

Dr J.Knezevic

Founder and President of the MIRCE Akademy



B2B over A+A

***Polly Vacher's Voyage To The Ice, VTTI
6th May 2003 - 27th April 04***

***Foreword: Squadron Leader Carl 'Spike' Jepson,
Officer Commanding and Team Leader, The Red Arrows;
with comments by Aviatrice Polly Vacher MBE***

The MIRCE Akademy, Woodbury Park, Exeter, UK, 2004

Published by Mirce Science

Copyright © 2004 by Mirce Science Limited,
Woodbury Park, Exeter, EX5 1JJ, UK.
Phone: +44 (0) 1395 233 856
Fax: +44 (0) 1395 233 899
E-mail: mirce@mirce.com
Web site: www.mirce.com

Editor: Dr J. Knezevic BEng, MSc, PhD, FRSS

Editorial Board: Dr J.Crocker, Professor A.Dubi, Dr M.El-Harram,
Mr J.Hessburg and Dr H.Suranga (Fellows of the Mirce Akademy)

All Rights Reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or any means, electronic, mechanical, photocopying, recording, scanning or otherwise, except under the terms of Copyright, Designs and Patents Act 1998 or under the terms of a license issued by the Copyright Licensing Agency, 90 Tottenham Court Road, London W1P 9HE, UK, without the permission in writing of the Publisher.

Neither the author nor Mirce Science Ltd. accept any responsibility or liability for loss or damage occasioned to any person or property through using the material, instructions, methods or ideas contained herein, or acting or refraining from acting as a result of such use. The author and publisher expressly disclaim all implied warranties, including merchantability or fitness for any particular purpose.

Designations used by companies to distinguish their products are often claimed as trademarks. In all instances where Mirce Science is aware of a claim, the product names appear in initial capital or all capital letters. Readers, however, should contact the appropriate companies for more complete information regarding trademarks and registration.

ISBN 1-904848-01-X

Printed & bound in Great Britain by Topics The Creative Partnership, Exeter, UK.

Acknowledgement

The author is grateful for the support given by:

*Polly Vacher,
Peter Vacher,
Cloude Hirtz,
Clive Nicholas,
Josua Roffler,
Arthur Moore,
Lynn Spiller,
John Crocker
Andy Jones*

during the preparation of this monograph.

To the memory of my mama, Zana Knezevic, 13.08.1928 - 14.12.2003

Content

1. Introduction	4
2. At the Beginning	5
3. The Science of the Challenge	7
3.1 The Solar System	
3.2 The Earth	
3.3 The Atmosphere	
3.4 The Weather	
3.5 The Arctic	
3.6 Antarctica	
3.7 Flying Hazards	
4. The System Response To The Challenge	20
4.1 Aviatrix Polly Vacher	
4.2 Aircraft Piper Dakota	
4.3 The Team	
4.4 The Sponsors	
4.5 Operational Resources	
5. Planning the Challenge	28
5.1 The Pilot's Preparation	
5.2 The Aircraft's Preparation	
5.3 Landing Permissions	
5.4 Meteorology	
5.5 VTTI Launch	
5.6 The Research	
6. Flying the Challenge	42
6.1 Europe 2003	
6.2 The Arctic 2003	
6.3 America 2003	
6.4 Antarctica 2003	
6.5 America 2004	
6.6 Australia 2004	
6.7 Asia 2004	
6.8 Africa 2004	
6.9 Europe 2004	
7. At the End	63
8. References	65
Appendix A: Polly's data: Flights - Date, Distance & Duration	66
Appendix B: Polly's data: Captain's feelings at Departure/Arrival	69
Appendix C: Polly's data: Weather conditions at Departure/Arrival	73
Appendix D: Polly's Data: Maintenance and Failure Information	77

Foreword

We, at The Red Arrows, have been particularly proud of our strong association with the 'Wings Around the World' ventures, our link with the Flying Scholarships for the Disabled and, of course, our friendship with Polly Vacher. We have taken an active interest in following her progress and, where possible, supporting her through both of her epic solo flights around the globe. This second venture, around the world via the poles, was clearly much more ambitious and much more hazardous than the first, yet she has attacked the challenge with courage and determination. Polly has pushed herself and her aircraft to the limits of endurance across the freezing icy wastes of the Arctic, the uninhabited jungles of Belize and the searing heat of central Australia.

The complexity involved in planning and executing a venture such as this is not lost on an organisation like The Red Arrows, as we routinely undertake such journeys ourselves. The true perspective though is only gained when one considers that these flights were safely and successfully undertaken whilst flying solo, unsupported and in a single-engine aircraft. By any standards these are outstanding achievements and clearly required considerable courage, determination and inner strength. These are the exact qualities that are required by the individuals for whom all of this effort was expended – the remarkable characters who have been awarded flying scholarships through the charity 'Flying Scholarships for the Disabled'.

I cast my mind back to when, at the age of 16, I was given the opportunity to fly through a Royal Air Force flying scholarship and consider the effects that had on me as a young man. Consider then the effect of this type of award to a disabled individual trying to rebuild a future. In their own words, scholars refer to rebuilding their confidence, the ability to face new challenges, regaining their self-esteem and the excitement of mastering a new skill. The Red Arrows have seen the positive effect these awards can have on the lives of disabled people around the country and, as a result, have sponsored the award of a full scholarship this year.

Polly can rightly be proud of her achievements in the field of aviation and we are humbled by her commitment to enabling others to share in the freedom of flight.

Squadron Leader Carl 'Spike' Jepson
Officer Commanding and Team Leader
The Red Arrows

1. Introduction

In July 2001 Prince Feisel of the Hashemite Kingdom of Jordan, a patron of the Royal International Air Tattoo Flying Scholarships for the Disabled, was presented with a cheque for £162,420 generated by Polly Vacher's flying project, Wings Around The World, WATW. (For further details see Ref. 1)

Polly flew around the world, totally alone – without a support crew following on in other aircraft – between January 12th and April 27th 2001 in a single engined Piper Dakota. The flight covered 29,000 nautical miles in 124 days, visiting over 20 countries and entering in aviation history as:

The smallest aircraft flown solo by a woman to circumnavigate the world via Australia and the Pacific

Being true to her self and full of energy with a desire to

- make a further contribution to her favourite charity,
- stretch her aviation skills even more, and
- support advanced research in Mirce Mechanics.

In the summer of the 2001 Polly created the ultimate challenge: another journey around the world but this time via the Arctic and Antarctica, places where no woman has flown solo in a light aircraft. Polly named her ultimate challenge ***Voyage To The Ice, VTTL***.

This monograph covers the research, preparation, planning, sponsorship and organisation of this great challenge followed by the events that took place during the 358 day long journey covering over 60,000 nautical miles in length, between May 2003 and April 2004. This journey culminated with a “final landing” in the aviation record history books as:

- ***The first woman to fly solo:***
 - ***In a single engine light aircraft over the North Pole***
 - ***In a single engine light aircraft over Antarctica***
- ***The first person to fly solo around the world via all seven continents***

She generated thousands and thousands of pounds for The Royal International Air Tattoo Flying Scholarship for the Disabled in Memory of Group Captain Sir Douglas Bader and delivered over 20,000 items of in-flight technical data in support of research in Mirce Mechanics.

2. At the beginning

“You should firstly consider the more conventional routes, before tackling a more challenging one” was the comment of Polly’s oldest son Julian, who is a commercial pilot, regarding her dream to fly around the world via the Poles.

Facing challenges has always been an essential driving force in Polly’s life. One of them was to fly around the world via the poles. By successfully completing a solo flight around the world, in the summer of 2001, Polly felt that she has flown “*enough conventional routes*” and that the time had come for her to attack her ultimate challenge. (Polly’s achievements are listed in Chapter 4 of this monograph.)

Always very modest about her achievements and never wanting to let charity, sponsors and herself down, during the summer of 2001 Polly had started quietly to examine the options and obstacles of her newest challenge.

The author was one of the very few privileged people to be involved with this project from the very beginning. At that time frequent emails were received from Polly with messages like: “*Plans for the next venture are moving ahead. ... It is still firmly under wraps.*”

In October 2001 Polly and Peter, her husband, produced a provisional route for the new flight. The very first estimate, by just looking at the map of the world, was that the whole flight could be covered in 55 legs and the total distance would be somewhere around 36,000 miles.

The longest and the most challenging leg of the whole journey would be the flight between Christchurch in New Zealand and McMurdo in Antarctica, which is almost to the mile equal to Polly’s longest flight between Hilo in Hawaii and Santa Barbara in USA, undertaken during Wings Around The World. In many respects, the 2068 nautical miles of inhospitable Southern Ocean were Polly’s biggest concern. One of the major considerations was the direction of flying between these two destinations. In fact, the direction for this leg was the chief determinant for the direction of flying of the entire project. Both options, eastbound (from England to New Zealand) and westbound (from England to Antarctica) had their advantages and disadvantages. However, this decision would determine the starting date of the project and consequently drive all other dates and events.

On the 8th January 2002, the Mirce Akademy of Mirce Mechanics undertook the study of the proposed flight with the aim of determining the necessary reliability and supportability issues concerned with its successful completion. The Akademy’s Master Diploma Programme students – Kenny Everett, Vaughan Russon, Jurgen Gross and Claude Hirtz were allocated to this project. By the time Polly met them for the first time on 4th March, the students have performed a Failure Mode and Effect Analysis on the aircraft and on the operation, maintenance and support resources needed for the flight around the world. They had also collected climatic data for Polly’s potential world-wide destinations regarding maximum and minimum temperatures, precipitation, relative humidity, average dew point, average wind speed and probability of occurrence of thunderstorms, for both options – eastbound and westbound.

.....

3. The Science of the Challenge

“We would not achieve much in the Antarctic without taking risk. However, we go to immense lengths to reduce risks to the minimum that is consistent with achieving our objective.”

Charles Swithinbank (4)

In science it has been accepted, at least since the 16th Century, that nothing happens without cause. Therefore, the events that create operational risk must have a cause. However, it is completely different to ask the question of whether it is possible to predict the occurrence of all possible “risk causing events”. Perhaps the honest answer is no, otherwise there would be no need for the word “risk”. Studying physical phenomena, describing them and finally making accurate predictions about their future occurrences is the chief objective of any science. Consequently, through the study and application of science, knowledge-based prediction can replace opinion-based hope or guesswork.

Mirce Mechanics, as defined by the author, studies the flow of functionability (function, performance and attributes) of man-made systems in time and place. Its objective is to understand processes, factors and resources that drive a system’s operational flow, to describe their relationships analytically and, ultimately, to predict system operational reality, under specified circumstances.

Hence, Mirce Mechanics studies any system and its operational process within the accepted framework. It is limited by the solar system (10^{10} meter) on the one hand and by the atom (10^{-10} meter) on the other. This physical range, of 10^{20} meter, is the smallest “natural scale” which enables the understanding of system operational cause-effect relationships and provides enough information for the accurate predictions to be made. In other words, this is the physical range within which, in the case of Polly’s challenge, the wind changes direction, suncups form on the blue ice runway, the landing gear olio leaks, the battery loses power, airframe and carburettor icing takes place and so forth.

The many challenges facing Polly’s VTTI project will be briefly examined in accordance with the principles of Mirce Mechanics developed at the Mirce Akademy.

.....

4. The System Response to the Challenge

“A System is a collection of elements arranged, by humans, after some distinct logical, scientific or instinctive method, on which at least one need-satisfying function is defined, with expected performance and attributes.” J. Knezevic [1]

The system considered in this monograph was named by Polly Vacher, its originator, as “**Voyage To The Ice**” (VTTI). The main elements of this system are:

- **The Aviatrix**
- **The Machine**
- **The Team**
- **The Sponsors**
- **The Flying Resources**

Nothing is a system unless a measure of its performance, as a function of the states of its elements, is defined. Thus in accordance with the principles of Mirce Mechanics the function of VTTI system was to:

.....

5. Planning the Challenge

“Victory awaits him who has everything in order – people call that luck. Defeat is certain for him who has neglected to take the necessary precautions in time – this is called bad luck.” Roald Amundsen, cited in [4]

Governed by a large number of factors that could have an impact on the VTTI project, from solar radiation, atmospheric conditions, seasonal elements to technical, political and cultural influences, Polly and Peter finalised a provisional route for the flight in spring of 2002.

Driven by Polly's desire to start the flight in the British springtime and taking into consideration the seasonal climatic differences, the route from Birmingham inevitably headed north towards Scotland and Norway with the intention of over-flying the North pole during the month of June. This timing would coincide with the best chance of Arctic High and clear skies in that region.

As a result of the annual rotation of the Earth around the Sun, Polly had around 5 months to make the flight south towards Argentina to fly over Antarctica during the summer months in the Southern Hemisphere. So, after over-flying the North Pole, the route south took in Canada, USA, Mexico, Guatemala, Belize, Antigua, Tobago, Trinidad, Brazil and Argentina.

Polly had to demonstrate a great deal of patience in waiting for the right weather window for her flight to Antarctica. From there the journey home was pretty much well defined, via New Zealand, Australia, Indonesia, Malaysia, Thailand, India, Bhutan, Oman, Bahrain, Jordan, Egypt, Greece, Yugoslavia, Italy, France and back to Birmingham

.....

6. Flying the Challenge

"I have heard it said that today, with easier access to high latitudes, the challenge has gone out of pole fieldwork. Those who believe it should stay at home – to avoid being disillusioned."
Charles Swithinbank (4)

Birmingham International Airport, on the 6th May 2003, was the venue for the beginning of the transformation of operational, maintenance and support plans into operational reality. The main elements of the Voyage To The Ice System, Polly and G-FRGN Piper Dakota, which engine had each completed 100 hours of flying, from overhaul, were ready for official take off.

Family, members of the Royal International Air Tattoo Flying Scholarships for Disabled team and scholars who benefited from the scheme in the past, sponsors, friends, well-wishers and the media arrived at 12 noon at Birmingham International Airport (52° 30'N, 01° 50'W) to see Polly at the start of her ultimate challenge. Thus, after almost two years to the day, from successfully completing her first flight around the world, Polly found her self at the same place, with the same aircraft, supporting the same charity but with a very different itinerary. The dream of flying over the ice was just to begin to become reality. HRH Prince Charles, as a Royal patron of the Centenary of Flight, joined the party at 15.30 to wish Polly "bon voyage". The Hurricane and Spitfire from the Battle of Britain Memorial Flight were all ready to support Polly's farewell flypast.

.....

7. At the End

"You make your own progress and your own luck. By determination, commitment, refusal to give up or be straitjacketed by convention or the short-sightedness of others, describe it as you will, you are the one who creates the airflow beneath your own wings." **Richard Noble (2)**

On 27th April, 2004, after 357 days of circumnavigating the globe via all seven continents, twenty countries and spending over 500 hours in the pilot's seat, Polly arrived, on schedule, at 12.30 p.m., at her starting point, Birmingham International Airport, but this time from the south. This time she was welcomed by two fire engines that ceremonially created a water arch, to salute the skill, knowledge and courage of Aviatrix Polly Vacher who has become

The first women to fly solo:

- *In a single engine light aircraft over the North Pole*
- *In a single engine light aircraft over Antarctica*

The first person to fly solo around the world via all seven continents

8. References

- [1] Knezevic, J., From B to B, Polly Vacher's Global Challenge, pp 48, Mirce Academy, Exeter, UK, 2001, ISSN 1470-9171
- [2] Ponomarev, L.I., The Quantum Dice, pp 251, Institute of Physics Publishing, 1993, Bristol, UK, ISBN 0-7503-0241-0
- [3] Polly's Diary, Website: Worldwings.org
- [4] Swithinbank, C., Forty Years on Ice, pp 228, The Book Guild Ltd. England, 1998, ISBN 1 85776 261 4.
- [5] Knezevic, J., Reliability, Maintainability and Supportability Engineering – A Probabilistic Approach, pp.292, plus software PROBCHAR, McGraw Hill, London, UK. [1993]. ISBN 0-07-707691-5
- [6] Wickson, M., Meteorology for Pilots, pp. 348, Airlife Publishing Ltd., 1992, London.
- [7] Wringe, R., Aircraft Ditching Course notice, Fleetwood Offshore Survival Centre, 2000.
- [8] Piper Dakota Pilot's Operating Manual handbook, Piper Publication department, June, USA, 1978.
- [9] Green, G.R. et al, Human Factors for Pilots, second edition, pp140, Avebury Aviation, 1996, Aldershot, UK, ISBN 0-291-39827-7
- [10] Campbell, R.D., Bagshaw, M., Human Performance and Limitations, pp 167, Blackwell Science, 1991 Oxford, UK, ISBN 0-632-02929-3
- [11] University of Sydney [Biomedical Sciences] Home Page
- [12] Hirtz, C. Impact of the Low Temperature on the Human Performance, Doctoral Diploma Research Project, Mirce Academy, UK, 2003.
- [13] Gross J., Impact of the High Temperature on the Human Performance, Doctoral Diploma Research Project, Mirce Academy, UK, 2003.
- [14] Swithinbank, C., Foothold on Antarctica, The Book Guild Ltd., England, 1999, ISBN 1-85776-406-4
- [15] Hartzell, Propeller Owner's Manual, January, USA, 1999.
- [16] Hirtz, C., Impact of a Weather Forecast on the System Operational Reliability, Doctoral Diploma Research Project, Mirce Academy, UK, 2003.
- [17] The Cambridge Encyclopedia, 3rd Edition, Edited by Crystal, D., Cambridge University Press, UK, 1999, ISBN 0-521-66800-X
- [18] Encyclopedia Britannica, Millennium Second Edition, CD-ROM
- [19] Knezevic, J., Personal Communication with Polly Vacher
- [20] Noble, R., THRUST-Through the sound barrier, pp. 320, Partridge, London, 1998. ISBN 1-85225-268-5
- [21] Centre for Astrophysical Research in Antarctica, CARA, website