The MIRCE Akademy

From B to B

Polly Vacher's Global Challenge

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

Dr Jezdimir Knezevic

Forward by Polly Vacher

"Facing challenges has always been an essential driving force in my life." **Polly Vacher - Aviatrix**

Woodbury Park, Exeter, EX5 1JJ, UK.
Phone: +44 (0) 1395 233 856
Fax: +44 (0) 1395 233 899
e-mail: quest@mircakademye.com
web site: www.mirce.com

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 and Andy Jones during the preparation of this monograph.

Content

1. Introduction

According to Albert Einstein, "Everything that the human race has done and thought is concerned with the satisfaction of felt needs" [1]

The need for flying is as old as the human race. Since 1903, thanks to the Wright Brothers, humans have been able to fly.

Flying by your-self in your own plane is a dream of millions, but a reality for very few.

However, flying by your-self in your own plane around the World is the dream of those privileged few, men and women, who owned a plane and were able to fly.

Polly Vacher is one of those few who transformed that dream into reality. By doing that she entered into history book as*: The smallest aircraft flown by a women to circumnavigate the world via Australia and Pacific*.

It was a great privilege and honour for the MIRCE Akademy of System Operational Science to be in a position to experience part of this record-making journey, as a sponsor. It was an unique opportunity to share the determination, talent and knowledge of one of the very rare and gifted people in the world who, within seven years of touching the joy-stick for the first time at the age of fifty, gained the skill and courage to fly a single engine airplane around the globe.

From the perspective of System Operational Science, Polly's trip was a great opportunity to study how meticulous preparation, self discipline and professionalism in every aspect of the journey culminated in **total operational success**.

Dr J.Knezevic

Woodbury Park, December, 2001

2. The System

"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.

Dr J Knezevic
MIRCE Akademy

2.1 The Need Satisfying Function

The system considered in this monograph was named by Polly Vacher, its originator, the "Wings Around The World" (WATW). The main purposes of the system were to:

1. Challenge the mental and physical ability of Polly Vacher to complete the around the world round trip solo in her single engine Piper-Dakota aircraft

2. Raise awareness of the needs of disabled people world-wide which will help them to rebuild their lives.

3. Raise funds for ***The Royal International Air Tattoo Flying Scholarship for the Disabled in Memory of Group Captain Sir Douglas Bader***. This Scholarship presents 'an intellectual and physical challenge that they never remotely believed they could overcome'. By doing so, they gain confidence, self-esteem and possibly a job.

The expected performance and attributes of the Wings Around The World system were:

1. To successfully complete the around the world trip solo in the Piper-Dakota, G-FRGN, between 12th January and 17th May 2001,

2. To raise awareness of the needs, abilities and opportunities of disabled people in over 20 countries on four continents.

3. To raise £150,000 for the Flying scholarship endowment which will provide an annual scholarship "for ever".

The main elements of the Wings Around the World system were:

- The aviatrix
- The aircraft
- The sponsors
- The Team
- The Flying Scholarship

As nothing is a system unless a measure of its performance, as a function of the states of its elements, is defined, each element of the WATW system, together with the relationships between them, will be examined in this monograph.

Complexity is proportional to the number of relationships that exist, and the number of ways in which the system can react with its environment (i.e. the degrees of freedom).

2.2 The Aviatrix

Name: Polly Mary Anne Vacher.
Date of birth: 13 January 1944.
Marital Status: Married with three (grown up) sons.
Education: Head Girl, Stover School, Newton Abbot. 8 'O' levels, 2 'A' levels.

Professional: Qualified physiotherapist, trained Middlesex Hospital, London.

Musical and singing training at Trinity College, London.
Licentiate of Trinity College, London.
Batchelor of Arts (Music), Open University
Masters degree in Music Education, University of Reading

UK Private Pilot's Licence, 1994.
Australian Private Pilot's Licence, 1994.
Australian Instrument Rating, 1995.
UK Instrument Rating, 1997.
UK Commercial Licence, 1999

Qualification: Physiotherapist, Middlesex Hospital, London 1963-65.
Physiotherapist, St. George's Hospital, Tooting 1965-66.
Physiotherapist, Nuffield Orthopaedic Centre, Oxford 1966-68.
Music teacher, in school and private 1978-present.
Director, Fregon Aviation Ltd., 1996-present.
Fund raiser, "Royal International Air Tattoo Flying Scholarships for the Disabled (in memory of Sir Douglas Bader)", 1997-present.

Interests: Flying, skiing, tennis, music (especially giving concerts for charity), flying for the disabled, public speaking, Australia, fresh challenges.

Recognition: From 1997 I have been one of five people, and the only woman, on the selection board for the "Royal International Air Tattoo Flying Scholarships for the Disabled".

Facing challenges has always been an essential driving force in Polly's life. At the age of 45, she did a tandem skydive to raise money for charity. This changed the direction of her life, as she was personally challenged to become a proficient skydiver. This was achieved in 1990 with a total of 245 jumps.

Then, Polly gave up skydiving as a hobby in favour of flying. In 1994 she gained a her UK Private Pilot's Licence, just before moving to Australia for 18 months in connection with her husband's work. Having held a flying licence for only a few months, Polly hired a light aircraft and flew with her husband Peter around the circumference of Australia, up the middle to Ayres Rock and Alice Springs and back across the Simpson Desert. With little experience in flying, this in itself was a challenge. They landed on dirt strips in the real outback, and on an island in the middle of the crocodile-infested Gulf of Carpenteria. They flew into an aboriginal settlement where they spent two nights with the local policeman, and went on night patrol with him.

In 1997 Polly Vacher flew solo in a single engine Piper Dakota across the North Atlantic. Peter joined her in America and together they flew around the periphery of the United States and Canada. They flew at 16,000 feet over the ……

2.3 The Aircraft

William Piper (1881-1970) was "the Henry Ford of Aviation". His dream was to develop and build an airplane for everyone. The Cub built the base of the general aviation community as no other design. He opened the doors for Everyone to learn to Fly.

The aircraft selected by Polly to accomplish her plan was the PA-28-236 Dakota. This Piper aircraft is a single-engine, single-propeller, low-wing monoplane of all metal construction. It has seating for up to four occupants and has a two hundred-pound luggage compartment.

The Airframe

The basic airframe is of aluminum alloy with the exception of the steel engine mount, the landing gear, miscellaneous steel parts, the cowling, and the lightweight plastic extremities (tips of wings, tail fin, rudder and stabilator).

Aerobatics are prohibited in this airplane since the structure is not designed for aerobatics loads.

Table 1. Light Manoeuvering Load Factors

Positive Load Factor (Maximum)	3.8G
Negative Load Factor (Maximum)	No inverted manoeuvres approved

The fuselage is a semi-monocoque structure with a passenger door on the forward right hand side and a cargo door on the aft right hand side.

The wing is of a semitapered design and employs a laminar flow NACA 65_2-415 airfoil section. The main spar is located at approximately 40% of the chord aft of the leading edge. The wings are attached to the fuselage by the insertion of the butt ends of the spar into a spar box carry-through, which is an integral part of the fuselage structure. The bolting of the spar ends into the spar box carry-through structure, which is located under the aft seats, provides in effect a continuous main spar. The wings are also attached fore and aft of the main spar by an auxiliary front spar and a rear spar. The rear spar, in addition to taking torque and drag loads, provides a mount for flaps and ailerons. A handle located between the front seats mechanically controls the four-position wing flaps. When fully retracted, the right flap locks into place to provide a step for cabin entry. Each wing contains one fuel tank.

……

The Supportive Sponsors

BOC Gases	Oxygen systems
Bristol Flying Centre	Pilot preparation and training
British Airways	Charity support
Far North Aviation	Avgas
Fleetwood Nautical College	Survival training
Highlight Repro	Certificate printing
H R Smith Group	Personal Locator Beacon
Imagecare.com	Photography and production
Kingfisher Graphics	Aircraft decals and wing names
The Limousin Society	Hospitality
Loop Carriers	Financial support
L S T S	Survival training

Nikon UK	Digital Camera
The Park Club	Fitness training
Ross Consular Services	Visas
Rotary Clubs	Worldwide Hospitality
Royal Garden Riverside Hotel, Bangkok	Hospitality and media support
The Ryedale Herd	Hospitality and financial support
T L Clowes Insurance	Financial support
Woodbury Park	Financial support
Virgin Cargo	Shipping
Fedex	Shipping

Wingnames

Around 1,400 individuals, clubs, schools and societies paid £25 each to have their name on the wings to 'Fly around the world with me'.

2.5 The Team

A committee of five volunteers, members of the British Women's association, was established with the mandate to raise funds by organising events and approaching Companies and Trusts who might wish to sponsor or give a donation towards the Flying scholarship. They were:

- **Polly Vacher, Chairman**

- **Valerie Cahill:**
- **Sue Chase**
- **Susie Dunbar**:
- **Rosemary Taylor:**
- **Alice Auckland**

The team has been working on this project over three years, including a major fundraising evening at the Imperial War Museum at Duxford attended by the Charity's Patron, Her Majesty Queen Noor of the Hashemite Kingdom of Jordan.

Polly's husband Peter and other members of her family have made a gigantic contribution towards this record breaking trip, through all its stages. ……

2.6 The Scholarship

The Royal International Air Tattoo Flying Scholarships for the Disabled scheme was established in 1983 in memory of the wartime, legless ace pilot Group Captain Sir Douglas Bader. The purpose of the scheme is to help disabled people rebuild their lives. Typically a person's life has fallen apart after becoming severely disabled from an accident in the prime of their life, or perhaps they have underachieved due to disability from birth. A flying scholarship presents an intellectual and physical challenge they never remotely believed they could overcome. By doing so they gain confidence and self-esteem. This can lead to getting a job, maybe for the first time.

3. The Environment

"We live submerged at the bottom of an ocean of the element air, which by unquestioned experiments is known to have weight, and so much, indeed, that near the surface of the Earth where it is most dense, it weighs (volume for volume) about the four-hundredth part of the weight of water ..... whereas... on the tops of high mountains it begins to be distinctly rare and of much less weight." **E. Torricelli (1608-47)**

The atmosphere of the earth is a thin spherical shroud composed of a mixture of gases and retained by gravitational attraction. It extends to a great height, but conventional flight is possible only in its denser layers. However, around 90% of the total mass of the air is found below 40km (25 miles). This thin layer of air makes life on earth possible.

The lowest layer of the atmosphere, the one in which humans live, is called the troposphere. The Greek word tropos means turning; turbulent air motion results in continual mixing, and the troposphere is host to much of what is called weather.

The temperature drops linearly in the troposphere-that is, the decrease in temperature with altitude follows a straight line. The cooling of the air with increasing distance from sea level is about -6.5 degrees Celsius per kilometer (-3.6 degrees Fahrenheit per 1000 feet).

The troposphere extends to about 11 km, and at its upper edge-called tropopause-there is a shift in the behavior of the temperature. Beyond the stratosphere is the cold stratosphere where the temperature remains a constant –56 degrees Celsius (-67 degrees Fahrenheit) for about 9 km.

……

4. The Operational Plan

"Operational Plan manages the demands for a needs-satisfying function in time and space."

Dr J.Knezevic
MIRCE Akademy

The main objective of creating an operational plan is the determination of the management of all consisting elements of the operation in the future, and the definition of the relationships between the elements of the system in time and space.

Taking into account all specified requirements at a very early stage of the planning process, known as the conceptual stage, the possible concepts of the future operation are examined in a broad form in order to outline the most favourable alternative. At this stage not all details of the operation are addressed. Thus, the outcome of conceptual stage is a general concept and plan for the future operational process, details of which might not be known fully.

4.1 The Operational Plan

Governed by a large number of factors, from technical to political, related to the Wings Around The World System, Polly and Peter have produced a provisional route for the journey, as shown in Table 9.

Table 9. Provisional Operational Plan (Route)

Leg	Departure	Dest. City	Dest. Country	N.Miles
1.	Birmingham	Caen	France	**221**
2.	Caen	Limoges	France	**237**

3.	Limoges	Nice	France	**335**
4.	Nice-	Ciampino	Italy	**274**
5.	Ciampino	Crete	Greece	**683**
6.	Crete	Akrotiri	Cyprus	**450**
7.	Akrotiri	Amman	Jordan	**580**
8.	Amman	Damman	Saudi Arabia	**879**
9.	Damman	Muscat	Oman	**545**
10.	Muscat-	Bombay	India	**849**
11.	Bombay	Jodhpur	India	**466**
12.	Jodhpur-	Calcutta	India	**928**
13.	Calcutta-	Bangkok	Thailand	**836**
14.	Bangkok	Kuala Lumpur	Malaysia	**658**
15.	Kuala Lumpur	Medan	Indonesia	**205**
16.	Medan-	Jakarta	Indonesia	**537**
17.	Jakarta	Yogyarkarta	Indonesia	**498**
18.	Yogyarkarta-	Surabaya	Indonesia	**217**
19.	Surabaya	Kupang	Indonesia	**671**
20.	Kupang-	Darwin	Australia	**448**
21.	Darwin-	Burketown	Australia	**594**
22.	Burketown	Cairns	Australia	**360**
23.	Cairns	Gladstone	Australia	**526**
24.	Gladstone	Gloucester	Australia	**522**
25.	Gloucester	Bankstown	Australia	**152**
26.	Bankstown	Canberra	Australia	**142**
27.	Canberra-	Bankstown	Australia	**142**
28.	Bankstown	Coffs Harbour	Australia	**254**
29.	Coffs Harbour	Tontouta	New Caledonia	**867**
30.	Tontouta	Nadi	Fiji	**682**
31.	Nadi	Pago Pago	Samoa	**701**
32.	Pago Pago	Christmas Island	Kiribati	**1158**
33.	Christmas Island	Hilo	USA	**1067**
34.	Hilo	Santa Barbara	USA	**2066**
35.	Santa Barbara	Big Bear	USA	**180**
36.	Big Bear	Colorado Springs	USA	**797**
37.	Colorado Springs	Denver	USA	**53**
38.	Denver	St. Louis	USA	**705**
39.	St. Louis	Piqua	USA	**296**
40.	Piqua	Washington DC	USA	**339**
41.	Washington DC	Hartford	USA	**278**
42.	Hartford	Boston	USA	**899**
43.	Boston	Gander	Canada	**840**
44.	Gander	Narsarsuaq	Greenland	**679**
45.	Narsarsuaq	Reykjavik	Iceland	**693**
46.	Reykjavik	Wick	UK	**645**
47	Wick	Birmingham	UK	**398**

Therefore, at the end of this stage of the journey, the provisional plan had to be converted into a detailed set of specifications related to every single element of the system according to which the round the world journey is to completed. As this process progressed, more information became

available which in turn provided the opportunity for the selection of the best solutions among all possible alternatives.

……

5. The Operation Process

"The Operation Process is a flow of operation tasks needed to meet the Operational Plan of the System".

Dr J Knezevic, The MIRCE Akademy

After years of preparation, lead by devoted and motivated team, supported by sponsors, with a nearly 1000 names on the wings, the day for the beginning of the operation process has arrived.

5.1 Start: Birmingham 12th January 2001

The Birmingham International Airport, was a venue for thee the beginning of the transformation of operational, maintenance and support plans into operational reality. The main elements of the Wings Around The World System, Polly, a day before her 57th birthday, and the G-FRGN Piper Dakota, whose airframe and the engine had each done 1712.9 hours of flying, from new, 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 wishes and media.

At 12.30 pm, Polly made a scheduled departure. Immediately after the take off she performed a spectacular fly-past in formation with RAF Harrier jump jet, piloted by Sqn. Ldr Al Pinner, and headed south towards France. This was the end of planning and the beginning of the around the world solo conquering operation.

7. The Support Process

"The Support Process is a flow of support task performed to provide necessary resources for System operation and maintenance".

Dr J Knezevic, the MIRCE Akademy

The final statistics regarding the additional, non-planned, demands for the support resources was as follow: ……..

8. System Operational Success

*"**System Operational Success** **is** **the provision of need satisfying function(s), in time and space, under the impact of Internal & External Disturbances".***

Dr J Knezevic, the MIRCE Akademy

8.1 Scheduled Arrival at the Birmingham International Airport:

On 17th May 2001, after 124 days of circumnavigating the globe through four continents, twenty countries and spending 232.45 hours in the pilot's seat, Polly arrived, on scheduled, at 10.30 am,

at her starting point, the Birmingham International Airport, from north. This time she made a fly-past, escorted by two RAF Harrier jump jets, which, with their hovering salute, acknowledge that the history has been made, by skilled, knowledgeable, and courageous aviatrix, Polly Vacher.

.

8.2 Personal Success

"I really feel the world is a small place"

Polly Vacher, 17th May 2001

……

9. Epilogue

You make your own progress and your own luck. By determination, commitment, refusal to give up or be straitjacketed by convention or the shortsightedness of others – describe it as you will – you are the one who creates the airflow beneath your own wings.

Richard Noble, [5]

Polly's pyramid of faith, love, support and management, with her courage, knowledge and meticulous preparation had carried her "Wings Round The World" system around the globe. By doing that she meet all objectives of her journey in the manner ***business as planned***.

The story of this remarkable journey became the text book algorithm for the Operational Success. The MIRCE Akademy of the System Operational Science salutes to each member of the WINGS AROUND THE WORLD TEAM and thanks POLLY VACHER for allowing us to be in the position to share the experience, feelings, toughs and the data of this unique journey.

10. References

[1] Einstein, A., The world as I see it, 1991
[2] Piper dakota Pilot's Operating Manual handbook, Piper Publication department, June, 1978.
[3] Hartzell, Propeller Owner's Manual, January, 1999.
[4] Shell Aviation Bulletin 595, Aviation Fuels in Drums, January 1998.
[5] Knezevic, J., Reliability, Maintainability and Supportability Engineering – A Probabilistic Approach, pp.292, plus software PROBCHAR, McGraw Hill, London, UK. (1993).
[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] Noble, R., THRUST-Through the sound barrier, pp. 320, Partridge, London, 1988.