Test-ban Treaty
CD	Conference on Disarmament
DCC	Defence Cabinet Committee
DCN	Defence Communications Network
DefCons	Defence Conditions

DAE	Department of Atomic Energy
DRDO	Department of Defence Research and Development
DSTC	Department of Science & Technology China
DCC	Development Control Committee
DG	Director General
DFH-1, 2	Dong Fang Hong-1, 2
DF-1, 2, 3, 4, 5	Dong Feng-1, 2, 3, 4, 5
DND	Draft Nuclear Doctrine (Indian)
EAMs	Emergency Action Messages
ECC	Employment Control Committee
ESDs	Environmental Sensing Devices
ELF	Extremely Low Frequency
GHQ	General Headquarters
GWOT	Global War on Terror
GDP	Gross Domestic Product
GNP	Gross National Product
HQs	Headquarters
HMG	Her Majesty Government
HMS	Her Majesty's Ship
HEU	Highly enriched uranium
HRP	Human Reliability Programme
H-bomb	Hydrogen bomb
IR	Imam's Representatives
IHE	Insensitive high explosives
IBGs	Integrated Battle Groups
IGMDP	Integrated Guided Missile Development Programme
ICBM	Intercontinental Ballistic Missile
IRBMs	Intermediate Range Ballistic Missiles
IISS	International Institute of Strategic Studies
IRGC	Islamic Revolutionary Guard Corps
JIC	Joint Intelligence Committee
JL-1	Ju Lang-1
KRL	Khan Research Laboratories
kT	Kiloton
LeT	Lashkar-e-Taiba
LOX	Liquid oxygen
LM-1, 2, 3	Long March-1, 2, 3
MRBM	Medium-range ballistic missile
MoU	Memorandum of Understanding
MR	Military regions
MoD	Ministry of Defence
MIDAS	Missile Defence Alarm System
MIRV	Multiple Independently Targetable Re-entry Vehicle
NCA	National Command Authority (Pakistan)
NDU	National Defence University

NESCOM	National Engineering and Scientific Commission
NSA	National Security Advisor
NSAB	National Security Advisory Board
NSC	National Security Council
NSNC	National Strategic Nuclear Command
NATO	North Atlantic Treaty Organisation
NCA	Nuclear Command Authority (Indian)
NCBMs	Nuclear Confidence Building Measures
NSG	Nuclear Suppliers Group
NWS	Nuclear Weapon State
PAEC	Pakistan Atomic Energy Commission
PINSTECH	Pakistan Institute of Nuclear Science and Technology
PTBT	Partial Test-ban Treaty
PNE	Peaceful nuclear explosion
PLA	People's Liberation Army
PALs	Permissive action links
PES	Permissive enable system
PRP	Personnel Reliability Programme
PID	Political Ideological Directorate
PM	Prime Minister
PSA	Principal Scientific Advisor
QRA	Quick Reaction Alert
RSS	Rashtriya Swayamsevak Sangh
R&D	Research & Development
RAF	Royal Air Force
SLBMs	Sea-launched ballistic missiles
SUPARCO	Space and Upper Atmosphere Research Commission
SOPs	Standard Operating Procedures
SAC	Strategic Air Command
SASA	Strategic Armament Safety Authority
SCCSS	Strategic Command and Control Support System
SFC	Strategic Forces Command
SPD	Strategic Plans Division
SPG	Strategic Policy Group
SPF	Strategy Programme Staff
SACEUR	Supreme Allied Commander Europe
SAM	Surface-to-air missile
TNWs	Tactical nuclear weapons
TSR2	Tactical Strike & Reconnaissance, Mach 2
TEL	Transporter Erector Launcher
UKAEA	United Kingdom Atomic Energy Agency
UF6	Uranium tetrafluoride
VLF/LF	Very Low Frequency/Low Frequency
VCDS	Vice Chief of Defence Staff
WMDs	Weapons of Mass Destruction

Introduction

Does there exist a possibility of developing and strengthening a global nuclear command and control (C2) norm based on standardised policies, mechanisms and procedures to ensure safe and secure conduct of nuclear operations? This research indicates such a possibility, the realisation of which depends on active and directed efforts by all nuclear weapon states (NWS) to have a greater control over *planning the unthinkable/Armageddon*. Undoubtedly, the risk of unauthorised and/or inadvertent nuclear use remains significant in the twenty-first century given the presence of growing number of nuclear weapons states (NWS) and aspirant countries. This is multiplied by the presence of unresolved conflicts and tensions among NWS such as India–Pakistan, US–North Korea, US–Russia, US–China coupled with a new and most challenging dimension of threat – non-state actors, with terrorist groups expressing interest in acquiring nuclear weapons. As a consequence NWS have sought to ensure that their nuclear forces are used only and when authorised and not otherwise through complex and specialised nuclear command and control systems with multiple layers of redundancy. These must also be capable of delivering credible nuclear deterrence, by making available the required nuclear forces to be launched when authorised. It must also carry out these functions effectively both during peacetime, crisis and if subjected to first strike. The policies, mechanisms, and procedures required to establish and maintain effective and efficient nuclear deterrence are subject to evolve over time in response to technological advancements and emerging challenges. However, development of nuclear C2 by different NWS in different times and regions with a directed objective of conducting an authorised nuclear use highlights the need to realise the existence of global nuclear C2 norm.

This book offers a set of dynamics that could form a global norm for nuclear C2 serving as a standard for new entrants into the nuclear club. The comparative study of development of nuclear C2 by four different nuclear weapon states (Britain, China, India, and Pakistan) demonstrates that despite several differences among these NWS, there is a central set of factors that remains constant over time and space. This further indicates that there exist commonalities in the development of nuclear C2 by different countries. The four cases (and time periods) that have been selected for study in this research are the United Kingdom (1952–1967), China (1964–1979), India (1974 to 1997 and 1998–2013),

and Pakistan (1998–2013). These have been deliberately chosen to be the first 15 years of development, the rough time taken for these countries to establish a credible nuclear C2 and periods where each system underwent a significant evolution.[1] This coverage across different time periods indicates the normative development of nuclear C2 at international level. Whilst these cases are separated in time and space they have the key commonality that each country has developed relatively small nuclear forces, certainly in comparison to United States and Russia. Case studies on Britain and China are selected because they contributed towards the development of the global norm of nuclear C2 along with other developed NWS – the US, Russia, and France. Whilst other small NWS states, such as France, Israel, and North Korea, could have potentially been included within this study they are not due in part to the author's limitation of conducting research on those cases. North Korea is relatively new NWS so information about its nuclear C2 systems is difficult to access. Likewise, Israel is not included due to its policy of nuclear opacity and lack of information on Israeli systems in the public domain. One of the observations of this research highlights the significance of nuclear testing to ensure necessary and sustained confidence in management of nuclear operations in the case of new NWS (India and Pakistan), which might destabilise the emerging global norm of nuclear C2.

This book offers a new analytical framework for studying nuclear C2 (discussed in Chapter 1) that can be further developed by exploring the nuclear C2 of, for instance, France and North Korea. The framework that is applied on all four selected NW states, identifies key factors including geostrategic (threat) environment, international norms, leadership, and control of nuclear operations (civil-military control) that can potentially shape the evolution and stability of nuclear C2. In this analysis particular attention is devoted to the interaction among three different stakeholders within the nuclear C2 enterprise. This follows from the recognition that politicians, the military, and scientists all have key but different roles to play in the development of such systems. Albeit roles that may not necessarily align at all times. Consequently, how these three stakeholders learn to co-exist with each other over time and establish strong working relations is explored. Moreover, among four independent variables of the framework international norms tend to be very challenging for newer NWS, particularly India and Pakistan, with reference to nuclear testing.

This book provides an insightful attempt to understand the subject of nuclear operations management that has continued to be shrouded in secrecy for about three-quarters of a century. The importance of nuclear C2 cannot be disputed; however, despite this there is a relative dearth of academic studies into how and why states develop these systems. This is due in part to the challenge of obtaining open source information on this topic. States have traditionally restricted information on the setup of their nuclear C2 systems out of concerns that adversaries could use this to undermine them. However, there has been a recent broader shift towards transparency when it comes to nuclear weapons issues, with the recognition that the sharing of certain types of information can also boost public confidence and inform best practice. In addition, some states

developed their initial nuclear C2 systems more than 50 years ago and certain details on those early systems have now been declassified. This research took advantage of this by exploring the key factors that have shaped the development of nuclear C2 systems.

Nuclear command and control

In order to structure analytical framework and subsequent testing of the framework, it is important to define and explain the broad contours of nuclear C2, and discuss the approaches that the subject has been studied with so far. Doing so will help situate the work carried out in this research.

The ultimate goal of nuclear C2 is succinctly summarised by Scott Sagan (2000: p. 16) who notes that the key question for such a system is, 'How do they (states) ensure that these weapons (unconventional weapons) actually are used according to [their] plans and not under different circumstances or for other purposes?' According to the US Department of Defense (2001: p. 2), such a system involves

> the exercise of authority and direction by the President, as Commander in Chief, through established command lines, over nuclear weapon operations of military forces; as Chief Executive over all Government activities that support those operations; and, as Head of State over required multinational actions that support those operations.

Here, the word *command* entails assigning a task by the highest political authority in a country – the president or prime minister as described in a country's constitution – to its military forces. *Control* implies monitoring the functioning of military forces as per the command by enforcing certain constraints with the help of doctrine, such as Standard Operating Procedures (SOPs) and communication and intelligence networks. This hints at the complex nature of nuclear C2, which stems from the complicated linkages between the personnel – civilian and military – and the technologies employed to ensure effective application of command and control. Adapting Paul Bracken's definition of military command and control, Zian Mian (2001: p. 6) hints at the scale of this task, stating that the

> command and control of nuclear weapons may well involve hundreds if not thousands of people at all level, many acting under orders and in diverse settings with different powers, interacting with each other and with a variety of technical system with nuclear weapons only being a small part of this.

In general, the literature on nuclear C2 points to three key requirements being necessary for a robust nuclear C2 system: the maintenance of positive and negative command controls; accurate warning and attack assessment; and the proper delegation of authority (Cimbala & Rainow, 2007: pp. 47–54; Cimbala, 2001a: pp. 123–131) where, effective communication is key in maintaining the effectiveness of each component.

Positive and negative command controls

Implementing positive controls refers to the prompt and reliable response of nuclear forces to an authorised command, whilst negative controls ensure that nuclear forces do not respond to an unauthorised command (Cimbala, 2001a: pp. 123–124; Cimbala & Rainow, 2007: pp. 47–48; Cimbala, 2002: p. 146). These can be in competition with one another with the relative power of each will depending on the broader security situation. For example, the US nuclear command system can be thought of as a revolver where the US president acts 'as a safety catch preventing other triggers from firing' (Bracken, 1983: p. 196). During peacetime this negative control measure remains firmly in place to prevent any possibility of an unauthorised weapons launch. However, as tension levels rise, negative controls are gradually relaxed to ensure prompt reaction, with positive controls gradually taking precedent. This change in controls is perhaps best illustrated by the US alert system of Defence Conditions (DefCons) where Level 5 represents the lowest level practice during peacetime with Level 1 being the highest level of alert depicting forces ready for imminent war during a crisis (see Sagan, 1985: pp. 99–139).

This complex and tricky interplay of positive and negative controls is embedded in Peter Feaver's (1992–1993: p. 168; also see 1992: pp. 12–21) Always/Never dilemma. This dilemma signifies that, 'Leaders want a high assurance that the weapons will always work when directed and a similar assurance that they will never be used in the absence of authorized direction'. There lies an inherent tension between the maintenance of positive and negative controls, or use-control measures, over nuclear forces because, in order to ready forces for prompt action or retaliation, there is a requirement to ensure certain steps can be taken, which could potentially lead to the reduction in controls guarding against accidental or inadvertent use (Feaver, 1992: pp. 12–21). Related to this are issues of assertive and delegative controls (Feaver, 1992: pp. 26–27). Assertive controls secure civilian solutions to the always/never problem whilst the delegative places the decision in the hands of the military. The effectiveness of delegative control therefore relies strongly on the professionalism of the military, including obedience with regards to following orders.

Valid assessment of warning and attack

Assessment methods are key in providing leadership with the necessary confidence to distinguish between true and false attacks (Cimbala & Rainow, 2007: p. 50). Here, decision makers should have the necessary time to respond appropriately after receiving a valid attack warning (Cimbala & Rainow, 2007: p. 50). In addition to the technologies needed to make accurate assessments, clear communication is also critically important for the interpretation of events especially during times of crisis. Communication channels are likely to be at their most vulnerable to enemy attack during a crisis and this can make the interpretation of events ambiguous and challenging. Here, it will be crucial to be able

to communicate command orders between the higher authority to the forces (Blair, 1987: p. 117). This situation is complicated by likely stresses and tensions that might exacerbate intrinsic cognitive biases when it comes to event interpretation (Dougherty, 1987: pp. 407–425).

The time factor is also important when it comes to assessment because, as tension levels rise, it is likely that political leadership might not have sufficient time to delve into the actions at the operational level thereby leaving decisions to the personnel on the lower rung of the chain of command (Blair, 1987: pp. 115–116). At the lower level in the US system, weapons commanders can make 'independent judgments' depending on the circumstances faced after receiving defence condition messages, but the authority to carry out such judgments 'is not a license' and abuse of this authority 'could bring reprimand' (Blair, 1987: pp. 117). Nonetheless, the 'Field commanders can act as a buffer to moderate certain excesses that an untempered alerting system might produce' (Blair, 1987: pp. 117). For example, during the Cold War the USSR installed several checks and balances in its C2 system in order to avoid unauthorised use and political usurpation of authority, and had protective measures against impetuous behaviour at any level of command (Cimbala, 2002: pp. 145–146). Indeed, the loyalty of the military to the civilian leadership will always be a critical factor within a C2 system.

Delegation of authority

The delegation of authority to launch a nuclear attack is an essential feature of a C2 system (Feaver, 1992–1993: pp. 168–170; also see Bracken, 1987: pp. 352–372). Contingency plans are also necessary in view of the vulnerability of a nuclear command system to attack. However, the flow of orders from the top down to the lower level where the nuclear weapons are located is not as simple as it appears to be in theory, due primarily to human factors. As Cimbala (2001c: p. 8) notes, in the chain of command, almost all personnel possess 'some discretion and may decide … to think for themselves once nuclear charges begin to move from storage sites to launch platform'. In this respect there is a risk that, when orders are passed downwards during a period of crisis mobilisation, organisational interests will emerge. For a C2 system to work effectively nuclear force commanders will need to 'follow orders to retaliate without questioning their own actions' (Cimbala & Rainow, 2007: p. 54). Accounting for bureaucratic processes and different organisational interests remains a crucial aspect of making decisions about response actions. A wide variety of nuclear forces, along with supported weapons, if maintained at high alert during peacetime in order to ensure deterrence, defence and survivability, will require continuous civilian control (Cotter, 1987: p. 17).

For the continuity of civilian control, it is important for any successor to the top political decision maker (president/prime minister) to be similarly drilled, exercised and trained with regards to the taking of crucial launch decisions. The following quote captures the essence of this issue:

> In theory, orders need not come from the president or vice president. As commander in chief the president may legally delegate his authority to release nuclear weapons either to a potential successor or to a subordinate such as the secretary of defense or a military commander, rather than depend upon the devolution of presidential authority to a formal legal successor if he is killed. Delegation down the military chain of command may be more effective than the presidential succession approach, but it is widely regarded as highly undesirable, even improper, for political and constitutional reasons and because of the danger of usurpation of the delegated power. Yet reliance on the statutory succession of presidential authority (at least below the vice president) poses a real risk of placing authority in the hands of an individual poorly prepared to exercise it and almost certainly badly or belatedly connected to military communications system.
>
> (Slocombe, 1987: pp. 41–54)

This trade-off is of a critical nature when governments want to implement a centralised and highly assertive C2 system with weapons in a non-alert state of readiness, under civilian custody, and that can only be used once authorised by the central command (Steinbruner, 1987: pp. 539–543). Such a system will ensure that weapons will not be used either by accident or through unauthorised command. The maintenance of such an assertive command, however, does increase vulnerability to a decapitative strike, as a result of which centralised command could be destroyed leaving behind unusable albeit intact nuclear weapons. This type of situation highlights the importance of delegating command authority – putting weapons in high alert status under the military operators' custody with prior delegation of authority to launch. Under this sort of delegation of authority arrangement, command vulnerability would reduce as the fear of a decapitative strike lessens, but it increases the risk of inadvertent or unauthorised use. During the 1970s, Americans' fears of a Soviet decapitation strike highlighted the complexities involved in nuclear C2. Combined with this, the fear of a loss of communication due to electromagnetic pulse generation, and other attacks, resulted in the creation of shared secrecy or shared control and later permissive action links (PALs) over nuclear launch.

Realising the critical significance of nuclear C2 to international security, scholars have approached the subject from different dimensions and studying different countries' command and control arrangements. Landmark studies on the topic are arguably the works of Bruce G. Blair (1985), Paul Bracken (1983), Peter Feaver (1992, 1992–1993: pp. 160–187), Scott Sagan (1993), Desmond Ball (1981), Shaun Gregory (1988: pp. 39–51, 1986, 1996), Stephen Twigge and Len Scott (2000a). An important edited book called *Managing Nuclear Operations* (Carter et al., 1987) provides a broad overview of C2 covering the major technical, political and psychological aspects. Contributors of this work have extensive experience of working with different aspects of nuclear C2, which serves to make this book comprehensive and authoritative.[2] This book helps in understanding the complex nature and norm of nuclear C2 of the US and USSR

developed during the Cold War period. It is limited in that it does not cover other NWS including Britain, France, and China. Comparatively, Shaun Gregory (1996) studies the development of nuclear C2 in the west European theatre and in individual states of the US, Britain, and France. His work on nuclear C2 of NATO provides an important understanding about the linkage between nuclear operations and flexible response, and assessment of NATO's performance during crisis and implementation of flexible response that helps whilst categorising the variables for this thesis. Different scholars highlighted the challenge of interoperability in NATO at decision and theatre level, however Gregory's study of strengths and weaknesses of NATO nuclear C2 as an organisation proves useful. Moreover, his chapter on Britain has extensively provided the baseline understanding about the Britain's case study that is further developed in this thesis. This work is limited as it is more focused on the west European theatre, which highlights the need to explore nuclear C2 development in other theatres such as Asia (China, India, and Pakistan). The present research attempts to fill this gap. Furthermore, the comparative approach used in this research that employs similar variables is helpful in assessing nuclear C2 evolution across different countries. This in turn generates an understanding about normative development of nuclear C2 at the international level.

In his influential scholarly account, Bruce Blair (1993) indicates the complex and intricate nature of nuclear C2 due to the involvement of human factors at different levels of command. Blair emphasises that technical and organisational constraints should not be ignored during the nuclear command development. For instance, he writes,

> The decision process in situ involves hundreds and thousands of people, many with delegated powers. It involves standard operating procedures, rules of engagement, and a large number and variety of technical C3I components performing a wide range of functions at all echelons. The course of events would surely be affected, perhaps determined, by how these elements of the decision process operate. Even the decision to authorise the use of nuclear weapons, the decision most readily associated with the model of a single actor, cannot be profitably isolated from these elements. It is the decision of a single actor in only the most trivial sense.
>
> (1993: p. 71)

Blair's work, along with Feaver's work, provide a useful understanding of processes involved in handling nuclear operations and the knowledge gained from this work is used in categorising the factors (such as threat environment, control and leadership) that influence development of nuclear C2.

Another work by Peter Feaver called *Guarding the Guardians* provides a deeper insight into the US pattern of civilian control over the nuclear arsenal. Feaver suggests four variables including the arsenal size and dispersal, perceived vulnerability of the nuclear forces, nuclear doctrine, and presidential style that influence the pattern of civilian control over nuclear operations. The discussion

in Feaver's book is of much relevance to this research because the variables that are drawn for the research link themselves with that of Feaver's variables (1992: pp. 3–40) in some ways, as explained Chapter 1. Peter Feaver later published a journal article entitled 'Command and Control in Emerging Nuclear Nations', in which he highlighted the influence of nature of civil-military relations within the country and the time–urgency factor on the structure of country's nuclear command and control, whether it will be delegative or assertive. This article was published in the winter issue of *International Security* journal of 1992/1993. At that time, India and Pakistan had not developed operational nuclear weapons capability. Therefore, the propositions that Peter Feaver has made in both of his studies about the US and emerging nuclear states are thoroughly studied and these propositions have helped in building the framework of this research to study the nuclear C2 of smaller nuclear forces, notably of Britain, China, India, and Pakistan.

Another study that was utilised is a book called *Planning the Unthinkable*. The contributors of this book study command and control systems of different states through the lens of realist, organisational and strategic culture theories; however, the emphasis upon strategic culture in explaining a state's behaviour rests on 'the notion that important differences do exist between people with different histories, outlooks, and preferences' (Wirtz, 1987, quoted in Sagan, 2000: p. 14). Strategic culture theory posits, as Sagan observes, that state's C2 is influenced by a state's domestic politics, decision-making norms and historical experiences and myths (Sagan, 2000: pp. 39–42). States with different cultural norms tend to adopt different designs for their C2. However, given the significance of domestic politics, Sagan (2000: p. 43) emphasises neoculturalists' proposition about the command system that in a situation where political leaders fear the possibility of military coup, there are higher chances of maintaining centralised control over military and especially over WMDs and the authority to use these weapons (Biddle & Zirkle, 1996: pp. 171–212). Moreover, the leaders' beliefs about surprise attacks also define the structure of C2 (Sagan, 2000: p. 44). Leaders with experiences of surprise attacks are likely to be obsessed about the decapitation strike that compels leaders to maintain high-level alerts of military forces during peacetime and a delegative C2 (Sagan, 2000: p. 44). Related to this, Peter Feaver (1992–1993: pp. 160–187) posits that the choice of delegative or assertive C2 system depends on the nature of civil-military relations and the understanding of geographical and time constraints.

Sagan highlights that strategic culture predicts that different states would adopt different C2 structures depending on the domestic decision-making norms, domestic interests, the procedures of succession, experiences of state's military and the dominant interpretations about whether surprise attacks initiate wars. Among these, the decision-making norms are significant for this research as they highlight the patterns of interaction among civil-military within the C2. However, this research observes normative development of nuclear C2 at global level that is likely to contradict the sui generis nuclear C2 structure proposed by strategic culture. Nevertheless, a strategic culture approach is important in

attributing legitimacy to decision-making. Slocombe (1987: pp. 132–133) adds here the critical requirement of legitimacy for the decision-making process: 'It is not sufficient that the order be made and communicated to the forces; it must be accepted as valid.' Therefore, it is critical to analyse how the decision-making process helps in locating the legitimate authority within a state that can issue launch orders.

Sagan (2000: pp. 45–47) aptly makes the point that understanding about what determines the C2 structure is important for the leaders, militaries, scholars and intelligentsia. He further stresses that an in-depth scholarly investigation should be conducted into the underlying processes that influence military doctrine and C2 and argues that the 'veil of official announcements' must be lifted through such investigations. It is at this point where literature recognises the importance of studying nuclear C2 from a cultural viewpoint because it will provide deeper insight about the structure nuclear C2 and will offer a degree of certainty about the future; thereby, enhancing the predictability about such matters. At this point strategic cultural theory complements this book because culture breeds norms guide behaviour therefore global nuclear C2 norms can potentially guide NWS behaviour to establish and maintain nuclear deterrence. The present research is largely a manifestation of this recognition. Moreover, the subject has largely been dealt from the technical and political aspects involved in maintaining nuclear C2 during the Cold War; however, few accounts are available that concentrate on the nuclear C2 development in the post-Cold War period and in new nuclear weapon states (Feaver, 1992–1993: pp. 160–187; Seng, 1997: pp. 50–92).

For instance, *Planning the Unthinkable* contains two separate chapters that discuss Indian and Pakistani nuclear C2 contributed by respective Indian scholar Waheguru Pal Singh Sidhu (2000: pp. 146, 156) and Pakistani scholar Zafar Iqbal Cheema (2000: pp. 174–175). Both scholars stressed the cultural approach to study C2 in comparison to the realist and organisational theories. These two chapters provide a useful insight, but this book was published in 2000, two years after India and Pakistan acquired operational nuclear capability. Several developments have occurred in subsequent years such as: both states announced their nuclear C2 authorities – India first announced its draft nuclear doctrine in 1999 and then updated version in 2003 and Pakistan announced its National Command Authority Act in 2010, and major developments occurred in their nuclear arsenal and delivery systems. Therefore, there exists a substantial gap in the literature. This research aims to fill in by covering these developments in order to provide an enhanced understanding about the two countries' nuclear C2 along with Britain and China that are not covered in *Planning the Unthinkable*.

Other notable works are focused on individual country. For instance, in *Planning Armageddon* Twigge and Scott (2000a) provide a comprehensive and detailed account of British nuclear C2 and associated infrastructure of intelligence and communications. It covers Britain's learning and efforts to manage its nuclear operations at national, bilateral and alliance level. It is based on recollections of officials and military personnel of Britain and the United States, which

makes it a uniquely important work on the subject. Since it is an extensive study of western and British nuclear forces, it outlines several guidelines that are utilised in this research. Building on these guidelines, this scholarship presents a comparative study of learning and efforts made by Britain, China, India, and Pakistan to manage their nuclear operations. Likewise, *Managing India's Nuclear Forces* by Verghese Koithara (2012) evaluates Indian nuclear force management in detail that highlights shortcomings in Indian nuclear decision-making and operations. This work, along with other studies on Indian nuclear C2 by different scholars (Tellis, 2001; Chengappa, 2000; Kanwal, Jan, 2000), provides baseline understanding about the Indian case study in this research project but they are limited in focusing on one country. In the case of China, there are very few scholars who have exclusively dealt with nuclear C2, notably John Wilson Lewis, Xue Litai, Jeffrey Lewis, Evan S. Medeiros, Mark Stokes and Wu Riqiang (Lewis & Litai, 1988, 1987: pp. 542–554; Fravel & Medeiros, 2010; Riqiang, 2011: pp. 91–120, 2013: pp. 579–614; Stokes, 2010; Lewis, 2014). The works of these scholars renders important insight into Chinese nuclear C2 development that is used in this thesis. Similarly, the works of Zafar Iqbal Cheema (2000: pp. 170–180), Bhumitra Chakma (2008), Zia Mian (2001: p. 6); Kothari and Mian (2001); Zafar Khan (2015), Feroz Hasan Khan (2012) and Naeem Salik (2009) provide a baseline understanding about Pakistan's nuclear C2.

The above-mentioned works and scholars remained focused on individual country's nuclear C2 and therefore are limited in their scope. This research is different from these earlier works in terms of its central inquiry, comparative approach to study the nuclear C2 development of Britain, China, India, and Pakistan, and observation. Hence this research endeavours to fill the gaps in the existing literature. The central inquiry of this book is to explore the main factors that determine the evolution and stability of nuclear C2 for small nuclear forces. The research seeks to answer this question by investigating in a comparative manner how the three stakeholders (political, military, and scientific communities) coexist within nuclear C2 systems of four NWS and how they contribute to the development of nuclear C2. Here the comparative approach differs from existing literature with reference to its treatment of key internal stakeholders. Generally, the literature focuses upon the civilian or political side and military side as two different forces and their mutual interaction. This book provides a unique study that identifies three key stakeholders – military, politicians, and scientists – that are critical for the evolution of and stability within the nuclear C2 in an NWS because together these three can ensure the effectiveness and synchronisation of the system. The scientific community is identified as an additional key stakeholder because the management of nuclear weapons operations extensively depends on the scientific research and development (R&D) that makes the importance of scientists for nuclear C2 critical. For this reason the behaviour and interaction of the scientific community with other two stakeholders is significant to study.

In addition, this book outlines a common analytical framework that identifies four independent variables including a geo-strategic threat environment, nuclear

weapons norms, leadership, and control of nuclear operations (civilian/military control) that influence evolution and stability of nuclear C2 for small nuclear forces. This single framework is then applied to four case studies. For each case study chapter, the external environment composed of geo-strategic and nuclear weapons norms is examined so as to sketch the threats and challenges to which each nuclear C2 had prepared an appropriate response in terms of nuclear force and posture development. Keeping in view the threats and challenges, the integration of three stakeholders within each state's nuclear C2 is then studied: the internal integration of politicians, military and scientists that requires sound leadership to communicate a clear vision and goals for the development of nuclear force (appropriate response) according to external environment, and a defined control to ensure conduct of nuclear operations according to plans. The study of key variables across the case studies is tied together in a comparative analysis to examine the level of similarity and variance across the four countries with respect to their nuclear C2 practices. This part generates insights into their importance, or otherwise in the context of nuclear C2.

Depending on the availability and accessibility of data on the subject, the process of data collection process was different for each case study. In the case of Britain, for example, data collection primarily involved analysis of archival documents at Kew Gardens and relevant secondary literature related to the subject. In the cases of China and Pakistan, both primary and secondary sources are used including interviews of individuals (including military personnel and scientists) with knowledge and understanding of nuclear weapons policy making in both countries. For the Indian case study, analysis is based on secondary research. Other sources (for all four case studies) include autobiographies, published writings on strategic matters, public debates in print and electronic media, and so on.

Fieldwork based on interviews remained very challenging in the case of China, India and Pakistan in accessing key personnel and experts and gaining data. For instance, Chinese experts gave generic information in their meetings with the author in Beijing. They were reluctant to share focused information on nuclear C2 issues therefore data collected from their interviews covered general issues of nuclear strategy. A couple of academics (Chinese as well as American) acknowledged their limited knowledge on operational issues due to secrecy and lack of information in the public domain. From these generic views, information and ideas are inferred to assess development pattern in Chinese nuclear C2.

Likewise, given the relative secrecy attached to nuclear matters in Pakistan, serving personnel associated with the nuclear programme could not be accessed. Therefore, the focus remained on retired personnel who have significant experience and knowledge of nuclear matters. Such individuals were approached for interview during the second half of 2014. The author worked for four years (2007–2011) as a researcher in the Arms Control and Disarmament Directorate of the Strategic Plans Division, which is the secretariat of Pakistan's National Command Authority. This experience proved very helpful in identifying, contacting, and interviewing relevant individuals. However, Pakistani individuals