



# RAMPARTS of EMPIRE

The Fortifications of  
Sir William Jervois  
Royal Engineer  
1821–1897

TIMOTHY CRICK



In the year 1860, Palmerston's parliament sanctioned the construction of the largest system of fortifications that the British Isles had ever seen, or would ever see again, to defend against a feared French invasion. For William Jervois, then a young major in the Royal Engineers, his appointment as 'design leader' of this programme was a major step in a career in fortress construction that would see his work in Britain, Aden, Bermuda, Burma, Canada, the Channel Islands, Gibraltar, India, Ireland, Malta and later, Australia and New Zealand.

Timothy Crick makes extensive use of extracts from Jervois' diaries and illustrations of his fortresses to give the reader a rounded picture of this Royal Engineer's wide-ranging career. He also captures a real sense of the fears of invasion that prevailed in this period. Throughout the book both the political background and the technical considerations involved in constructing forts and armaments are carefully explored to flesh out the motivations in what is sometimes referred to as the 'Golden Age' of British fort building.

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The Fortifications of Sir William Jervois  
Royal Engineer, 1821–1897

**William Jervois** was a military engineer who rose to prominence as a result of Lord Palmerston's extensive programme of fortification against a feared French invasion in the middle years of the nineteenth century. *Ramparts of Empire* is a detailed and engaging study of his life and works. As the first comprehensive study of this influential Victorian, the book is an important contribution to military and engineering history as well as to the history of Imperial Britain.

**Timothy Crick** makes extensive use of extracts from Jervois' diaries in order to present a rounded picture of this Royal Engineer's wide-ranging career. He traces Jervois' achievements both within the British Isles and in Empire outposts as far afield as Canada, Bermuda, India, Australia and New Zealand.

**The text** is richly illustrated with photographs and plans of Jervois' forts, while supporting appendices provide a mine of supplementary information. This includes a gazetteer of Jervois' works along with documentary evidence of his involvement in plans for a Channel Tunnel and a proposal for attacking the seaboard of the United States.

**Timothy Crick** has a PhD in Mechanical Engineering and spent many years in industry as a design engineer. He has lectured in industrial design and the history of industrial architecture and he is a member of the Fortress Study Group, the Coast Defense Study Group (US) and the Palmerston Forts Society.




William Francis Drummond Jervois as a Lieut. Colonel in 1862. (Courtesy John Jervois)

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Royal Engineer, 1821–1897

Timothy Crick

*Wm. J. Drummond Jervis*



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# CONTENTS

List of Illustrations	VI
Foreword	XI
Acknowledgements	XIII
Illustration Sources	XIV
Abbreviations	XV
Glossary	XVI
Chronology	XVIII
Introduction	1
Chapter One: Early Days in Africa	4
Chapter Two: Appointment in Alderney	11
Chapter Three: The Threat from France	27
Chapter Four: The 1859 Royal Commission	40
Chapter Five: Defending the Naval Bases	52
Chapter Six: Missions to Canada and the United States	85
Chapter Seven: The Ironclad Forts	105
Chapter Eight: Imperial Progress	126
Chapter Nine: Australia, New Zealand and the Threat from Russia	166
Chapter Ten: Coast Defence, Honours and Retirement	191
Chapter Eleven: Jervois' Work in Context	199
Appendix A: Gazetteer: List of fortifications and other works associated with Jervois	239
Appendix B: The Relative Industrial Strength of the Major Powers in the Nineteenth Century	245
Appendix C: The 'Battle of Dorking' and its Successors	247
Appendix D: The Arming of the Coaling Stations, 1884	249
Appendix E: 'A Plan for Attacking the Seaboard of the United States'	250
Appendix F: Jervois and the Channel Tunnel (1883)	254
Appendix G: The Relative Value of the British Pound	256
Chapter Notes	257
Select Bibliography	276
Index	286

# ILLUSTRATIONS

## **Colour Plates**

(between pp. XVI and XVII)

- Plate 1 A plan of the defences of Gosport.
- Plate 2 Plan of Fort Grange, Gosport.
- Plate 3 Fort Grange, Gosport: infilled ditch and entrance to the keep.
- Plate 4 Details of Fort Grange, including elevation and sections.
- Plate 5 Plan of Fort Nelson, Portsmouth.
- Plate 6 Drake's Island, Plymouth: 12in RML.
- Plate 7 Drake's Island, Plymouth: seaward face of casemate battery.
- Plate 8 Fort Tregantle: northern ramparts.
- Plate 9 Stack Rock Fort, Milford Haven, from the air looking north.
- Plate 10 Popton Fort, Milford Haven from the air.
- Plate 11 South Hook Fort, Milford Haven, aerial view looking west.
- Plate 12 Fort Hubberstone, Milford Haven, aerial view looking north-west.
- Plate 13 Fort Scoveston, Milford Haven, aerial view looking north-west.

## **Black and White Figures**

<i>Frontispiece</i>	William Francis Drummond Jervois as a Lieut. Colonel in 1862.		p.
<i>Title page</i>	Jervois' signature.		19
	<b>Introduction</b>	p.	
0.1	Engraving of HMS <i>Warrior</i> .	2	2.9 Fort Clonque, Alderney, from the south. 19
	<b>1: Early Days in Africa</b>		
1.1	WFD Jervois, aged 29.	5	2.10 Fort Clonque, Alderney, aerial view of the fort looking south-west. 19
1.2	Sketch by Jervois of an encampment during his survey of British Kafferia.	8	2.11 Plan of Fort Albert. 20
1.3	An engraving of the Grey Hospital for Natives, British Kafferia.	9	2.12 Fort Albert, Alderney, Mount Hale Battery. 21
	<b>2: Appointment in Alderney</b>		2.13 Fort Albert, Alderney, Roselle Battery. 21
2.1	The Alderney harbour breakwater.	12	2.14 Fort Albert: general view from Braye Bay. 22
2.2	Model of Alderney showing beaches where an enemy might attempt to land.	14	2.15 Fort Albert: arrangement of batteries. 22
2.3	Map of Alderney showing forts designed or completed under Jervois' direction.	15	2.16 Typical nineteenth-century lettering in various parts of Fort Albert. 23
2.4	Three of the forts constructed at the north-eastern tip of Alderney.	16	2.17 Aerial view of Fort Albert, looking south, in 1979. 23
2.5	Fort Tourgis, Alderney: bastionette.	16	2.18 Caponier at the northern salient of Fort Albert. 23
2.6	Aerial view of Fort Tourgis, Alderney.	17	2.19 Fort Grosnez, overlooking Braye Harbour, viewed from the breakwater. 24
2.7	Fort Tourgis, Alderney, north-western face.	17	2.20 Proposed extensions to the Alderney breakwater. 25
2.8	Fort Clonque, Alderney, showing the causeway at low tide.	18	
			<b>3: The Threat from France</b>
			3.1 Armstrong 12pdr RBL Mk.1 wrought iron field gun, in the AWM, Canberra. 27
			3.2 The engine room of HMS <i>Warrior</i> , showing the Penn trunk engines. 28
			3.3 Map of Cherbourg showing the fortifications. 29

	p.		p.
3.4	32	5.13	61
3.5	33	5.14	62
3.6	34	5.15	62
3.7 & 3.8	35	5.16	64
3.9 & 3.10	35	5.17	64
3.11	37	5.18	65
3.12	38	5.19	65
<b>4: The 1859 Royal Commission</b>			
4.1	41	5.20	65
4.2	42	5.21	66
4.3	42	5.22	66
4.4 & 4.5	43	5.23	67
4.6	44	5.24	67
4.7	44	5.25	67
4.8	45	5.26	68
4.9	45	5.27	68
4.10	48	5.28	69
4.11	50	5.29 & 5.30	69
<b>5: Defending the Naval Bases</b>			
5.1	53	5.31	70
5.2	55	5.32	71
5.3	56	5.33	72
5.4	56	5.34	72
5.5	57	5.35	73
5.6	58	5.36	73
5.7	58	5.37	73
5.8	59	5.38 & 5.39	74
5.9 & 5.10	59	5.40	75
5.11	59	5.41	76
5.12	59	5.42	76
		5.43	76
		5.44	77

	p.			p.	
5.45	Stack Rock Fort, dismounted gun.	77	7.1	Fort Constantine, Sebastopol.	105
5.46	South Hook Fort: aerial photograph.	78	7.2	Fort Sumter NC.	106
5.47	Interior of the barracks at Fort Hubberstone.	78	7.3	Deck view of the USS <i>Monitor</i> .	107
5.48	Popton Fort, aerial photograph.	79	7.4	Tests of various guns against various types of armour plate at Shoeburyness.	109
5.49	Fort Scoveston and Stack Rock Fort, aerial photograph.	80	7.5	Jervois' initial design for one of the larger sea forts at Spithead.	110
5.50	Fort Hubberstone on the peninsular in the foreground, and Popton Fort facing it across the water.	80	7.6	Iron shield built up from hot-rolled sections at Millwall, London.	111
5.51	Nothe Fort, Weymouth: aerial view.	81	7.7	Spit Bank Fort, Spithead.	113
5.52	Interior view of the fort, showing the rear of the casemates and the parade.	81	7.8	Plan of the roof level of Spit Bank Fort.	114
5.53	Cliffe Fort, Kent: aerial view.	82	7.9	Spit Bank Fort from the air, looking north-east.	114
5.54	The ruinous fort today, seen from the south.	82	7.10	A replica 12.5in, 38ton RML in one of the armoured casemates of Spit Bank Fort.	115
	<b>6: Missions to Canada and the United States</b>		7.11	Plan of the gun floor of Spit Bank Fort.	115
6.1	Engraving showing a Brigade of the the Royal Artillery embarking at Wapping for Canada.	86	7.12 & 7.13	Spit Bank Fort, landward elevation and section looking south-west.	116
6.2	Munitions being loaded on to small boats at the Tower of London.	87	7.14	No Man's Land Fort, Spithead, vertical aerial view before redevelopment.	117
6.3	The SS <i>Great Eastern</i> , the world's largest ship.	87	7.15	No Man's Land Fort, Spithead, aerial view after redevelopment.	117
6.4	Aerial view of Fort Gorges ME.	88	7.16	Steam yacht with one of the Spithead forts in the background.	118
6.5 & 6.6	Fort Sumter interiors.	89	7.17	Horse Sand Fort.	118
6.7	Gardner naval machine gun.	90	7.18	The fourth and final Spithead fort, St Helen's Fort.	118
6.8	Fort Winthrop, Governor's Island, Boston.	90	7.19	Portland Breakwater Fort.	119
6.9	Fort Warren, situated on one of the many small islands in Boston Harbour.	91	7.20	Plymouth Breakwater Fort from the north-east.	120
6.10	Fort Adams.	92	7.21	Aerial view of the fort, looking west.	121
6.11	Fort Henry, Kingston, Canada: aerial view looking north-west.	94	7.22	The fort from the north-west, with the break- water beyond.	121
6.12	Fort Henry: 32pdrs on the terreplein.	94	7.23	The location of the breakwater and fort in relation to Bovisand Fort.	121
6.13	Fort Henry: escarp and ditches with 32pdr visible over rampart.	94	7.24	The interior of the fort, looking west, showing the rear of the casemates.	121
6.14	<i>Rochambeau</i> ex-USS <i>Dunderberg</i> : a 'casemate' ironclad.	98	7.25	12in BL 43ton gun of 1881.	122
6.15	A 1923 aerial view of Forts Tompkins and Richmond.	98	7.26, 7.27 & 7.28	Fort Konstantin, Kronstadt.	123
6.16	General Pierre Gustave Toutant Beauregard.	99	7.29 & 7.30	Two views of one of the iron caponiers at Strasbourg.	124
6.17	15in Rodman SB gun named the 'Lincoln'.	99	7.31	The aft gun barbette of HMS <i>Temeraire</i> .	125
6.18	Bombproof at Battery Rodgers.	100		<b>8: Imperial Progress</b>	
6.19	Fort Runyon, one of the ring of fortifications protecting Washington.	101	8.1	Map showing the world-wide network of coaling stations and bases.	127
			8.2	The arrival at Malta in 1882 of one of the Armstrong 100ton RML guns.	128

	<i>p.</i>		<i>p.</i>
8.3	129	8.28	152
8.4	129	8.29	153
8.5	129	8.30	153
8.6	130		
8.7	131	<b>9: Australia, New Zealand and the Threat from Russia</b>	
8.8	132	9.1	167
8.9	132	9.2	169
8.10	133	9.3	170
8.11	134	9.4	171
8.12	135	9.5	171
8.13	136	9.6	173
8.14	136	9.7	173
8.15	137	9.8	175
8.16	137	9.9	176
8.17	141	9.10	177
8.18	145	9.11 & 9.12	177
8.19	147	9.13	178
8.20	148	9.14	178
8.21	149	9.15	179
8.22	149	9.16	180
8.23	150	9.17	184
8.24	151	9.18	185
8.25	151	9.19	185
8.26	152	9.20 & 9.21	186
8.27	152	9.22	186
		<b>10: Coast Defence, Honours and Retirement</b>	
		10.1	198

<b>11: Jervois' Work in Context</b>		<i>p.</i>			<i>p.</i>
11.1	Torre Massimiliana on the island of St Erasmo in the Venice Lagoon.	201	11.23	Fort Pharos, Alexandria, Egypt after bombardment by Royal Navy.	217
11.2	Map of the fortifications of Ulm and Neu-Ulm in 1880.	201	11.24	Rodman 15in SBME.	218
11.3	Fort Friedrichsau (Werk XXXXI), a girdle fort east of the city of Ulm.	202	11.25	Mallet's 36in mortar.	219
11.4	A typical example of one of the girdle forts built around Cologne c.1874.	203	11.26	'Curved fire', showing effect on bringing down escarp wall.	219
11.5	The result of a trial using rifled artillery against a brick Martello tower.	204	11.27	Whitworth RBL field gun being tested on a Southport, Lancashire beach in 1860.	219
11.6	The graving dock in Sebastopol capable of accepting the largest Russian warships of the time, c.1840.	205	11.28	The 6.3in RML howitzer of 18-cwt.	220
11.7	Portrait of General Eduard Ivanovitch Todleben.	205	11.29	Fort Nelson, north-west ditch looking towards the double caponier at the northern salient.	224
11.8	Great Britain, War Office, Topographical Dept: the Malakoff or Kornileff Bastion.	206	11.30	Fort Nelson, double caponier.	224
11.9	Fort Sumter, from the sand bar.	207	11.31	Fort Nelson, western face and flank of the redan.	225
11.10	Plan of Fort Pulaski, Savannah, Georgia, USA.	208	11.32	Fort Nelson, western ramparts with gun positions and double Haxo casemate.	226
11.11	Fort Pulaski: breach in casemate caused by Union artillery.	208	11.33	Fort Nelson, showing earthen traverse and entrance to tunnel.	226
11.12	General Gillmore's Report to General Totten.	208	11.34	Fort Nelson, detail of vaulted passageway.	226
11.13	Blockade runner <i>Lilian</i> with a cargo of contraband food and military supplies.	210	11.35	Fort Nelson, flanking galleries above northern caponier.	227
11.14	The 'Pulpit' at Fort Fisher (NC).	210	11.36	Fort Nelson, chemin-de-rondes.	227
11.15	Experiments at Shoeburyness in 1864.	211	11.37	Fort Nelson, restored magazine.	228
11.16	Fort Issy plan and sections.	212	11.38	Fort Nelson, view from the north-west.	228
11.17	Fort Issy detailed sections.	213	11.39	Portrait of the Belgian General Henri Alexis Brialmont.	233
11.18	Map showing Prussian battery positions.	213	11.40	The French Army Summary of the Report on the Experiments carried out in the Bourges area.	234
11.19	Krupp field gun on a high-angle carriage.	214	11.41	The Bourges tests.	235
11.20	Fort Montrouge (Paris) interior, after the Franco-Prussian war.	214	11.42	Fort Loncin, showing the poor quality of concrete used to build the Liège forts.	236
11.21	Fort Issy interior following the Civil War that followed the Franco-Prussian war.	215	<b>Appendices</b>		
11.22	French Mitrailleuse, side view.	215	12.1	Map of the main entrance to New York in around 1870.	252

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# FOREWORD

As Chairman of the Fortress Study Group it gives me much pleasure to write the Foreword to this excellent book by Timothy Crick on the career and influence of Lieutenant General Sir William Jervois, an officer of the Royal Engineers and the foremost British expert on fortification in the Victorian era.

The Fortress Study Group, founded in 1975, has a charitable aim to promote the study of fortifications built to withstand artillery, which, by definition, means post-medieval fortifications. It is, therefore, most appropriate that the Fortress Study Group should support this biography of one of Britain's most prolific fortification designers.

My own interest in fortification developed from my service in the British Army. For over thirty years I found myself following in the footsteps of Jervois, serving in Gibraltar, Rangoon, Hong Kong and Australia. In Australia I worked in Fort Queenscliff and inspected a host of other forts designed by Jervois which instilled in me a lasting appreciation of his genius as a fortification engineer and a personal interest in the subject of this book.

The arcane vocabulary in books on fortification can deter the general reader, but here the author succeeds in fine style in bringing to life an intriguing and intelligent officer who did not, perhaps, receive the full acknowledgement of his talents that should have been his due.

From the Tudor period the science of fortification was slow to develop in Britain. With the development of artillery and because of the consequent need for advances in fortification in the fifteenth century, successive sovereigns and the most famous English military engineer of the period, Sir Richard Lee, depended heavily upon continental 'consultants'. These included the Italians Gian Tommaso Scala, Antonia da Bergamo and Giovanni Portinari and the Austrian Stefan von Haschenperg. In the following century the Dutch military engineer Bernard de Gomme was responsible for constructing fortifications for both Charles I and Charles II.

It was only in the eighteenth century that British military engineers began to come to the fore, particularly with the advent of threats from the French Republic in 1793 and Napoleon in 1803. Officers such as Twiss, Mann, Morse and D'Arcy were responsible for the construction of a vast network of defences in England and Ireland, while in 1812, Charles Pasley became the head of the newly formed Royal Engineer Establishment, the forerunner of the School of Military Engineering. Famous as these officers were in Britain, however, they were little known elsewhere and, indeed, continued to follow closely the precepts of better known military engineers on the Continent, such as Vauban and Montalembert.

It was under the tutelage of Pasley at the Royal Engineer Establishment that Jervois developed his talent for military engineering, and although initially studying the principles of Vauban, Jervois quickly demonstrated an awareness of the effect the latest developments in artillery would have on these principles. The author shows how Jervois' influence on British fortification spanned a period of over forty years from his arrival in Alderney in 1852 until his retirement from the largely honorary appointment of Colonel Commandant of the

Royal Engineers. His most productive period was during the time he was Secretary to the 1859 Royal Commission on the Defences of the United Kingdom and Deputy Director of Works for Fortifications, when he was involved in the design of the Portsdown forts built for the defence of Portsmouth. Jervois was an early proponent of the use of 'invisibility' in their siting. It was during this period of his career that it was said that Jervois' influence in the matter of fortification far surpassed his relatively junior rank.

His influence was also to be seen throughout the Empire. He was despatched to report on the fortifications of Canada, India, Australia and New Zealand and he continued to advise on fortifications even after his career took an administrative turn. Jervois was not a 'Ministry' soldier, and as a result, he never achieved the position of Inspector General of Fortifications, the post he was probably the most qualified to hold. Instead, his path led him to colonial appointments as Governor of the Straits Settlements, Governor of South Australia and Governor of New Zealand.

Examples of his forts may still be seen today in Canada, Australia and New Zealand as well as Britain, and the author concludes with a resumé of the effects of Jervois' work on the science of fortification in the British Empire and beyond. For, as so often with men of genius, lasting recognition would seem to have lain abroad rather than at home.

**Bill Clements**  
London, March 2011

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The material contained in Appendix E, 'A plan for Attacking the Seaboard of the United States', is reproduced by permission of The National Archives, Kew. That in Appendix G, *The Relative Value of the British Pound*, is copyright of Lawrence H Officer, [www.measuringworth.com/ukcompare/](http://www.measuringworth.com/ukcompare/), and is reproduced here with permission.

I thank my colleagues in the Fortress Study Group, especially David Bassett and Charles Blackwood, the Palmerston Forts Society, and the former United Kingdom Fortifications Club, for their support and advice both formal and informal. I am greatly indebted to my brother-in-law the late Major Ch. Stuart Hamilton for his kindness and assistance in facilitating my research on the island of Malta.

I am very grateful to the good people at The Exeter Press: Anna Henderson, Editor and Steve Dent, Project Manager and Designer of this book and fellow member of the Fortress Study Group.

While acknowledging my debt to those who have given so generously of their time and expertise during the writing of this book, the errors and omissions are mine alone.

Lastly, I thank my wife Brigid for her unfailing support over a project spanning a number of years.

**Timothy Crick**

Canberra, Australia and Wickham, UK

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# ABBREVIATIONS

## OF COMMONLY USED SOURCES

ADB:	<i>Australian Dictionary of Biography</i> . Formerly the 'Dictionary of Australian Biography'
APAC:	Asia, Pacific and Africa Collection at the British Library (see also IOR)
AWM:	Australian War Memorial, Canberra
BL:	British Library (or, in context, 'Breech Loading')
CDNB:	<i>Canadian Dictionary of National Biography</i>
DNB:	<i>Dictionary of National Biography</i> (Great Britain)
DNZB:	<i>Dictionary of New Zealand Biography</i>
GBPP:	Parliamentary Papers, Great Britain
HC:	House of Commons, Great Britain
HCCL:	Hampshire County Council Library
ILN:	<i>Illustrated London News</i>
IOR:	India Office Records, now part of APAC at the BL
JRE:	<i>Journal of the Royal Engineers</i>
JRUSI:	<i>Journal of the Royal United Service Institution</i>
LC:	Library of Congress, United States of America
MEB:	<i>Modern English Biography</i> (Australia)
MLSA:	Mortlock Library, South Australia
NLA:	National Library of Australia
NSWLA V&P:	New South Wales Legislative Assembly, Votes and Proceedings
PRAI:	<i>Proceedings of the Royal Artillery Institution</i>
PRO:	Public Record Office, Kew, now The National Archives (Great Britain)
Vic. PP:	Parliamentary Papers of Victoria (Australia)

*See Glossary for abbreviations of technical terms*

**Note on fort dating:** There is little consistency in this. Some authorities give the date construction was completed, others when the initial gun complement was installed. In this instance an attempt has been made to give an end of construction, as some forts had to wait years to be armed and a few were never armed at all.

# GLOSSARY

- Banquette:** Firing step behind a Parapet.
- Barbette:** Semi-circular platform on which guns are placed to fire over a Rampart, hence guns *en barbette*.
- Bastion:** A projection from the Curtain wall of a Work designed to allow the garrison to observe the adjacent walls and defend them by Enfilading fire.
- Bastionette:** A small bastion at the Salient of a work to aid in local defence.
- Berm:** Pathway along the top of the Escarp and at the bottom of the Rampart to provide a ledge to prevent debris falling into the Ditch.
- BL:** Breech Loading.
- Bomb-proof:** A solidly built structure whose roof is capable of resisting plunging fire and falling shrapnel.
- Caponier:** A gun battery projecting into a Ditch and designed to fire along it. In an earlier form it was a covered passageway connecting the inner and outer parts of the work across a Ditch.
- Carnot Wall:** Free-standing wall, pierced for rifle fire, placed in a Ditch at the foot of the Escarp.
- Casemate:** Enclosed space in a Work from which a gun is fired through an Embrasure.
- Cavalier:** Battery raised to fire over other sections of a Work.
- Chemin de Rondes:** Similar to a Berm but with a Parapet to give cover to riflemen.
- Counterfort:** Wall or arch buttressing the inner face of a Revetted Escarp or Counterscarp.
- Counterguard:** Outwork placed in front of a Bastion or Ravelin to protect it. Open at the rear.
- Counterscarp:** The outer wall of a Ditch.
- Counterscarp Gallery:** Casemate, armed with guns or rifles, placed in the Counterscarp to defend the Ditch and connected to the main Work by an underground passage.
- Covered Way:** Pathway along the Counterscarp of a Ditch, sunk below ground level to afford protection for members of the garrison patrolling it. Fitted with a Banquette to facilitate fire across the Glacis.
- Crownwork:** A large work projecting from the main body consisting of a Bastion and two Demi-Bastions, designed to protect it.
- Cupola:** Type of armoured turret, which in the case of late nineteenth and early twentieth works was often retractable and had a hemispherical top plate of thick steel.
- Curtain Wall:** The exterior wall of a Work between Bastions.
- Dead Ground:** Ground unable to be observed by the garrison of a Work and which might be useful to an enemy.
- Demi-bastion:** A work projecting from the main body of a Work with one face and one flank, essentially half a Bastion.
- Demi-caponier:** Caponier with only one face fitted with Embrasures, protecting a Ditch.
- Ditch:** Deep trench dug around a Work to give protection against Escalade and mining by providing a major obstacle to the attacker. Can be either dry or wet.
- Driving Band:** A band of soft metal, usually a copper alloy, around the shell of a breech loading gun. When the gun is fired the band is deformed or 'engraved' by the grooves of the rifling imparting a spin to the shell as it passes down the barrel.
- Embrasure:** Opening in a Rampart or Casemate of a Work through which a gun is fired.
- Enceinte:** The fortified perimeter of a Work or fortified town and the space enclosed by it.
- Enfilade:** To fire along the flank or Ditch of a Work, or from end to end along a line of troops.
- Escalade:** To climb the wall of a Work particularly by using ladders.
- Escarp:** The inner wall of a ditch. Sometimes spelt 'Scarp'.
- Fascine:** Bundle of closely packed brushwood used to strengthen field works or Ditches.
- Fleche:** Arrow shaped mound placed in advance of a projection from a Work to give protection to it.
- Gabion:** Wickerwork basket filled with stones or earth used to strengthen field works or for other purposes where reinforcement is required.
- Glacis:** The sloping outer surface of a Work connecting the top of the covered way to the natural ground surface, and kept clear of obstructions so as not to impede the fire of the garrison.
- Gorge:** The rear portion of a Work usually left lightly protected to render it more vulnerable if captured by an enemy.
- Gun Cotton:** an explosive made by treating cellu-



**Plate 1** A plan of the defences of Gosport (1869, revised 1893) showing the five forts of the the Gosport Advanced (or 'Gomer-Elson') Line, as well as the lines and batteries defending Stokes Bay, the other fortifications, and the various naval establishments in the area. The main railway pre-dates the forts, having opened in 1841; the branch line to Stokes Bay was opened in 1863. (© Crown Copyright. NMR WD764)

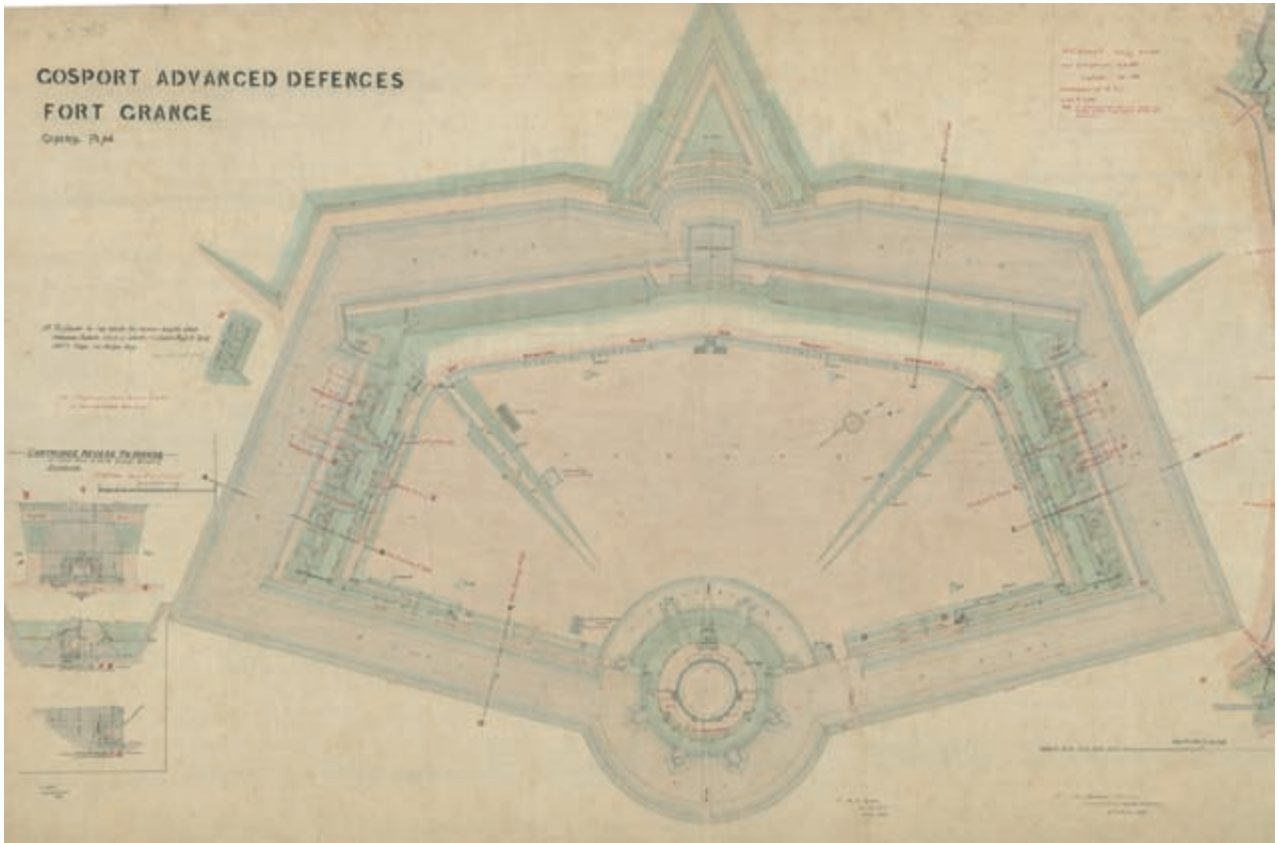


Plate 2 Plan of Fort Grange, Gosport (1869, revised 1893). (© Crown Copyright. NMR WD765)



Plate 3 Fort Grange, Gosport: infilled ditch and entrance to the keep. (© Crown Copyright. NMR, BB96 08601)

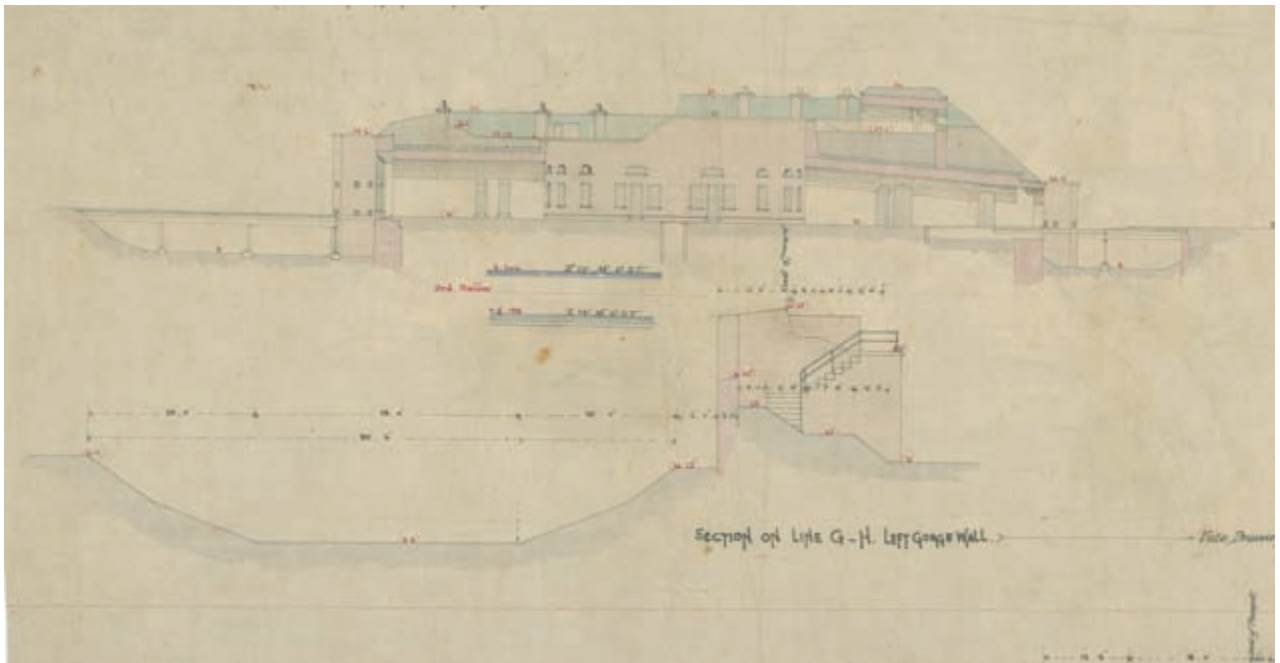


Plate 4 Details of Fort Grange: sections of keep and gorge wall (1869, revised 1893). (© Crown Copyright. NMR WD776)

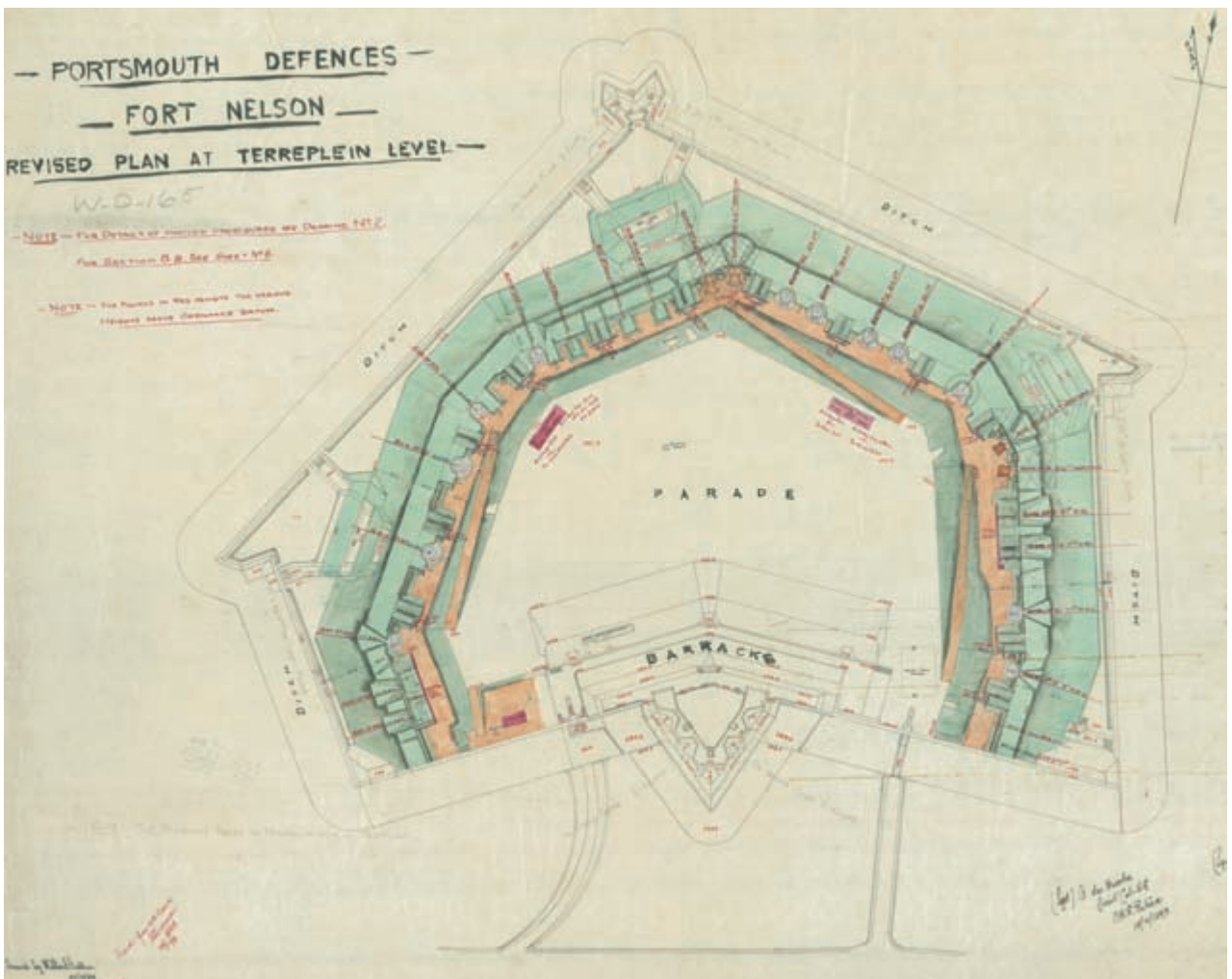


Plate 5 Plan of Fort Nelson, Portsmouth, from 1893. (© Crown Copyright. NMR WD165)



**Plate 6** Drake's Island, Plymouth. 12in RML on reproduction mounting on emplacement no.5 of the upper battery. On the skyline in the distance is Fort Staddon. (© Crown Copyright. NMR, AA98 01876)



**Plate 7** Drake's Island, Plymouth. Seaward face of casemate battery, showing granite construction and iron shields. Plymouth Hoe and de Gomme's Royal Citadel can be seen in the distance. (© Crown Copyright. NMR, AA96 02250)



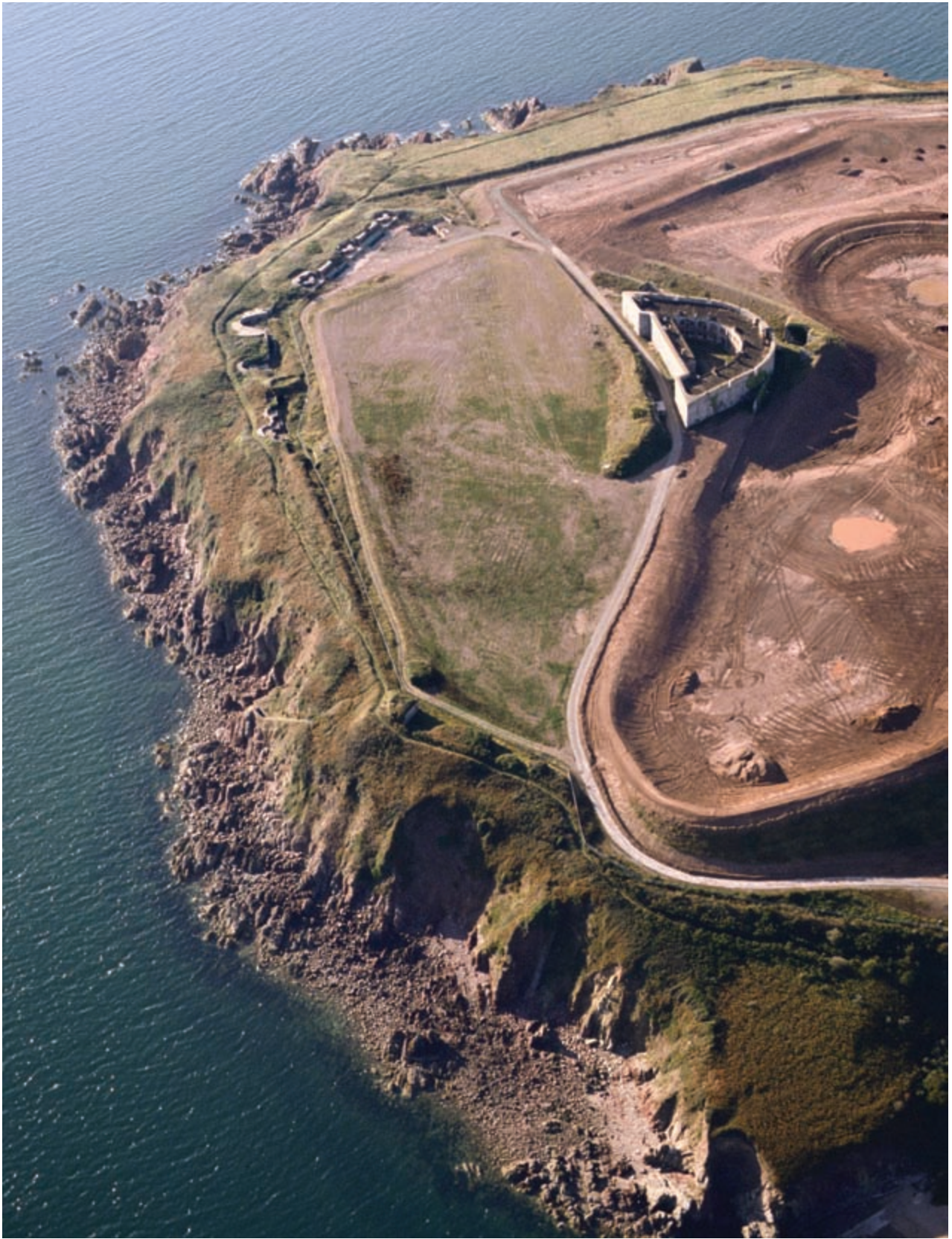
Plate 8 Fort Tregantle. Northern ramparts with Haxo casemates, handrail and gutter. (© English Heritage. NMR, AA000724)



**Plate 9** Stack Rock Fort, Milford Haven, from the air looking north. The original small fort of 1852 can be seen in the centre, surrounded by the 1860s casemated battery. (© Crown Copyright: RCAHMW 2002-cs-0770)



**Plate 10** Popton Fort, Milford Haven, photographed from the air in 1995. Note the sites of former oil tanks, dating from the period when the fort was part of BP's Ocean Terminal (1960s-1990s). (© Crown Copyright: RCAHMW DI2006-0582)



**Plate 11** South Hook Fort, Milford Haven, aerial view looking west, with the remains of the gun positions above the cliff edge to the left, and the 'D'-shaped barracks to the right. The remainder of the fort, including most of the ditch, has largely been swept away during the site's use since 1957 as firstly part of an Esso oil refinery, and now a Liquefied Natural Gas (LNG) terminal. (© Crown Copyright: RCAHMW 90-cs-0933)



**Plate 12** Fort Hubberstone, Milford Haven, aerial view looking north-west. (© Crown Copyright: RCAHMW 90-cs-0930)



**Plate 13** Fort Scoveston, Milford Haven, aerial view of the fort looking north-west. Constructed in an area of farmland characterised by long, narrow field strips dating back to Norman times, the area immediately around the fort was cleared and replaced with large, open fields to provide clear fields of fire for the garrison. (© Crown Copyright: RCAHMW 97-cs-0015)

lose materials such as cotton with with hot concentrated nitric and sulphuric acids.

**Haxo Casemate:** A vaulted casemate open to the rear placed on a Terreplein. Invented by Général Haxo of the French Army.

**HP or Hydro-Pneumatic Gun:** A type of disappearing gun where the recoil forces are stored by an hydro-pneumatic mechanism and used to restore the gun to the firing position after loading.

**Hornwork:** An outwork consisting of two Demi-Bastions separated by a short Curtain wall and joined to the main Work.

**Howitzer:** a gun generally designed to elevate up to 45 degrees.

**Loop:** Narrow aperture through which a rifle may be fired. Sometimes referred to as a 'Loop-hole'.

**Lunette:** An arrow-shaped outwork in the form of a detached Bastion.

**Machicolation:** A projecting ledge, with holes on its underside, on the face of a building through which missiles may be dropped on an attacker.

**ML:** Muzzle Loading – a type of early gun loaded through the muzzle.

**Merlon:** A raised bank between two Embrasures to give additional protection to the gunners.

**Moncrieff:** An early type of disappearing gun where the recoil forces are used to operate a counterweight to bring the gun back to the firing position after loading. Invented by a Captain Moncrieff of the Edinburgh Artillery Militia.

**Mortar:** a gun designed to operate up to (but obviously not quite!) 90 degrees

**Overbank Carriage:** Field gun with its trunnions raised on special brackets to allow the gun barrel to achieve a much steeper elevation than normal and permit the piece to fire at close range from behind cover. An example outside the Prague Artillery Museum has two sets of trunnion bearings allowing the gun to be converted back to a field gun in the field. The construction of these carriages was usually lighter than a contemporary Howitzer.

**Parade:** Open, flat area often used as a drill ground, particularly in a polygonal Work.

**Parados:** Traverse sited to give protection to fire directed at the rear of a Work or to an individual part of it such as a magazine.

**Parapet:** An earthen bank to give protection to riflemen; the top of a Rampart.

**Picric Acid:** used to make explosives by combining ammonium picrate and potassium nitrate.

**Polygonal:** (1) Describes a Work whose Trace has four or more sides. (2) Describes a system of fortification arranged to provide defence in depth by forts able to give mutual support to one another. Derived from the French expression *Polygone*.

**Racer:** Semi-circular, metal track laid flush in the floor of gun emplacement to allow the wheels of a gun-carriage to traverse freely (Note: Artillerymen refer to the wheels on a gun-carriage as 'Trucks').

**RA:** Royal Artillery.

**Rampart:** A protective earthen bank above the Escarp behind which are sited the main defences of a Work.

**Ravelin:** A triangular shaped outwork placed inside the Ditch.

**RE:** Royal Engineers.

**Redan:** A triangular projection from the exterior face of a Work to allow the garrison to defend the adjacent walls and ground.

**Revetment:** Portion of an Escarp wall, or other vertical surface, reinforced to prevent it collapsing into the Ditch.

**RBL:** Rifled Breech Loading.

**RML:** Rifled Muzzle Loading.

**Salient:** The corner of a Work, projecting outwards.

**Sap:** Shallow zigzag trench employed in the investment of a Work.

**Shop, The:** The Royal Military Academy at Woolwich where young Engineer and Artillery officers were trained.

**Tenaille:** A low bank placed in front of, and to give protection to, the base of a Curtain wall.

**Tenaille Trace:** A Work whose Trace consists of a series of triangular Redans at right angles to each other in a 'zigzag' formation.

**Terreplein:** The surface behind the Rampart, and raised above the Parade, on which guns are mounted.

**Tête du Pont:** Fortified work built adjacent to a bridge and designed to protect it.

**Trace:** The ground plan of a fortified Work.

**Traverse:** Earthen bank giving protection from enfilading fire.

**Work:** A term used to describe a 'fortified place' in military engineering, possibly derived from the German *Werk*, meaning a 'fort' in this context.

# CHRONOLOGY

- 10 September 1821 Born at Cowes, Isle of Wight, son of General William Jervois, KH, Colonel of the 76th Foot and Elizabeth, daughter of William Maitland.
- February 1837 Admitted to the Royal Military Academy at Woolwich following early  
(aged 16) education at Dr Burney's academy (Gosport) and Dr Barry's school.
- 19 March 1839 Commissioned.  
(aged 17½)
- April 4 – August 4 1841 Sailed for the Cape.
- 8 October 1841 Appointed Lieutenant.
- 1842 (aged 21) Appointed Brigade-Major.
- 1845 Appointed Adjutant of the Royal Engineers and Royal Sappers at the Cape.
- 1847 Accompanied General Sir George Berkeley to the frontier. To British Kafferia to undertake a survey.
- 13 December 1847 Appointed Captain.
- 1848 Returned to England on board HMS *Devastation*.
- 1849-52 Captain (Company commander, Sappers and Miners) at Woolwich.
- 19 March 1850 Married Lucy, daughter of William Norsworthy, by whom he had two sons (one became adjutant of local military forces in Adelaide) and three daughters.
- June 1852 Ordered to Alderney, with his company.
- August 1854 The Queen and Prince Albert visited Alderney.
- 29 September 1854 Appointed Brevet-Major.
- January 1855 Transferred to London District as Commanding Royal Engineer (Major).
- 8 April 1856 Appointed Assistant Inspector-General, Fortifications.
- 1857 (aged 38) Appointed Secretary of the Defence Committee under the Presidency of the Duke of Cambridge.
- 1858 Employed, by direction of General Peel, Secretary of State for War, in making maps of possible battle-fields in the defence of London.
- 7 February 1860 Appointed Secretary (major), Commission into the Defence of the UK.

13 February 1861	Appointed Brevet Lieutenant-Colonel.
1 April 1862	Appointed Lieutenant-Colonel.
5 October 1862	Appointed Director of Works for Fortifications.
1863	Appointed Companion of the Bath.
6 October 1863– 7 December 1863	Sent on special mission to report on defences of Canada and Nova Scotia. Also visited principal ports on the eastern seaboard of United States. Also inspected possible defence sites in Bermuda.
1864 (aged 44)	Visited Canada and the United States again.
1 April 1867	Appointed Brevet Colonel.
1869 (aged 48)	Sent to inspect works at Halifax, Bermuda, Gibraltar and Malta.
1869 and 1871	Gave lectures at the Royal Institution on the Coast Defences.
1870	Served on the Committee on Coastal Defence.
1871–1872	Employed by the Government of India to inspect and report on the defences of Aden, Perim, Bombay and the Hooghly. Also visited Burma and reported on the defences of Rangoon and Moulmein.
21 January 1872	Appointed Colonel.
28 May 1874	Appointed KCMG (Knight Commander of the order of St Michael and St George).
1875	Retired from War Office and appointed Governor Strait Settlements.
April 1877	Appointed Defence Adviser to Australian colonies. Visited New South Wales, Victoria, Queensland and South Australia.
4 June 1877	Report on the Military Defences of the Australian Colonies.
1 October 1877	Appointed Major-General.
2 October 1877	During this tour he was appointed Governor of South Australia. He also visited Tasmania.
1878	On leave first half of year in UK on family business.
7 December 1878	Opened Jervois Bridge, Adelaide.
7 November 1879	Laid foundation stone of University of Adelaide, Institute and Art Gallery.

19 December 1879	Completion of 'Marble Hill', a residence for the Governor built on the Mount Lofty range outside Adelaide at Jervois' suggestion.
7 April 1882	Appointed Lieutenant-General.
6 & 10 July 1882	Gave lectures on 'Colonization' at Adelaide Town Hall to YMCA.
20 January 1883	Assumed the position of Governor-General of New Zealand.
4 October 1884	Delivered address on Defence of New Zealand to NZ Institute.
26 January 1888	Attended gathering of governors of colonies, ministers etc in Sydney and gave well-received speech.
1888	Gave address at the opening of the Auckland University College.
7 June 1888	Elected Fellow of the Royal Society.
18 March 1889	Relinquished Governorship of New Zealand and left for UK via Australia.
21 November 1889	Admitted to the Royal Society.
1890	Serves on 'Consultative Committee on Coast Defence Duties' (President, Lord Stanhope, Secretary of State for War).
April 1891 til his death	Lives at 'Merlewood', Virginia Water, Surrey.
January 1891	Reads a paper to the Royal United Service Institution on 'Home Rule for the Navy'.
1892 (age 71)	Revisits South Australia (where he had a severe illness) and New Zealand.
28 June 1893	Becomes one of the Colonels Commandant, RE.
17 March 1895	Lucy, his wife, dies.
1 May 1895	His second son, Major John RE, dies.
16 August 1897	Sir William dies after a carriage accident at Bitterne, Hants.
20 August 1897	Buried in churchyard at Virginia Water, Surrey.

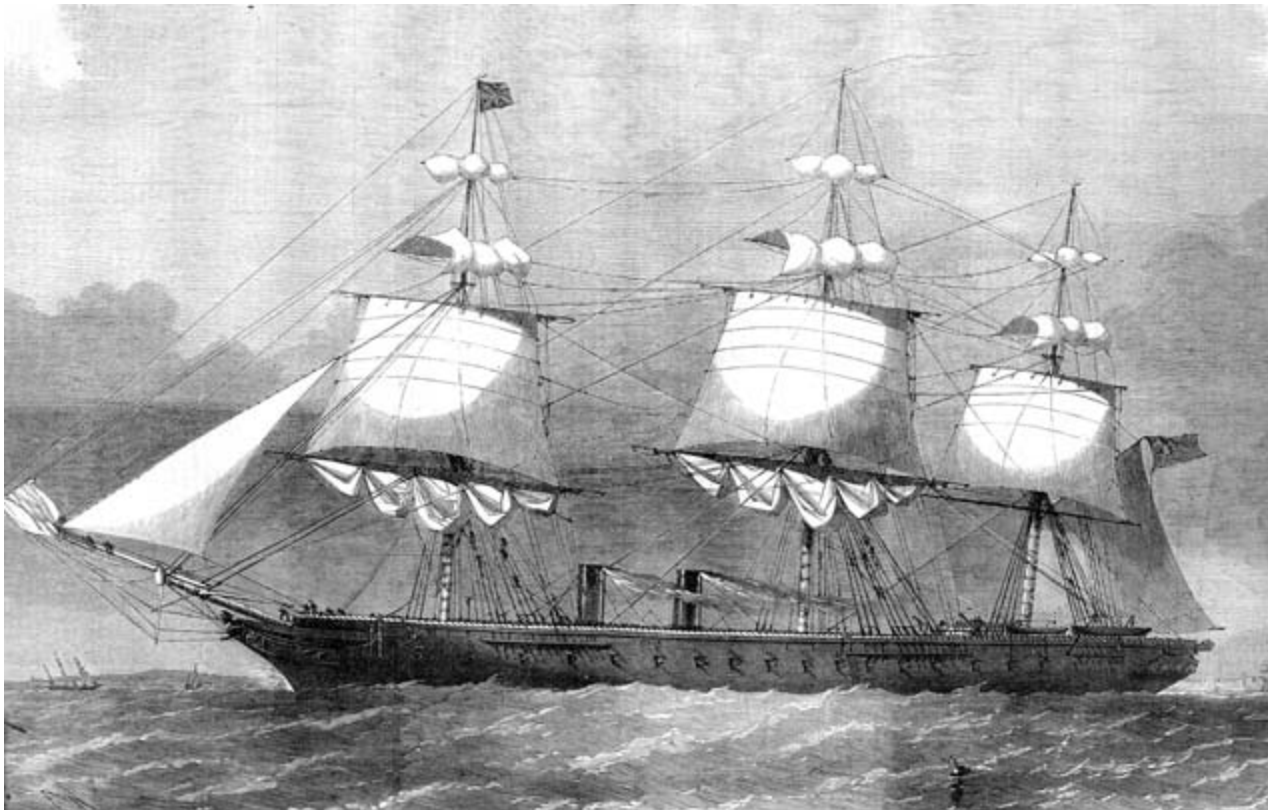
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# INTRODUCTION

The nineteenth century ushered in one of the greatest periods of change in history. Communication between peoples improved ten-fold. With better education people began reading not only the latest newspapers but also the illustrated journals like *The Illustrated London News* and *Harpers Pictorial History*. The latest achievements of engineers and engineering were often depicted in dramatic engravings. Brunel's Saltash Bridge and his gigantic steamships, De Lesseps' Suez Canal, Eiffel's iron tower, Stevenson's tunnels and bridges, Telford's viaducts and the amazing network of canals both in Britain and France. What was less well recorded was the work of Britain's Royal Engineers. To take a few examples more or less at random, who today outside Canada remembers Colonel John By RE (1787-1876) and the Rideau Canal? The plan was to link Kingston on Lake Ontario with Ottawa and connect with Montreal via the Ottawa River, thus avoiding the St Lawrence and with it the danger of US military interference. Engineering feats are sometimes described as heroic or even Herculean. The Rideau Canal is a case in point. By, with two specially raised companies of Royal Sappers and Miners (later the Royal Engineers), local labourers and contractors cut a waterway through an unmapped mass of granite hills, gullies and lakes. Compounding these difficulties was the presence of clouds of mosquitoes and consequently the loss of at least a thousand men through malaria, not to mention the results of drinking homemade whisky and accidents. The waterway when completed in 1832 was 123 miles (198 kilometres) long and incorporated 52 dams and 47 hand operated locks.

In India engineers of the armies of the three Presidencies assisted by the Royal Engineers created much of the country's infrastructure still enjoyed today. Lieutenant (later General) Sir Arthur Thomas Cotton (1803-1899), Madras Engineers, was responsible for the design and construction of the great irrigation works on the River Cauvery, which watered the rice crops of the Tangjore and Trichinopoly districts in the late 1820s. In 1838 he designed and built sea defences for Vizaagapatam. He masterminded the Godavery Delta project where 720,000 acres (29,1377 hectares) of land were irrigated and the entry to the port of Cocanada was made navigable in the 1840s. The Indian Government even erected a statue in his memory in 1983.

Meanwhile in the 1850s Henry John Temple, 3rd Viscount Palmerston (1784-1865, title inherited 1802), Prime Minister of Britain, managed to convince a number of influential people that France was actively considering an invasion of Britain. At his bidding in 1859 Parliament set up a Royal Commission on the defences of the United Kingdom. The important position of secretary was given to a young major of the Royal Engineers, William Jervois. Jervois was undoubtedly one of the most gifted alumnae to emerge in his time from the Royal Military Academy, otherwise known as the 'Shop'. Not long



0.1 Engraving of HMS *Warrior*, probably during her first commission 1862-1864, commanded by Captain the Hon. Arthur Cochrane, then aged 27, and son of the famous Lord Cochrane, Earl of Dundonald. (Author's Collection)

before, he had designed and directed the fortification of the Isle of Alderney in the English Channel, an important strategic asset to Britain. The Commission's report, written by Jervois, recommended the fortifying of Portsmouth, Plymouth, Portland, Pembroke, Dover, Chatham and the Medway. The estimated cost of the largest scheme of fortification ever seen in Britain was the enormous sum of £11,830,000. Jervois, as Director of Works for Fortifications, was design leader and responsible to General Burgoyne RE (Royal Engineers). Though not without controversy, the forts were duly built, coming in on time and under budget. They can still be seen in many parts of Britain, a tribute to the high construction standards of the Royal Engineers. Jervois' next mission was to advise the Canadian government on a system of fortifications designed to protect their citizens from a possible takeover by a newly militant United States. On behalf of the British government he visited Canada twice in 1863 and again in 1864. On two of these occasions he dressed in mufti and examined a number of forts on the US eastern seaboard. In 1869 he was sent to inspect works at Halifax (then in Nova Scotia), Bermuda, Gibraltar and Malta.

From 1871 to 1872 and from 1874 to 1876 he was employed at the request of the Indian Government to examine the defences of Aden, Perim, Bombay (Mumbai) and the Hooghly. He also visited British Burma and made recommendations for improving the defences of Rangoon and Moulmein. In 1874 he was knighted and the following year he resigned from the War Office to take up a new appointment as Governor-General of the Straits Settlements, nowadays part of Malaysia. He put down an insurrection in the State of Perak in 1876 largely brought about by the Colonial Office in London insisting on appointing British officials known as Advisors to each of the ruling Sultans.

In 1877 Russia re-opened the quarrel which had led to the Crimean War of twenty years earlier and invaded Turkey. Unlikely as it may now seem, in the Australian Colonies it was believed that this aggression by the Tsar could lead to an invasion of India through Afghanistan. If this was successful they envisaged a threat to their gold shipments to Europe from a Russian navy using the Royal Navy's bases on the Indian sub-continent. Lord Carnarvon, Secretary of State for the Colonies, at once summoned Jervois from his task in the Straits Settlements and appointed him Defence Advisor to the Australian Colonies. Jervois made a rapid though comprehensive tour of Australia and identified sites suitable for fortification around three-quarters of Australia's coastline. In due course his assistant, Colonel Peter Scratchley, designed and superintended the construction of the new forts. Soon Jervois was on the move again to take up a new appointment as Governor of the State of South Australia, where he kept a close eye on the progress of the local fortifications. After a successful posting in Adelaide he was appointed Governor-General of New Zealand in 1883 where, amongst other duties, he arranged for further fortifications to be built in the face of the widely perceived threat from marauding Russian cruisers. He died in 1897 during his retirement.

There is no doubt that William Jervois was an exceptionally gifted member of a Corps given to producing highly talented and diligent engineers. He was Britain's premier fortress builder in what has been described as the 'golden age' of fortress building. This was a time of heightened sensitivity regarding the importance of frontiers amongst both the old and new nations across the redrawn map of nineteenth-century Europe. Quite apart from Britain, the newly independent Belgium, Prussia, Austria, Romania, Poland and Italy all built extensive and expensive fortifications along their borders. Many still remain today.

Through the lens of Jervois' achievements, this book endeavours to place the construction of these massive works in their geo-political, economic, and technological context. I hope that you will enjoy reading it as much as I enjoyed writing it.

**Timothy Crick**

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