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978-0-521-56456-4 - The Athenian Trireme: The History and Reconstruction of an Ancient Greek Warship, Second Edition

J. S. Morrison, J. F. Coates and N. B. Rankov

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THE ATHENIAN TRIREME

Shortly before the successful launch of *Olympias*, a reconstructed Greek warship, the first edition of *The Athenian Trireme* was published, providing historical and technical background to the reconstruction of the ship in a Greek shipyard. Since then, five seasons of experimental trials have been conducted on the ship under oar and sail, and the lessons learned have been supplemented by new archaeological discoveries and by historical, scientific and physiological research over the last fifteen years. For this second edition, the text has been recast and a number of substantive changes have been made in the light of the sea trials and new research. In addition, there is an entirely new chapter which describes the trials of *Olympias* in detail, reports the performance figures obtained, and outlines the changes which the authors would wish to incorporate into any second reconstruction. There are nineteen new illustrations, including eleven photographs of *Olympias* at sea demonstrating features of the design which could be represented only by drawings in the first edition.

J. S. MORRISON was formerly President of Wolfson College, University of Cambridge and is an Honorary Fellow of Churchill College, University of Cambridge. He is the author of *Greek Oared Ships* (with R. T. Williams, 1968), and of *Long Ships and Round Ships* (1980). With J. F. COATES he published *The Athenian Trireme* (1986) and *Greek and Roman Oared Warships* (1995).

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THE ATHENIAN TRIREME



*The history and reconstruction of an
ancient Greek warship*

Second edition

*J. S. MORRISON, J. F. COATES
and N. B. RANKOV*



CAMBRIDGE
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PREFACE TO THE SECOND EDITION

The first edition of this book went to press as the reconstructed trieres was already under construction, and she was launched as the Hellenic Navy ship *Olympias* in June 1987. Between then and the summer of 1994 the Trireme Trust in conjunction with Trireme Trust USA conducted five seasons of experimental trials in *Olympias* under oar and sail. These provided a great many insights into the problems and practicalities of operating a ship of this type, some of which have necessarily modified the authors' views on details of the design. Some modifications have also been suggested by new archaeological discoveries and by historical, scientific and physiological research over the last fifteen years.

The authors are therefore most grateful to Cambridge University Press for agreeing to publish a revised and augmented second edition. This has enabled us to recast the text to take account of *Olympias*' existence, and to make a number of substantive changes throughout in the light of the sea trials and new research. It has also allowed Boris Rankov to add an entirely new chapter which describes the trials of *Olympias* in detail, reports the performance figures obtained, and outlines the changes which the authors would wish to incorporate into any second reconstruction. The opportunity has also been taken to add nineteen new illustrations, including eleven photographs of *Olympias* at sea demonstrating features of the design which could only be represented by line drawings in the first edition.

The construction of *Olympias* was financed by the Greek Ministry of Culture and the Hellenic Navy, and our trials of the ship would have been impossible without the generosity of those two organisations and without the very considerable logistical support of all kinds provided by the latter. The authors offer their heartfelt thanks to the countless officers and men of the Hellenic Navy General Staff, of the Naval Constructors department, of the Petty Officers Training School (SMYN) at Poros, of the support

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vessels *Kos* and *Kriti*, and of course of the *Olympias* herself, who have helped to make the project work. We would also like to acknowledge the unstinting help and support provided by a succession of British ambassadors and naval attachés to Greece, and by the British Council and the British School at Athens. Last but not least, we wish to thank the almost 1,000 volunteer crew and supporters from all over the world who have either rowed in *Olympias* or helped with the organisation of her sea trials. This new edition was produced out of the perspiration and hard work of all of them.

J.S. Morrison
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PREFACE TO THE FIRST EDITION

In the collection of material for this book, and in the scientific and technical work for the design of the ship which is its *raison d'être*, the authors have received generous help from a wide range and a large number of individuals and institutions. We have done our best to acknowledge this help in the Introduction, List of Illustrations and footnotes to the text, but realise that we cannot here give just recognition to much that has been of vital importance to us.

More widely we wish to thank those in this country who with us have founded and who have given support and backing to the Trireme Trust. Our Greek friends deserve particular mention: Mr George Dracopoulos, Captain A. I. Tzamtzis of the Hellenic Maritime Museum, Mr H. E. Tzalas of the Hellenic Institution for the Preservation of Nautical Tradition, whom we first met at Greenwich in April 1983, Admiral E. Makris, whom we met subsequently in Piraeus, and last but by no means least Commodore I. Kolliniatis and Captain S. Platis, with whom we have had the pleasure of working closely towards the realisation of what is likely to prove the fastest oared ship afloat. Collectively they have been successful in securing Greek financial backing for building the trireme. We thank them all for their confidence, collaboration and friendship.

We acknowledge with gratitude the award by the Leverhulme Foundation of an Emeritus Research Fellowship to John Morrison which has helped very greatly in the assembly of material, and in travel, connected with the book.

Lastly we wish to thank Cambridge University Press and its skilful and sympathetic staff whose efficient labours have made it possible for the book and the ship to be launched together.

J. S. Morrison
J. F. Coates

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ABBREVIATIONS

anc.	ancient
<i>AJA</i>	<i>American Journal of Archaeology</i>
<i>Arch. Eph</i>	<i>Archaiologike Ephemeris</i> (<i>Eph. Arch.</i> before 1860)
C.	Cape
<i>CP</i>	<i>Classical Philology</i>
<i>CQ</i>	<i>Classical Quarterly</i>
<i>CR</i>	<i>Classical Review</i>
<i>FGrH</i>	<i>Die Fragmente der Griechischen Historiker</i> : F. Jacoby, 1957–8
<i>GOS</i>	Morrison and Williams (1968): <i>Greek Oared Ships</i>
<i>GROW</i>	Morrison and Coates (1995): <i>Greek and Roman Oared Warships</i>
<i>IG</i>	<i>Inscriptiones Graecae</i>
<i>IJNA</i>	<i>International Journal of Nautical Archaeology</i>
<i>JEA</i>	<i>Journal of Egyptian Archaeology</i>
<i>JHS</i>	<i>Journal of Hellenic Studies</i>
LSJ	Liddell–Scott–Jones: <i>Greek–English Lexicon</i>
<i>LSRS</i>	Morrison (1980) <i>Long Ships and Round Ships</i>
<i>MM</i>	<i>The Mariner's Mirror</i>
mod.	modern
<i>PCG</i>	<i>Poetae Comici Graeci</i> : K. Kassel and C. Austin (eds.)
pr.	promontory
<i>RA</i>	<i>Revue Archéologique</i>
SI	Système International
<i>SIG</i>	<i>Sylloge Inscriptionum Graecarum</i>
t.t.	technical term

The initials JSM, JFC and NBR are used to refer to the three authors.

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INTRODUCTION

The idea of building a full-scale reconstruction of a trieres, or Greek trireme as it is better known in English, the first and most famous of the standard oared warships of the ancient Mediterranean, first took shape in 1981. Roddi Williams and I (JSM) were beginning work on a book about the later oared warships of the Hellenistic and Roman navies, and had asked John Coates to join us. He had recently retired as Chief Naval Architect for the Ministry of Defence, and was interested in marine archaeology. We were aware that the weakness of *Greek Oared Ships 900–322 BC* (1968) had been its neglect of the architectural and engineering aspects, and we could see that in the explanation of the nature of the later (and larger) ships these considerations would have a vital part to play.

At this point, Charles Willink, a classical scholar whom I had known at Trinity, telephoned to say that he had been having dinner with Frank Welsh, a banker and writer, and Edwin Wolff, a Liverpool solicitor who had recently spent a year as a Visiting Senior Member at Wolfson, my most recent College at Cambridge. The idea had come up of making a reconstruction of a trireme, and he asked if I was interested. I telephoned John Coates, warning him that if we did agree to undertake such an enterprise most of the work would fall on him. It so happened that he and I, as might have been foreseen, had just reached the conclusion that before we could approach the design problems of the later ships we should need as a starting-point to develop in more detail the design of the trieres; for it was beginning to appear that the design of the later ships was likely to have been based on that of the trieres. Early design work on the trieres had already been started, so we were in the mood to agree to undertake the project, and we did so.

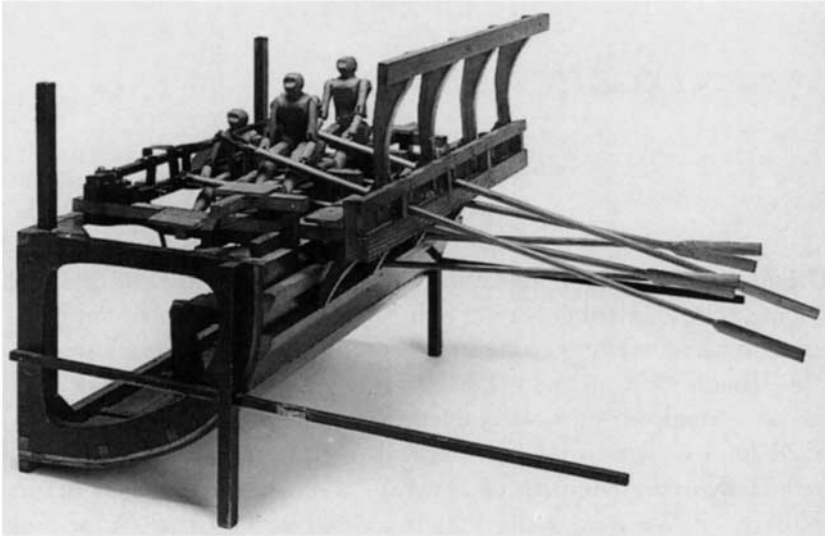
The first public step was a press conference in the City of London in August 1982, at which the project was announced to the world, and a partial model of the proposed oarsystem was exhibited (fig. 1). Seven years

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1. Model made by Sinclair Morrison in 1940 to demonstrate that the oars in each three-level unit of a trieres could be of the same length.

before, there had been a correspondence of record length in *The Times* (6 September to 4 October 1975) on the subject of the trieres. We were not therefore surprised at the considerable attention the announcement aroused in this country as well as in continental Europe and in the USA. The trieres was clearly not only a matter of arcane interest to a few classical scholars, ancient historians and archaeologists. A much greater number of other people had had their curiosity stimulated, and frustrated, in their school-days by reading about these famous and quite extraordinary warships, and finding no adequate explanation of how they were pulled by their huge crews of oarsmen. Rowing men, boatbuilders, scientists and Mediterranean yachtsmen all joined in, displaying very decided views on various aspects of the ship and its performance, and adding significantly to the body of relevant knowledge.

The press conference was followed in April 1983 by an Advisory Discussion. This was a 'live' version of the *Times* correspondence and so designated with the profitable outcome of the latter in mind. It was held at the National Maritime Museum at Greenwich under the auspices of the Director, Dr Basil Greenhill, and with the valuable and energetic assis-

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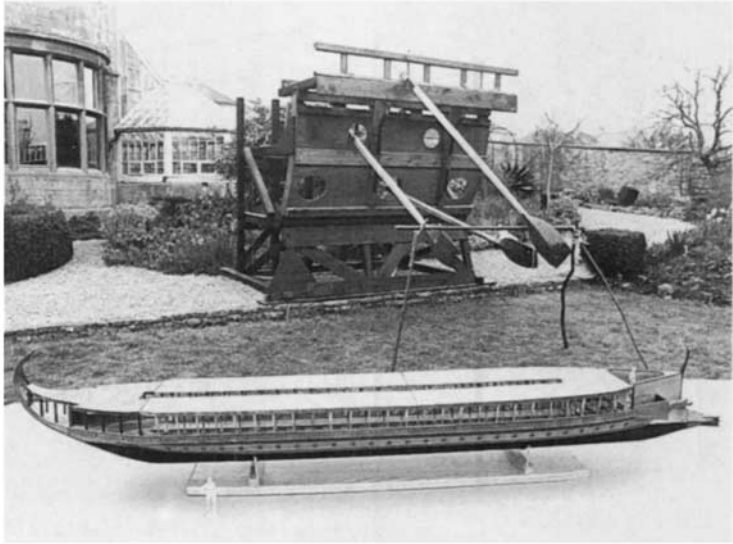
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2. Full-scale mock-up of a trieres' oarsystem made by JFC and David Moss in 1982/3. In front, the model of the proposed replica made by Norman Gundry in 1982/3.

tance of Dr Seán McGrail and his department. During the previous winter John Coates and another naval architect, David Moss, had built a full-scale mock-up of the oarsystem which we were proposing for the reconstruction (fig. 2), while another friend of John Coates, Norman Gundry, made a 1.5 m model of the whole ship (fig. 2, foreground), both to be shown, with drawings, at Greenwich. All the people who were known to have an interest in the subject were invited to attend the discussion, and a good number, including a strong contingent from Greece and one or two from other continental European countries and from America, were able to come. We wanted to receive as many comments and suggestions as possible before, rather than after, the designs were finalised, and to have time to consider them.

The model and the working drawings were exhibited and explained, and the ancient evidence discussed. The mock-up of the oarsystem, with a pool alongside, was set up outside the Museum, and manned by a crew of oarsmen from Emmanuel College, Cambridge, who after some preliminary

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3. The mock-up demonstrated at the National Maritime Museum, Greenwich, April 1983.

splashing settled down to a steady, if cautious rhythm (fig. 3). A naval onlooker¹ suggested that the uppermost oarsmen might more comfortably hold their oars with their inner hand under rather than above the oar (a position adopted in fact by the uppermost oarsmen of the open Roman trireme, Trajan's flagship, on Trajan's column (fig. 4)). There was some discussion of the steepness of the angle made with the water by the uppermost oars, which we were subsequently able to reduce. In general, both oarcrew and spectators expressed themselves satisfied with the system, although some doubts remained about the top oars.

For the structure of the hull we proposed to take as a model the third-century Phoenician oared ships² found by Miss Honor Frost off Marsala (anc. Lilybaeum) and also the fourth-century Kyrenia merchant ship (fig. 5).³ It was fortunate that Richard Steffy was able to be present at the

¹ Admiral Sir Simon Cassels KBE, The Admiral President of the Royal Naval College. ² Honor Frost (1973) and (1974b).

³ H. W. Swiny and M. L. Katzev (1973) and (1974).

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4. The three-level open trieres on Trajan's Column in Rome, early second century AD.

discussion. He was a member of the team from the Texas Institute of Nautical Archaeology which had raised the Kyrenia ship. He gave advice on the method of construction, and the discussion on this topic was particularly fruitful.

The Advisory Discussion at Greenwich was recorded and published by the National Maritime Museum in December 1984. It had attracted a good deal of attention in the press, and had resulted in an invitation from the *Daily Express* to exhibit the mock-up, the model and the working drawings at the Earl's Court Boat Show in January 1984. In September 1982 John Coates and Eric McKee,⁴ who was advising the Trust as an expert in methods of wooden boat construction, visited Greece to study the work that was being done in a Piraeus boatyard on a replica of the Kyrenia merchant ship. John Coates was invited to give a lecture on the Trust's project to a Greek audience. In conversations with the President and Secretary General of the Hellenic Maritime Museum (Admiral E. Makris and Captain A. I. Tzamtzis), with the President of the Institute for the Preservation of Nautical Tradition (Mr Harry Tzalas) and with representatives of the

⁴ See the Bibliography.

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5. The Kyrenia merchant ship, fourth century BC.

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Hellenic Navy, the Trust's representatives became aware that there was a great deal of active interest and substantial support for the project in various quarters in Greece, official and unofficial. Sadly, and to the detriment of the project, Eric McKee died suddenly, shortly after taking part in these promising discussions.

In Britain the promoters of the project had by now formed the Trireme Trust, with charitable status. Air Vice-Marshal Peter Turner, Bursar of Wolfson College, became its Treasurer, and a public appeal for contributions was made. A number of generous donations resulted, including a substantial gift from Mr Eddy Kulukundis and research grants from the Classical Faculty at Cambridge and a number of Cambridge Colleges. The exhibition of the mock-up and model at the Boat Show, the former with oars pulled by crews from Trinity, Magdalene and Corpus Christi Colleges, brought in some further contributions and widened the general interest in the project. Achievement of the Trust's aim began now to seem possible.

It was realised at the outset that before the building of the ship could be put in hand a good deal of preliminary experimentation would be necessary. Small models to test the run of planking at bow and stern would have to be made, and destruction tests carried out on the mortice-and-tenon joints by which the planks of the hull were fastened edge to edge. It was also seen to be necessary to build a piece of the hull to full scale to try out the ancient methods of construction, as attested by the discovered remains of ancient hulls, and to experiment in accurate detail with the seating and pulling arrangements for the oarsmen. Problems which drawings might not reveal could thus be identified and tackled in advance of the actual building of the ship. A Trial Piece built for these purposes would also serve as a useful guide for the future boatbuilders, and might ultimately find a place in a Maritime Museum, since it would be a section, accurate in all respects, of the built ship. Accordingly, in June 1984 a contract for building a full-scale Trial Piece, one-seventh as long (5.5 m) and slightly over half as broad (3.5 m) as the eventual ship, was placed with Coventry Boatbuilders at an initial cost of £30,000 (which eventually rose to £40,000). In view of the favourable prospects which were developing in Greece the Trust thought it essential to press on with these essential preliminary stages, although funds from the appeal were not yet sufficient to cover them, Lloyd's Bank and the Co-operative Bank provided overdraft facilities.

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In February 1984 Frank Welsh and I had visited Athens to talk to our Greek friends. They came forward with a firm proposal that the two ministries involved, Defence and Culture, and the National Tourist Organisation, should put up half the cost of building the ship (which they estimated at £300,000) if the Trust would put up the other half, in addition to the research and development costs already incurred and the cost of the Trial Piece. On our return the Trust began to look for some more substantial sponsorship. In June 1984 Frank Welsh went to Athens for the Poseidonia shipping exhibition, taking with him the Gundry model for display on the Hellenic Navy stand. He was then officially informed that the Hellenic Navy, having received assurances of full financial support from Greek sources, was prepared to go ahead with the building of the ship in Greece, the Trust providing the Trial Piece, detailed specifications and working drawings, and conducting the sea trials of the ship when completed. John Coates and I went to Athens at the end of June shortly after the public announcement there of the initiation of the project by the Hellenic Navy and the Trust in partnership. Mr George Dracopoulos, chairman of Empros Lines, offered free transport of the Trial Piece from Felixstowe to Piraeus and back.

By this time, after more than a year's work, John Coates had developed the design to the point where a specification could be written. As the Hellenic Navy wished to press ahead and invite tenders to build, he set about writing it. With substantial help from Dorian Dymoke, this 150-page document was completed, together with the building drawings, in time to meet the Hellenic Navy authorities again at the end of July. In consultation with John Coates, they immediately translated the specification into Greek and sent out invitations to tender for building the trieres in Greece.

During the winter of 1984/5 while the building contract was being negotiated in Greece, the Trial Piece was being constructed in Britain, rather slowly at first owing to the large amount of work involved in forming and fitting the keel and the thick lower strakes. Commander Stavros Platis and Lieutenant Christos Leletzis of the Hellenic Navy visited Coventry to see the progress and to understand the problems of building an ancient ship. In May 1985 the building contract was awarded to the boat-building firm of the brothers Tzakakos of Kiratzini a suburb of Piraeus. The two brothers are seen in fig. 6 in front of the Trial Piece at Coventry a few weeks later.

The Stewards of the Henley Regatta kindly agreed to a request from the

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6. The Trial Piece at Coventry Boatbuilders, June 1985, with the Tzakakos brothers.

Trust that the Trial Piece should be shown at the Regatta before being shipped out to Greece at the end of July. Their chairman Mr Peter Coni QC earned our gratitude for the helpful and efficient way he enabled us to carry out this rather unusual operation, financed by a generous grant from the Hellenic Foundation.

To be sure that all would be well at Henley, the Trial Piece was given a preliminary testing in the moat of Coombe Abbey near Coventry, where the fifteen oars were pulled with great enthusiasm and precision first by Warwick University Boat Club and then by Worcester Rowing Club. Since it was only a small part of the complete ship and asymmetrical along its length and across its breadth, the achievement by means of a number of steel drums of exactly the right position in the water demanded by the sophisticated oarsystem was a matter of delicate calculation and experiment. Fig. 7 shows how John Coates' sums and the Worcester Rowing Club's performance came right.

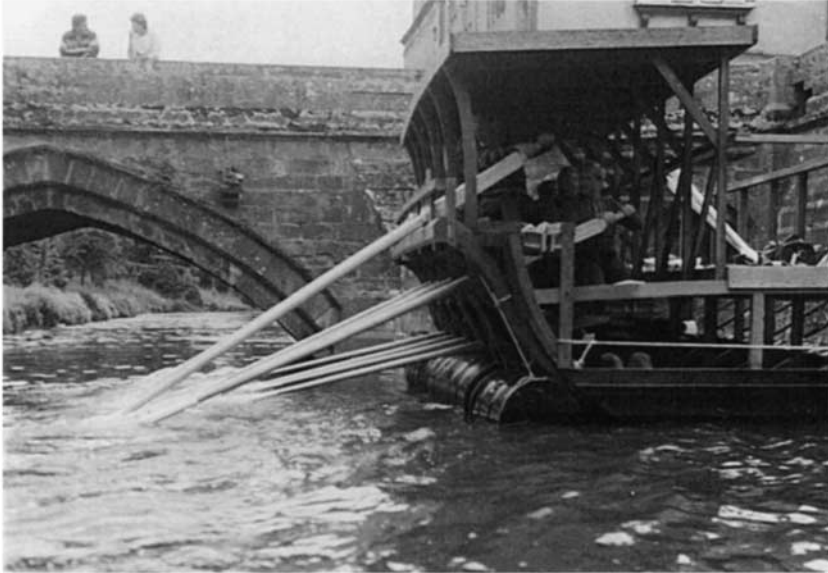
At Henley, publicity for exhibiting the Trial Piece was financed by grants from Global Asset Management and the Grocers' Company, and the whole event was organised with the greatest efficiency and enthusiasm by the Trust's Henley representative Rosie Randolph of Watlington. Our purpose at Henley was to interest and inform the international rowing

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7. The Trial Piece pulled by the Worcester Rowing Club at Coombe Abbey, June 1985.

community about the trireme and the building of the ship in Greece with a view to the recruitment of volunteer oarsmen and oarswomen for the sea trials in the autumn of 1986 or the spring of the following year. A number of rowing clubs and about 150 individuals put their names on the list, among them Boris Rankov, an oarsman and ancient historian who later became one of the rowing masters in the reconstructed trieres. To these the Trial Piece gave some indication of what pulling a trieres would be like (fig. 8), and it did not seem to deter them. The exhibition also stimulated a very lively interest by many members of the public in the whole project. Some useful contacts were made and suggestions put forward in the area of fund-raising. These were important because the activities of the Trust were still being run almost entirely on credit.

After two weeks at Henley the Trial Piece was lifted from the river onto a truck and driven to Felixstowe, where one of Mr George Dracopoulos' Empros Line ships was waiting to take it to Greece. The first stage of the British part of the project had been completed.

Building the trieres herself had already started in Greece and, in the

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8. The Trial Piece at Henley Royal Regatta, July 1985.

event, took two years and two months from signing the contract to completion of acceptance trials by the Hellenic Navy. Oversight of construction was by the Hellenic Navy assisted by John Coates. The second stage of the British part of the project, the conduct of the sea trials to explore the performance of the ship, began at the end of July 1987 at Poros, off the east coast of the Peloponnese where the Hellenic Navy generously accommodated free of charge the necessary 200 odd oarcrew, deck crew and trials staff. At the start of these trials no one knew anything about operating such a ship; there was all to learn.

Thanks to the continued support of the Hellenic Navy, four more periods of trials at Poros were possible, in the course of which, with the help and exertions of internationally recruited oarcrews of men and women, achieved speeds were raised to nearly nine knots, about half a knot short of the historically deduced target speed for fast triereis. The performance under oar achieved in the sea trials was greatly assisted by the enthusiastic and dedicated contributions of both oarcrew and trials staff from the USA, organised by the Trireme Trust, USA.

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The ship, named *Olympias*, has, as may have been expected, been revealed by trials to have some shortcomings, but the trials also demonstrated beyond reasonable doubt that the design of the ship was correct in its fundamentals. She has therefore fulfilled the purposes for which she was built and has fully justified carrying out this large project in experimental ship archaeology, quite apart from the enjoyment given to the many who have been aboard her in one capacity or another.

Reports of all the periods of sea trials have either been published or are currently in press and the knowledge gained from operating this reconstructed trieres has been applied in proposing more recently some practical designs for the dozen or so other attested types of warship which were also instruments of sea power in the Mediterranean during the millennium from the time of Archaic Greece to that of the Roman Empire.