

# RERU VALLEY EXPEDITION PROPOSAL 2011



## FOREWORD

The destination of this expedition is to the Reru valley in the Zaskar range. This range is located in the north East of India in the state of Jammu and Kashmir, between the Great Himalayan range and the Ladakh range. Until 2009 there had been no climbing expeditions to the valley, and there are a large number of unclimbed summits between 5700m and 6200m in this area: only two of the 36 identified peaks have seen ascents.

Our expedition aims to take a large group of 7 members that will use a single base camp but split into two teams that will attempt different types of objective. One team will focus on technical rock climbing ascents, whilst the other team will focus on alpine style mixed snow and rock ascents of unclimbed peaks with a target elevation of around 6000m.

## CONTENTS

1. Expedition Aims & Objectives .....	3
2. Background .....	3
3. Itinerary.....	12
4. Expedition Team .....	13
5. Logistics .....	19
6. Specialist Equipment .....	23
7. Finances .....	25
8. Training .....	25
9. Contingency Plans .....	26
10. Risk Assessment and Safety Plan .....	27
11. Post Expedition .....	27
12. Acknowledgements.....	27
13. Bibliography .....	28
Appendix A - Risk Assessment.....	30
Appendix B - Lake Louise Self Assessment Scorecard .....	38
Appendix C - Budget.....	39
Appendix D - Safety Plan .....	40
Appendix E - Incident Response .....	44
Appendix F - Avalanche Safety.....	47

## 1. EXPEDITION AIMS & OBJECTIVES

### AIM

To achieve first ascents of unclimbed peaks in the Reru valley, Zaskar range, Northern India.

### GENERAL OBJECTIVES

- Complete the first ascent of multiple unclimbed peaks in the Himalayas.
- Complete the first ascent of multiple unclimbed technical rock routes in the Himalayas.
- Identify other potential objectives in the area for future expeditions.
- Report on the expedition to provide information and inspiration for Imperial College and the wider mountaineering community to explore the Himalayas.
- Provide feedback to Kimikazu Sakamoto on the accuracy of the recent American Alpine Journal article on the region.
- Extend the mountaineering and expedition experience of all members.
- Continue to publicise Imperial College as a leading university in exploratory mountaineering

### ETHOS

The expedition is designed to be lightweight and unsupported (beyond portage). The team will make every effort to be self sufficient, ethically and environmentally sound in conjunction with Earthwatch institute guidelines ([www.earthwatch.org](http://www.earthwatch.org)) and Leave No Trace ([www.lnt.org](http://www.lnt.org)). The expedition will be split into two teams with different objectives.

## 2. BACKGROUND

### LOCATION

The Reru Valley is located in Northern India in the state of Jammu and Kashmir. The mountains bordering the Reru valley range from 5700-6200m. The region is best accessed from the airport at Leh; Reru village can then be accessed by a 3 day drive from Leh via the town of Padum. The drive is followed by a trek to base camp. The valley starts near Reru village at 76°57'48, 33°19'36 (See figure 1 and figure 2).



Figure 1: Reru location, Delhi, Leh, Padum and Reru valley are labelled.

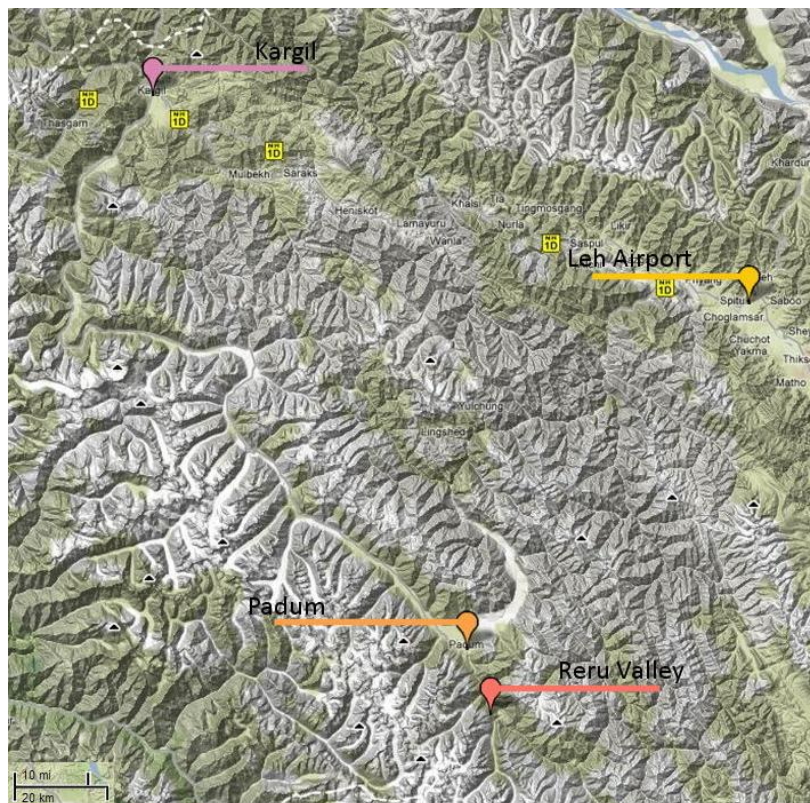


Figure 2: Reru valley and surrounding area.

## PREVIOUS EXPEDITIONS

### 2009 KYOTO ZANSKAR EXPEDITION

In August 2009 Kimikazu Sakamoto and three additional senior Japanese mountaineers led an exploratory expedition to the Reru valley with the objective of identifying virgin peaks. Their decision to travel to Reru was inspired by renowned Indian mountaineering authorities Safyabrata Dam and Harish Kapadia who at that point believed no climbing had taken place in the Reru Valley. The team identified and named peaks numerically, R1-R36 and photographed 21 peaks that they believed to be virgin summits. The expedition was purely for reconnaissance and they did not make any ascents of the peaks, however, they did write an account for the American Alpine Journal 2010. The team have been in touch with Mr Sakamoto, who has been extremely helpful in providing logistics information and many of the photographs contained in this proposal.

### 2009 PEAK ASPECT

In September 2009, Peak Aspect (a UK-based climbing instructing partnership led by Jason Bailey) travelled to the Reru valley with the main objective of attempting an unclimbed peak. They achieved this by climbing Skilma Kangri 5977m (figure 3) and a trekking peak which they named Mt. Jules 5800m. They also wrote an account of their expedition for the American Alpine Journal 2010 and commented that they believed no climbing party had visited the area prior to 2009.



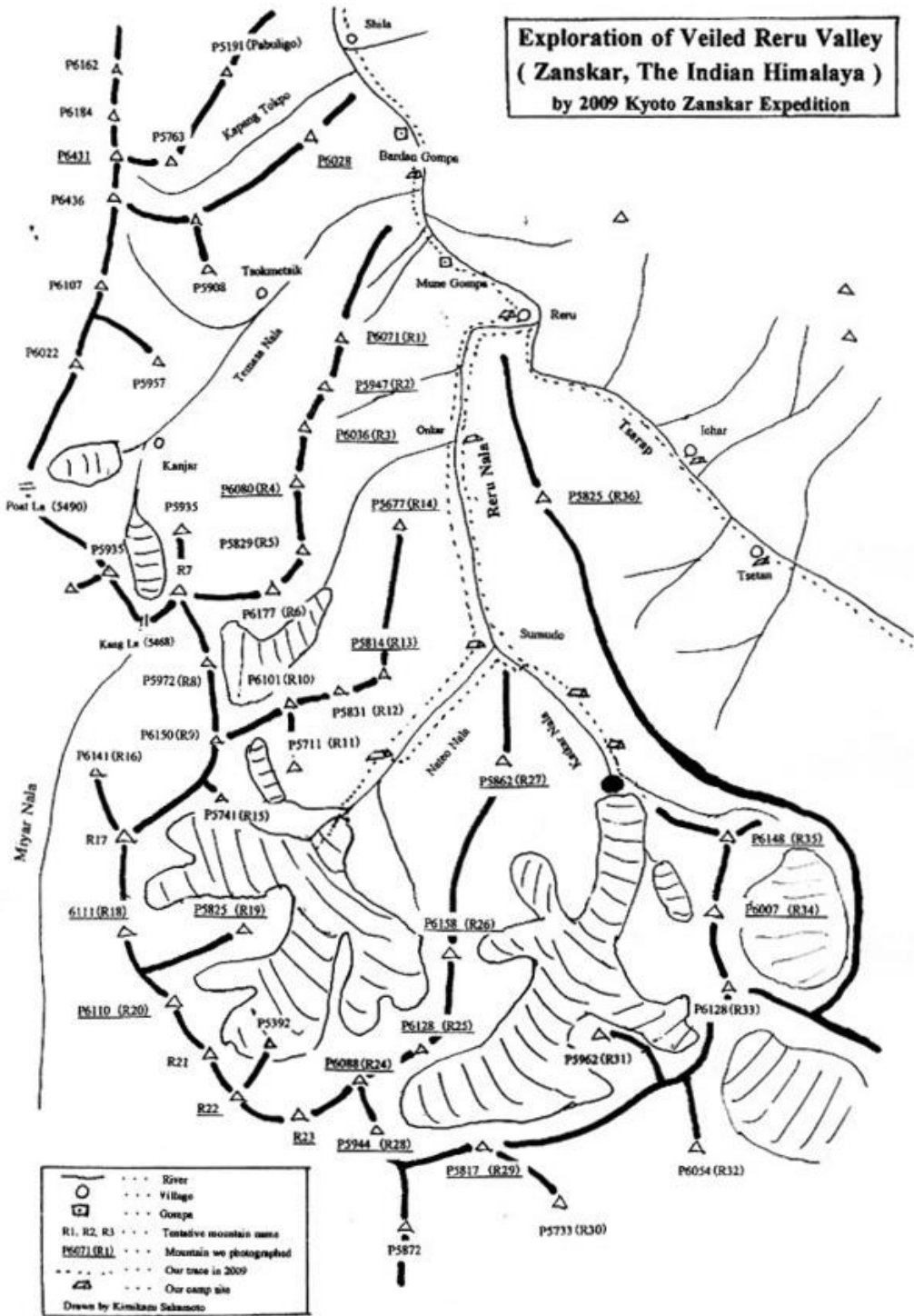
*Figure 3: Skilma Kangri 5977m, climbed by peak aspect expedition September 2009 (© Peak Aspect)*

## MOUNTAINEERING IN THE RERU VALLEY

Mountaineering in the valley ranges from trekking peaks to challenging technical rock faces and mixed climbs. The Reru valley splits into 3 subsidiary valleys, the smaller western valley is unnamed, the central valley is Natta Nala and the final easternmost valley is Katkar Nala. The neighbouring valley to the West of Natta Nala is the well known mountaineering valley, the Miyar Valley. Unlike the Miyar valley, however, Reru has had very little exploration.

The 2009 Kyoto Zanskar expedition identified 36 summits accessible from Reru valley. Figure 4 is a sketch map of these summits. A list of relevant summits, corresponding altitude and where possible, a photograph, are all given below (figures 5-9) and ordered by their subsidiary valley.

**OBJECTIVES**



Outline of Reru Valley Area

Figure 4. Map of Reru Valley. (Ref: Kimikazu Sakamoto)

Peaks R1-R4 and R13 & 14 are mostly exposed rock and should be suitable for technical rock ascents without any snow and ice equipment. Peaks R5, R6, R10 & R12 are further up the unnamed valley and are accessed via a glaciated basin. These peaks are expected to have more snow on them (consistent with other peaks on the ridge adjoining the Miyar valley) and should give more possibilities for mixed routes. The team are currently searching for photos of this particular group of mountains and are waiting for additional information on them from Mr Sakamoto.

#### RERU WEST MASSIF: ACCESSED BY UNNAMED WESTERN RERU VALLEY



*Figure 5: R1 6071m. (Kimikazu Sakamoto)*



Figure 6: R2 5947m. (© Kimikazu Sakamoto)



Figure 7: R3 6036m, R4 6080m. (© Kimikazu Sakamoto)



RERU WEST CENTRAL MASSIF: ACCESSED BY NATTO/RERU/MIYAR VALLEYS



Figure 8. R14 5677m. (© Kimikazu Sakamoto)



Figure 9. R13 5814m (left) and R14 5677m (right). (© Kimikazu Sakamoto)

## BASE CAMP

The expedition will establish base camp at the entrance to the unnamed western Valley. This will position us well for climbs on peaks R1-R5 and R10-R15 but will also reduce the distance required for portering from the village. It should also be possible from this position to make an extended trip of 4-5 days further south for attempting peaks around the Katkar Nala. See figures 10 and 11.

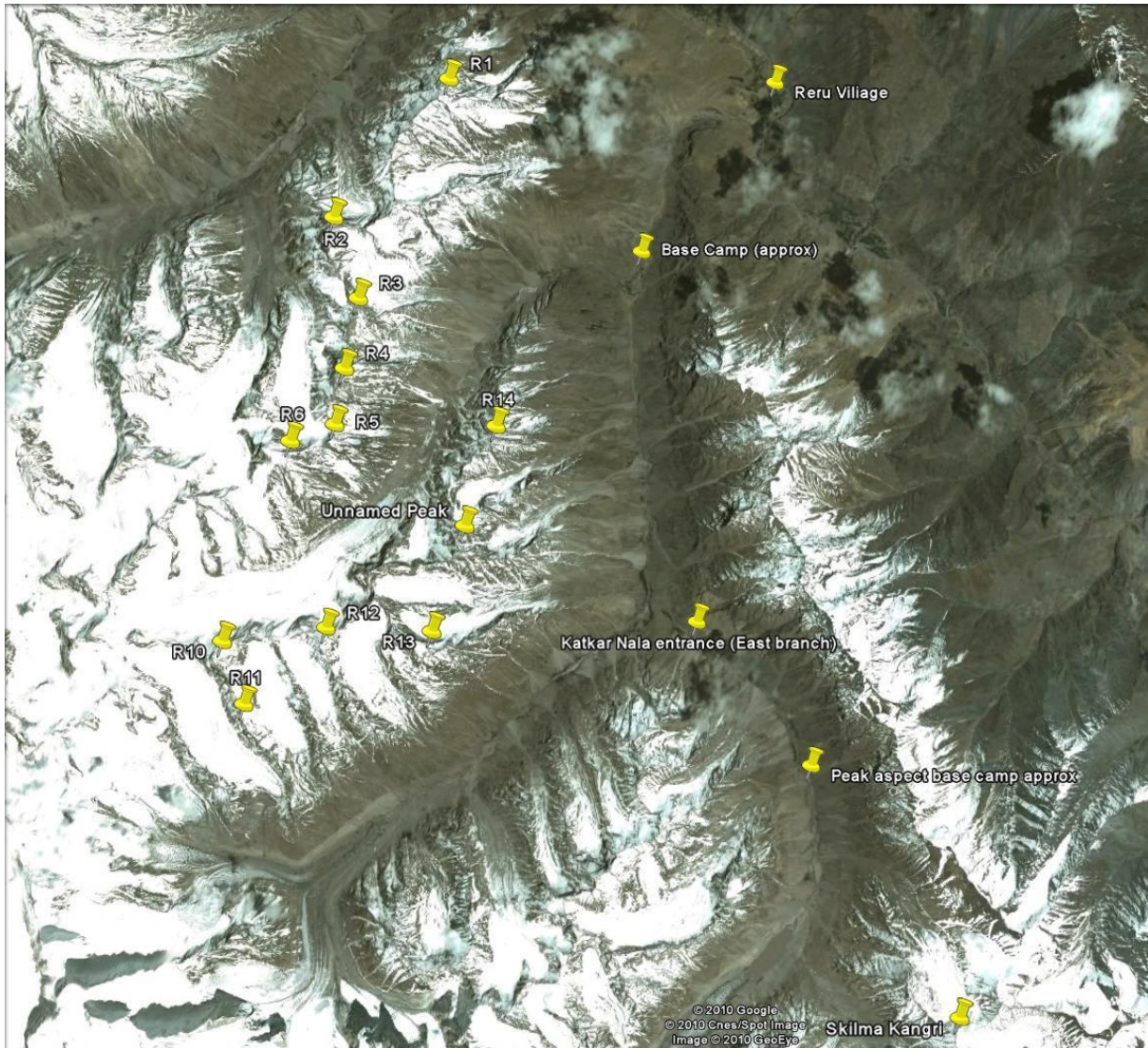


Figure 10: Satellite image of Reru valley with points of interest, potential objectives and base camp marked (© Google Maps).

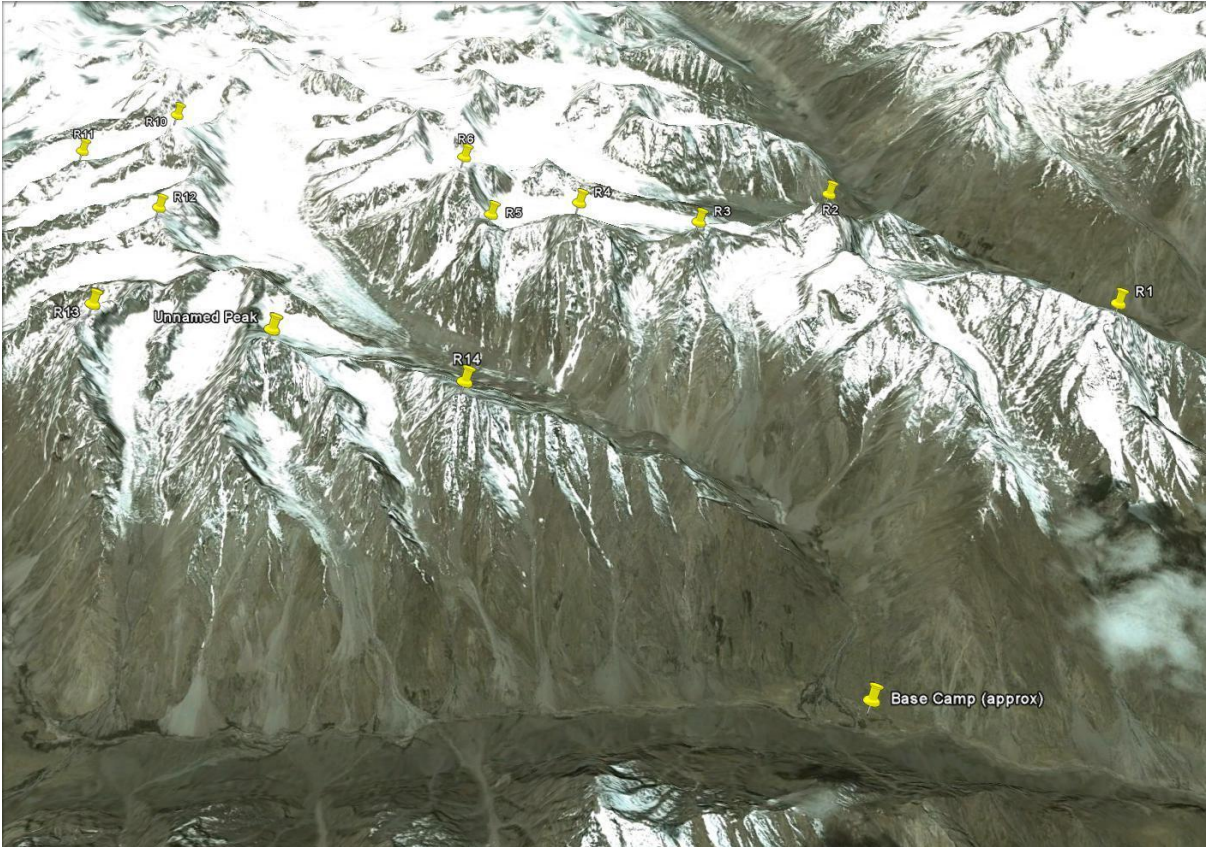


Figure 11: 3D image looking from the East of Reru valley. Potential objectives and base camp are marked.

### 3. ITINERARY

The expedition will take place from end of August to the end of September 2011. Personal communication with the previous expedition teams suggest this is the most suitable time to visit.





The schedule is flexible which allows for any unexpected delays, and the inclusion of contingency days.

27 <sup>th</sup> Aug	Flights from Heathrow to Delhi Airport.
28 <sup>th</sup> Aug	Halt day in Delhi – a requirement by the IMF
29 <sup>th</sup> Aug	Flight transfer to Leh
30 <sup>th</sup> Aug	Day in Leh to buy food etc.
31 <sup>st</sup> Aug	Car to Kargil
1 <sup>st</sup> Sep	Car to Padum
2 <sup>nd</sup> Sep	Car to Reru
3 <sup>rd</sup> Sep	Trek 7km into Reru valley, establish BC at entrance to unnamed valley
4 <sup>th</sup> Sep	Explore local surroundings and assess possible routes.
	Attempt mountaineering objectives.
	Re-establish base camp to explore new valleys if necessary.
22 <sup>nd</sup> Sep	Pack equipment. Burn and bag all waste for removal.
23 <sup>rd</sup> Sep	Trek to Reru village.
24-26 <sup>th</sup> Sep	Car from Reru to Leh
27 <sup>th</sup> Sep	Contingency Day (May be taken in Delhi or Leh)
28 <sup>th</sup> Sep	Return flight from Leh to Delhi.
29 <sup>th</sup> Sep	Halt day in Delhi – a requirement of the IMF
30 <sup>th</sup> Sep	Return flight from Delhi to London




## 4. EXPEDITION TEAM

All seven team members are active members of the Imperial College Outdoor Club and Imperial College Mountaineering club and have been climbing for a number of years. The team is structured into two sub groups which will attempt different objectives. The teams were formed with an appropriately experienced leader and subsequent team members by their preferred objective.

### ALPINE MIXED TEAM

			
<b>Jonathan Moodie</b>	<b>Kunal Masania</b>	<b>Dominic Southgate</b>	<b>Jonathan Bull</b>
Expedition Leader	Liaison Officer	Alpine Mixed Team Leader and Medical Officer	Equipment Manager

### TECHNICAL ROCK TEAM

		
<b>Hal Watts</b>	<b>Robin Jones</b>	<b>Joe Prinold</b>
Technical Rock Team Leader	Logistics	Treasurer

## TEAM BIOGRAPHIES

### JONATHAN MOODIE

27 YEARS OLD, EXPEDITION LEADER

#### ACADEMIC BACKGROUND

2007 - 2011 PhD Biomechanics, Bioengineering Department, Imperial College London  
2003 - 2007 MEng Biomedical Engineering, with Mechanical Engineering, Imperial College London

#### EXPERIENCE

2002 - Present Extensive rock Climbing experience gained both in and outside of university trips, focussing on traditional climbing on single or multi pitch routes on a range of rock types. Comfortable leading E1. Most weekends visiting areas including Peak District, Lake District, North and West Yorkshire and North Wales. Hiking in Wales, Lakes and Peaks, trail running to 30miles

2010 Outdoor Club Summer Tour to Chamonix for alpine climbing. Routes include Arête des Cosmiques (AD), SW Face of Dent du Geant (4013m) Aiguille de Rochefort SE ridge (4001m AD), Chochoer Clocheron (TD) and Voie Frisson Roche (TD).

2010 ICUOC Winter tour, Scottish mixed winter climbing, ice climbing, snow shoeing and cross country skiing in Cairngorms.

2010 Membership of the Eagle Ski Club of Great Britain for ski touring and ski mountaineering.

2010 Experience of Aid climbing to A2

2009 Multi day trekking in the Cretan White mountains.

2009 - 2010 Experience as a climbing instructor at Ethos sports centre

2009 Completed SPA training

2007 - 2010 Climbing trips to Spain, Greece, Croatia, Italy and France

2005 Completed First Aid at Work qualification

### DOMINIC SOUTHGATE

28 YEARS OLD, ALPINE MIXED TEAM LEADER

#### ACADEMIC BACKGROUND

2009 - Present PostDoc, Bioengineering Department, Imperial College London  
2005 - 2009 PhD Biomechanics, Bioengineering Department, Imperial College London  
2001 - 2005 MEng Mechanical Engineering with year abroad (Sydney), Imperial College London

#### EXPERIENCE

2000 - Present Avid climber and mountaineer. Regularly climbing and leading groups indoors and out on the mountains. Over 25 weekend trips with Outdoor Club to UK destinations plus many outside of university. I have hiked in many locations, including the GR10 and Haute Route in the Pyrenees, Half Dome in Yosemite, the Blue Mountains and Cradle Mountain in Australia and the Drakensburg Mountains in South Africa. I have also climbed sport and bouldering routes in many places, including Mallorca, Cote d'Azur and Fontainebleau.

2009 Multiple days snow-shoeing in Quebec, Canada in winter.

- 2009 Lead the Imperial College East Greenland Expedition to North-West Renland, climbing 3 new peaks and 2 new routes.
- 2009 Gained membership of the Alpine Club.
- 2008 Completed Single Pitch Award training.
- 2008 Multiple ascents in the French Alps on Imperial College Outdoor Club summer tour including Dent du Geant by the normal route (4017m, AD) and Mont Blanc du Tacul by the North Face Triangle (4248m, AD).
- 2007 Qualified Mountain Leader (summer).
- 2007 Member of the Imperial College Shimshal Expedition climbing Yazghil Sar, Northern Areas Pakistan (6001m, AD).
- 2007 Gained Wilderness Medical Training First Aid qualification (valid 3 years).
- 2003 Member of Imperial College Trans-Greenland Training Expedition (first expedition to establish the route).
- 2003 Scottish mixed climbing and multi-pitch trad climbing with Outdoor Club on Easter tour to Scotland.
- 2002 - 2003 Chairman of the Imperial College Outdoor Club and Secretary of the Exploration Society.
- 2002 Multiple ascents in the Swiss Alps on Outdoor club summer tour (up to grade PD) and 4100m+.
- 2001 Ice climbing and cross country skiing with Outdoor Club winter tour in Scotland.

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## KUNAL MASANIA

27 YEARS OLD, LIAISON OFFICER

### ACADEMIC BACKGROUND

PhD MSc, BEng (hons) Research Associate in the Mechanics of Materials Group, Department of Mechanical Engineering Imperial College London.

### EXPERIENCE

Very keen sportsman, rowed and cycled competitively from a young age, hence have a solid background which has really driven my interest in mountaineering. Hard winter ascents include routes on Ben Nevis and in the Cairngorms (Savage Slit, Pot of Gold) up to grade V/VI Scottish and ice climbing (Scotland and Norway) WI 5+/6 multi pitch. Trad multi pitch routes up to TD+ in the French Alps.

- 2009 - 2010 Alps including the Cosmique Arête solo, Grepon and Frendo Spur (20 routes in the D - TD+ range). Experience of travelling and navigating over glaciated terrain in white out conditions as well as multi-day mountaineering routes.
- 2008 New routing and big walling in Morocco where a 600m 7a+ ob. sport route (Storm o'clock) was set. Sponsorship from Imperial College Expedition Board, Sir Richard Sykes, Hilti, Lyon equipment, First Ascent and the Dunsheath Expedition Award.
- 2009 Treasurer of the Exploration Society at Imperial College London. Organised lectures with guest speakers such as Andy Kirkpatrick and Joe Simpson. Experience with organizing many ice climbing trips to Rjukan Norway.
- 2008 - 2010 Multiple trips to Scotland (Ben Nevis and Cairngorms) for multipitch winter climbing.
- 2008 Vice President, Imperial College Mountaineering Club. Organised many weekend trips for the club to various destinations around the UK. Primary focus was on trad climbing and

- bouldering in locations such as Devon, Cornwall, Swanage, Pembroke, Dartmoor, Peak District, Lake District, Yorkshire and Northumberland.
- 2006 - 2007 Ice climbing in Rjukan, Norway. Leading WI 4 multi pitch routes.
- 2005 - Present Vast trad climbing background in the UK and abroad. Comfortable in leading E2 trad routes with experience in climbing in areas all over the world, for example Greece, Turkey, France, Spain, Tanzania, Kenya, India, Morocco, Australia, Philippines and the US.
- 2004 Trekked Kilimanjaro (5985m) via the Umbwe-Mweka route prior to taking up climbing and mountaineering.

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## JONATHAN BULL

25 YEARS OLD, EQUIPMENT MANAGER

### ACADEMIC BACKGROUND

- 2008 - Present Engineering Doctorate (EngD) Nuclear Engineering, Imperial College London.
- 2003 - 2007 MEng (Hons) Mechanical Engineering, University of Manchester.

### EXPERIENCE

Growing up near the Scottish Highlands, Jonathan has been involved in a variety of outdoor pursuits from an early age. He maintains a high fitness level. While travelling the world alone during his gap year, he began rock climbing, and has since undertaken many adventurous trips all over the world. He is comfortable leading trad multi pitch up to E1 on many rock types, including dubious, and has never had a climbing accident.

- 2008 - Present Member of Imperial College Mountaineering Club. Lead up to Scottish winter IV/4, WI 5, UK trad E2, sport 7c in UK/France/Norway/Greece.
- 2007 Hiked the arduous 100km northern half of GR20 route in Corsica.
- 2006 Took part in a month-long guided mountaineering expedition to a very remote part of the Peruvian Andes, including summiting on 6 peaks of over 5000m and a new route on Alccachaya 5780m (AD+).
- 2006 Took 5-day alpine safety skills course in Chamonix: glacier safety, leading ice pitches, protection, avalanche safety, loose rock pitches.
- 2003 - 2007 Member of Manchester University Mountaineering Club (committee 2005). Many trips all over the UK, including the adventurous sea cliffs at Gogarth. Lead up to E2 trad/Scottish winter III/3. Trained many novices to lead trad multi pitch safely.
- 2003 Planned and undertook 6 months of solo travel to Canada, New Zealand and Australia. Did several high-altitude multi-day treks in the Rockies and Southern Alps. Began rock climbing.
- 2002 With 9 friends organised and fundraised a month-long expedition to Borneo with World Challenge Expeditions. Included voluntary work, a week-long jungle trek and ascent of Mount Kinabalu (4095m).
- 2003 - Present Regularly ran 10km cross-country and cycled long distances.
- 1993 - Present Walked many of the Scottish Munros.

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## HAL WATTS

24 YEARS OLD, TECHNICAL ROCK LEADER



## ACADEMIC BACKGROUND

2010 - Present Industrial Design Engineering MA/MSc, Imperial College and The Royal College of Art.  
2004 - 2008 MEng (Hons) Mechanical Engineering at Imperial College London.

## EXPERIENCE

Has spent quite a lot of time on long multi-pitch routes and mountain routes (including: Kleine Matterhorn, Wellenkuppe, Aiguille du Plan, Aiguille du Midi, Grepon, Dent du Requin, Aiguille du Goute, Aiguille de Blatiere, Aiguille du Peigne, Aiguille de L'M, Petites Charmoz). Was also expedition leader on two successful expeditions on which both expeditions completed first ascents. Has completed wilderness first aid medical training.

2010 French Alps, Spent several weeks climbing in the Chamonix area. Ascents include le Ticket, le Carre, le Rond and la Lune on the Aiguille du Peign (TD+).

2009 Did a lot of indoor climbing, regularly climbing V6 and several trad and bouldering trips in France and the UK 10 day climbing trip to Mallorca climbing routes up to 300m.

2008 Spent ten days climbing in Switzerland climbing routes up to 650m.

2008 Led Imperial College Taghia Big Wall Expedition which completed the first ascent of a remote 600m big wall (E3/A3+). Sponsorship from Imperial College Expedition Board, Sir Richard Sykes, Hilti, Lyon equipment, First Ascent and the Dunsheath Expedition Award.

2008 - 2009 Chair of Imperial College Exploration Society.

2007 - 2008 Climbed for two weeks in the French Alps.  
Expedition leader of Imperial College Quimsa Cruz 2007, which completed 8 first ascents in the Bolivian Andes up to a grade of E5 and an altitude of 5000m Supported by Imperial College Expedition Board, Mount Everest Foundation, First Ascent and the BMC. Stores Manager of Imperial College Mountaineering Club

2006 - 2007 Spent two weeks climbing in Cornwall up to E1 and two weeks in the Alps. Went on many weekend trips around the UK.

2005 - 2006 Extensive trad climbing and first trip to the Alps, based around Zermatt and Chamonix, climbed up to D+. Completed SPA training.

2004 - 2005 Went on trips to UK crags most weekends and did mostly trad climbing. A ten day trip to the Costa Blanca in Spain and Completed routes up to 350m in length.

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## ROBIN JONES

25 YEARS OLD, LOGISTICS

## ACADEMIC BACKGROUND

2007 - Present EngD in Non-destructive Testing Mechanical Engineering Dept, Imperial College London  
2003 - 2006 BSc in Physics at Warwick University

## EXPERIENCE

2010 - 2011 Chairman of Imperial College Union Outdoor Club (ICUOC)

2007 - 2010 Many weekend climbing trips within the UK (North Wales, Peak District, Lake District, Cornwall) both personally and with ICUOC. Trad climbing confidently at E1, with best onsight of E3 6a.

2010 BMC Student Safety Seminar

2010 Hiking in Yosemite Valley, California, including Half Dome.

- 2010 Climbing and mountaineering around Chamonix France with ICUOC summer tour. Routes including Cosmiques Arête (AD), Aiguille de Rochefort (4001m AD) and a traverse of the Mer de Glace. Multi-pitch rock climbing: Cocher Cochon (TD 6a) and Voie Frisson Roche (TD 6a).
- 2010 Sport climbing in El Chorro, Spain. F7a onsight, and F7a+ red point.
- 2010 Attended a two day First Aid Course organised by St John Ambulance at Imperial College.
- 2010 Ice-climbing in Rjukan, Norway. Single-pitch up to WI4, and multi-pitch to WI3, including 7 pitch Fabrikfossen.
- 2010 Scottish winter mountaineering in Cairngorms National Park, and subsequently Welsh winter mountaineering in Snowdonia.
- 2009 Sport climbing in Paklenica National Park, Croatia.

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## JOE PRINOLD

25 YEARS OLD, TREASURER

### ACADEMIC BACKGROUND

- 2009 - Present PhD student in the Musculoskeletal Mechanics Group, Department of Bioengineering, Imperial College London.
- 2004 - 2008 MEng (Hons) Mechanical Engineering at Imperial College London.

### EXPERIENCE

Played rugby, squash and rowed to a highly competitive level from a young age giving a strong athletic background. Multi pitch routes up to TD+ in the French Alps. Short trad multi-pitch routes up to E2 in the UK. Single pitch trad climbing all across the UK on a range of rock types up to E3. Sport multi-pitch routes across Europe to 6b+. Bouldering on a range of rock types up to V7.

- 2008 French Alps including the Cosmique Arête (AD), Arête de Papillons (D), Voie Couzy (TD-), La Piegne (TD+). Experience in travelling over glaciated terrain.
- 2009 - 2010 Vice President, Imperial College Mountaineering Club. Organised a number of weekend trips for the club across the UK and France. Main focus was on trad climbing and bouldering. Also, organised a sport climbing trip to Arco in Italy for long multi-pitch and single-pitch climbing.
- 2004 - 2010 Large number of trips across the UK with ICMC and personally, focussing on trad climbing and bouldering: Pembroke, Peak District, Yorkshire, Swanage, North Wales, Cheddar Gorge, Portland, Wye Valley, Dartmoor. Confidently leading E1/E2 for both single and multi-pitch with best onsight of E3 5c single pitch and E2 5c multi-pitch.  
Multi and single-pitch sport climbing trips abroad both personally and with ICMC including France, Spain, Italy, Croatia, Thailand, Vietnam, Mallorca and Corsica. Including 400m routes in Paklenika, Croatia (6a+) and a 350m route in Verdon Gorge, France (6a+), and a 600m route in Arco, Italy (6b).

## 5. LOGISTICS

### TRANSPORT

The nearest airport to Reru valley is Leh Kushok Bakula Rimpochee airport and is serviced by flights from Delhi, provided by JET, GoAir, Kingfisher and Indian Airways flights. Reru village, which sits at the top of Reru valley, can be reached by road, communication with the previous expedition groups suggest allowing 3 days to complete the 300 mile journey, with stops at Lamaru or Kargil and Padum (figure 12).

Transportation for getting the expedition team members from London to the Reru Valley will consist of flying to Leh, via Delhi, followed by driving the remaining distance to the valley:

1. Scheduled flight from London to Delhi Airport.
2. Internal flight from Delhi to Leh.
3. Car from Leh in a westerly direction to Kargil.
4. Continue by car south-east towards Padum.
5. Continue from Padum southwards into Reru valley.

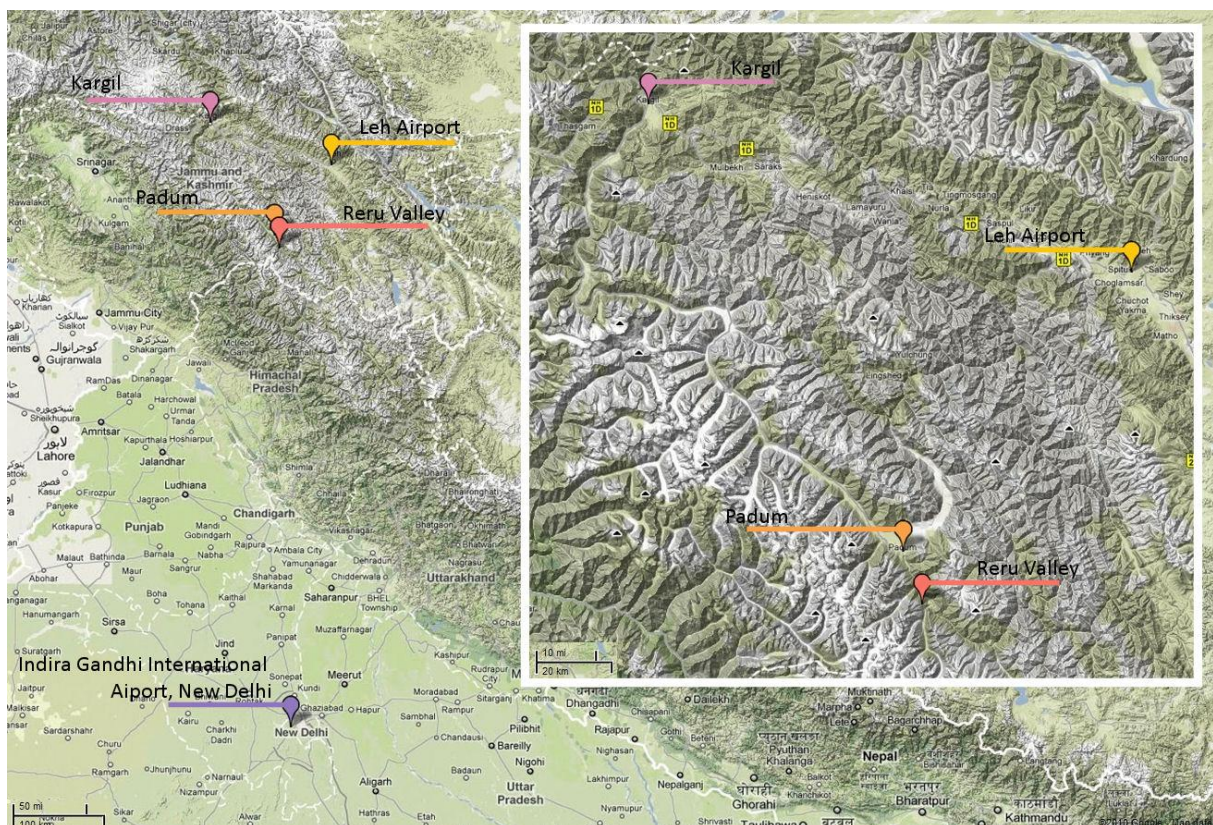


Figure 12: Map showing the points visited during travel to Reru Valley. International flight to Delhi. Domestic flight to Leh. Car journey from Leh to Reru, via Kargil and Padum.

Internal flights within India can be booked online in advance through [yatra.com](http://yatra.com). In country logistics (car hire etc.) will be organised by a local agency: Rimo Expeditions, [www.rimoexpeditions.com](http://www.rimoexpeditions.com).

## CURRENCY

The currency of India is the Indian Rupee (INR), at the time of writing GBP 1 = INR 72. Over the past year, the exchange rate has fluctuated between 65 and 75 Indian rupees to the pound. Rupees may not be removed from India and can not be obtained in advance of arrival in the country. Therefore, an immediate priority upon arrival in Delhi will be to change sterling currency for Indian Rupees either at official currency vendors within the airport, or at banks in the city itself. The lack of ATMs outside major towns and cities will be taken into account when travelling within India in order to ensure that unnecessarily large amounts of currency are avoided whilst ensuring sufficient funds are available for the payment of local staff and entry fees and for purchasing commodities.

## WEATHER

Personal communication with the leader of the previous trekking expedition to Reru valley reports that the weather is similar to that of the Karakorum, and the climbing season is from July to September. In addition, the road from Leh to Padum via Kargil is only opened around the middle of June, due to the necessity to wait for the snow to melt from the Pensi La. There are three locations from which weather data is regularly reported, and they are all approximately 200km from Reru valley: the city of Jammu (SW), the city of Srinagar (W), and the town of Kargil (NW). Only Srinagar has past climatological information however, and this data reports that the mean temperature for September has a minimum of 12.9°C and a maximum of 27.8°C; however, this is for an altitude much lower than that of the Reru Valley. A report from a previous expedition to Reru states that the temperature varies between -20°C and +15°C. Our choice of equipment will reflect the type of conditions that we would expect given this information. The 5-day forecast for Kargil is available from [www.imd.gov.in/section/nhac/distforecast/kargil.htm](http://www.imd.gov.in/section/nhac/distforecast/kargil.htm) (Indian Meteorological Department) and this can also be received whilst in country by phoning 0091 1800 1801717.

## AVAILABLE MAPS

There are a number of trekking maps that cover the Reru valley and surrounding area, two are listed below and are available in Stanfords, London. However they are trekking maps and their summit heights are unofficial.

### **1. Ladakh and Zaskar South: Upper Zaskar – Rupshu**

Published by Editions Olizane, ISBN: 9782880863692, Scale: 1:150,000

### **2. Leh, Zaskar and Nubra Valley**

Published by West Col Productions, ISBN: 9780906227756, Scale: 1:200,000

There is a 'Survey of India' map which we are currently trying to obtain. Use will also be made of the sketch map drawn by Mr Sakamoto and of Google Earth images overlaid with contour lines.

## PERMISSIONS AND PERMITS

The Indian Mountaineering Foundation necessitates that foreign expedition teams employ and equip a Liaison Officer (LO) for peaks over 6000m. A fee of \$500 is payable in lieu of equipping the LO with equipment equivalent to that of the rest of the team. The peak permit fees for mountains between 6000m and 6500m in altitude are \$500 for the first two team members, with \$200 payable for each additional team member up to seven.

Reru valley lies in between two National Parks: Kishtwar and Hemis, as such no park fees are payable. However, previous expeditions have reported paying a fee of 100 Rupees per tent per day at Reru Camp as an entry fee to the valley itself.

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## INSURANCE

Insurance cover will be arranged via the BMC to a level suitable for Himalayan mountaineering at an altitude equivalent to that of the identified objectives.

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## VISAS AND EXPEDITION PERMIT

The expedition team members are all British Citizens and as such can enter India with a tourist visa. At an early stage, passports of each team member will be checked in order to ensure that each has more than six months before expiry. Each team member will apply for a tourist visa for their passport at a VF Service UK India Visa Application Centre, approximately two months prior to the start of the expedition. The fee for each tourist visa is £39.05 (including VAT and handling charges) and the visa is valid for six months from the date of issue.

In addition to the tourist visa, expedition team members will require a mountaineering 'X' visa. The first step in acquiring this visa is seeking approval of the expedition from the Indian Government. An expedition is usually only approved one month prior to the start of the expedition. Once this approval has been obtained, authorisation will be sent to the High Commission of India in London, allowing the tourist visas previously obtained to be converted to the mountaineering 'X' visa. Due to the time constraints imposed by the necessity to wait for authorisation of the expedition, obtaining these 'X' visas is likely to require attendance at the High Commission in person. The cost per visa will be an additional £28.86, and these will also be valid for six months from the date of issue.

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## EXPEDITION MEDICINE

The Medical Officer will be primarily responsible for all medical and health issues during the expedition; however, both team leaders have previously attended the Wilderness Medical Training (WMT) "Far From Help" course. First-aid training will be sought for the remaining team members and if possible, a dedicated course from WMT to ensure a minimum standard within the group. The Medical Officer will also pursue higher level training, such as "Far From Help" Part II.

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## TRAVEL HEALTH

All team members have completed childhood courses of immunisation against MMR, Diphtheria, Tetanus, Polio, Meningitis C and received the BCG vaccine. Before departure, advice will be sought from Imperial College Health Centre on what specific vaccinations and prophylactic therapies are recommended for the areas we will be visiting. These are, however, likely to be very similar to those for the Obra Valley expedition in 2010. Anti-malarial medication may not be recommended as the areas we will be visiting are very low risk for this disease.

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## NUTRITION

Calorific requirements are increased at high altitude, and during exertion. It is expected that each team member will require an intake of approximately 4000 calories per day whilst at high altitude. As a rough guide, intake should be 65% carbohydrate, 20% fat and 15% protein. Discussions will be made with the in-country agent to ensure a balanced diet and mix of meals. Every effort will be made to cater to all team-members tastes to ensure adequate calorie consumption.

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## HIGH ALTITUDE MEDICINE

This is a medium-high altitude expedition and there is potential for the occurrence of altitude illness. In addition to altitude illness, caused by hypobaric hypoxia, decreased temperature and increased exposure to UV light are significant risks to health. Altitude illness is discussed briefly below, and all hazards are included in the Risk Assessment appended to this proposal (Appendix A).

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## ALTITUDE ILLNESS

Acute Mountain Sickness (AMS) is possible at high altitude and failure to acknowledge and treat it can be life threatening if High Altitude Pulmonary Oedema (HAPE) or High Altitude Cerebral Oedema (HACE) develops. The primary focus to avoid altitude illness will be on gradual ascent and awareness of symptoms. Careful attention will be paid to hydration, which will aid the acclimatisation process. Above 3000m, average ascent will be limited to 1000m every 3 days and the usual format of 'climb high, sleep low' will be adopted. Base camp is likely to be at around 4400m, for which it is possible to fully acclimatise for most climbers. All team members have previously acclimatised to altitudes above 3500m, and no team member has suffered more than very mild symptoms. In addition, two members have been to 6000m on previous Imperial College expeditions without any issues.

As the highest objective summits for this expedition will be around 6200m, we will not carry bottled oxygen or a hypobaric chamber. Acetazolamide will be carried though and may be used to aid acclimatisation at the discretion of each team member. All members will familiarise themselves with the Lake Louise Self Assessment questionnaire (Appendix B), which will be used to diagnose AMS. When ascending to higher altitudes symptom scores will be recorded daily to aid in early diagnosis of AMS. We will endeavour to obtain translations of the Lake Louise Self Assessment questionnaire (with phonetic spellings) for use with any locally employed team members travelling to high altitude.

The treatment of choice for AMS that does not resolve with rest will be descent, although acetazolamide and dexamethasone will be carried for symptomatic use where symptoms worsen or descent is not possible.

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## EQUIPMENT

Each climbing party will carry a small first aid kit suitable for taking on ascents in addition to a main medical kit which will be kept at base camp to deal with trauma and major illness. The contents of the base camp kit will be duplicated where possible in a second kit to reduce the risk of losing all the medical supplies if one kit is lost. It is likely that some medications from the Obra Valley 2010 expedition will still be within their expiry date and could be reused, however, some will need replacing and additional quantities required for the larger expedition team size.

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## RESCUE

Rescue and recovery may take up to 72 hours to arrive, which will mean the team will have to be self-sufficient for this period of time. Antibiotics and analgesic medication will be obtained through the Health Centre contact. A satellite phone will allow contact with a doctor for additional medical advice in case of emergencies.

## ENVIRONMENTAL IMPACT

We intend on leaving the area as we find it. We will minimise our environmental impact by conforming to guidelines by Earth Watch International, the 'Leave no trace' philosophy ([www.int.org](http://www.int.org)) and environmental guidelines outlined by the BMC ([Http://www.thebmc.co.uk/world/exped/guide\\_1.htm](http://www.thebmc.co.uk/world/exped/guide_1.htm)).

Solid human waste will be disposed of by burying away from water sources. Liquid waste will be disposed of locally away from water sources, the use of eco friendly cleaning agents and soaps should minimise environmental impact of this. Hazardous waste such as fuel will be disposed of at the first suitable location prior to any flight. Batteries will be returned to the UK for disposal. Plastic waste will be removed from the valley and disposed of at the first suitable location, either Leh or Delhi; all remaining waste will be burnt.

The Expedition will adhere to the UIAA Ethical Code and the Kathmandu declaration (<http://www.thebmc.co.uk/world/exped/uiaacode.htm>). The expedition will use porters and cooks and therefore emphasis is placed upon porter welfare and employment ethics for this expedition.

## FOOD

Following guidance from a number of previous expeditions, a cook will be provided by Rimo Expeditions at base camp. Ration packs will be purchased in the UK and packaged into day packs for climbing teams. The majority of the food will be bought locally.

## WATER

Water will be obtained by melting snow when at altitude or from meltwater streams at lower altitudes, if necessary glacier melt water can be filtered. The water requirements for each member will vary; guidance from the Royal Geographical Society Expedition Handbook suggests the fluids requirements are 4 litres a day, with one extra litre for every hour of exercise. We will take these recommendations very seriously and closely monitor our hydration levels during our mountaineering activities.

## FUEL

Fuel will be purchased in Leh and stored in approved fuel containers. Royal Geographical Society Expedition Handbook and the previous expeditions suggest 0.33 litres of petrol are required per stove per day if no running water is available in nearby streams.

## 6. SPECIALIST EQUIPMENT

### CLOTHING AND FOOTWEAR

The climate will be Alpine in nature and thus a similar clothing system will be used, utilising a layered approach to maximise versatility. Although the weather conditions in the area are generally stable there is always the possibility of precipitation, particularly in the evenings, and thus considerable waterproofs will be required. For colder and drier weather wind chill will be a serious factor and down jackets will be worn. Excess layers will be removed to prevent unnecessary perspiration which leads to damp clothing and a potential hypothermia once

exercise intensity is reduced. A frequent changing of layers will be particularly important for the Alpine Rock Team because there will be significant periods of intense activity followed by prolonged periods of inactivity (whilst belaying etc). Most members have their own down jackets and other appropriate layers, but additional clothing items are easily available in the UK.

Both teams will use mountaineering boots suitable for the altitudes that will be encountered. These will be lightweight insulated alpine boots (e.g. La Sportiva Baturas) or more heavyweight plastic double boots (e.g. Scarpa Omegas). These boots will be used for general mountaineering by all and almost exclusively by the High Summit Group. This group will also carry rock boots if there are any particularly technical sections of rock; however they are unlikely to be used. The Alpine Rock Team will carry rock boots and these will be used extensively on more technical sections of rock climbing. Some members may need over-gaiters or extra insulation for boots that they already own while all members have appropriate rock boots. Again, this equipment is easily available in the UK.

## TENTS AND SLEEPING

Four expedition mountain tents will be used (Terra-Nova Quasar or similar) that will facilitate more flexible climbing teams if required, and will be particularly useful if the two teams set-up alternate advanced camps. Given the extra room in these tents it will be possible to fit up to 4 members in a tent if there is irreparable damage to another tent. The other advantage of these tents is that both Imperial College Union clubs have a number of these tents and so the intention is that these would be borrowed.

In order to cope with low night-time temperatures, sitting out bad weather and nursing a casualty all members will have expedition grade down sleeping bags with an extra allowance in case of unexpected circumstances. A number of team members will need to purchase these from the many available UK retail outlets. Ground insulation will be important, particularly if sleeping on glacier or advanced bivouacs. A number of team members will need to purchase suitable equipment for this, with a down mat being the optimum solution (e.g. Exped DownMat).

## CLIMBING EQUIPMENT

The essentials of alpine climbing; harness, helmet, ice axes (pair), crampons and half ropes, will be carried as well as a selection of other equipment that will vary between the two teams as well as on the inspection of each individual route. More rock based routes will necessitate a wide selection of nuts, hexes, camming devices and pitons. More mixed or mountaineering style ascents will require snow and ice protection like snow stakes, deadmen and ice-screws. All members own a significant amount of climbing equipment. However, it may be necessary to purchase or borrow a certain amount of gear; particularly snow and ice protection. Both the Mountaineering and Outdoor clubs have these items available.

## COMMUNICATIONS

Two-way radios will be carried by all members of a climbing group to allow clear communication. This is subject to gaining permission to import these items with the Indian government. In the case where these cannot be used a system will be learnt by all team members that allows clear non-verbal communication when necessary, as is common practice for multi-pitch climbing. A satellite phone will be held at base camp to allow communication with the outside world. Storing of these devices will need to be carefully considered given the detrimental effects of cold temperatures on battery life. A solar charger will also be used when needed.



## 7. FINANCES

### BUDGET

The budget for the expedition can be found in Appendix C. Discussion of the budget follows.

### TRAVEL EXPENDITURE

The total cost of the flights from the UK to Leh is about £700, £4900 in total: subsequent overland travel will be subject to confirmation from the Expedition agents. The total figure should be in the region of £8400 or below for the whole team.

### EQUIPMENT EXPENDITURE

All members of the expedition are able to borrow equipment from the Imperial College Union's Outdoor and Mountaineering clubs, significantly reducing equipment costs. However, several of the members require personal equipment e.g. down jackets, down sleeping bags and down mats and Cat 4 glacier sunglasses. The expedition plans to donate several group items to the clubs and societies involved as an exchange for the heavy use that the loaned equipment will be subjected to. Suppliers and national distributors will be contacted in order to obtain discounted rates for equipment purchase. Grants for equipment are available, such as the Lyon award, and will also be applied for.

### INCOME

The expedition will seek expedition approval as well as additional financial assistance from the following sources:

- Imperial College Expedition Board
- British Mountaineering Council,
- Mount Everest Foundation,
- First Ascent,
- Wilderness Award,
- Shipton-Tillman Grant,
- Nick Estcourt Award,
- Max Clifford Mountaineers Grant,
- The Gordon Foundation,
- Albert Reckitt Memorial Trust and,
- Edinburgh Trust No 2

If there is a deficit in the funding then this will be covered by a greater personal contribution from all expedition members.

## 8. TRAINING

The team will be training indoors throughout the year at the local climbing walls, focussing particularly on endurance and lead climbing. Regular weekend trips will be undertaken both with the clubs and independently,

allowing continued outdoor and mountaineering training. Finally, a number of the team will also complete a season of Scottish Winter, Ice Climbing and Summer Alpine climbing through association with the Mountaineering, Outdoor and Exploration societies.

Two of the expedition members already have wilderness first aid training, the remaining member will also receive wilderness first aid training, and the remaining two will train to a higher level.

## 9. CONTINGENCY PLANS

There are 35 unclimbed summits in Reru valley, if our objectives are climbed prior to our arrival, new objectives can easily be located from within the valley.

Should access to the Reru valley be prohibited for and unseen reason, then the objectives will be refocused to the Miyar valley. The Miyar valley borders the Reru valley on its south eastern aspect and has similar access to Reru. It can be reached by car from Leh to Padum (see figures 2 and 12) then trekking to the Kang La pass, or from its southern end via Udaipur, which is accessed by road from Delhi should we be unable to fly to Leh. There is extensive knowledge on the Miyar Valley which will enable rapid planning should the need to relocate objective arise. There are several unclimbed peaks (30-33, figure 13) and some which border the Reru valley, for example Pt 5775. The same logistics company would be used for the Miyar valley as for the Reru valley (Rimo Expeditions).

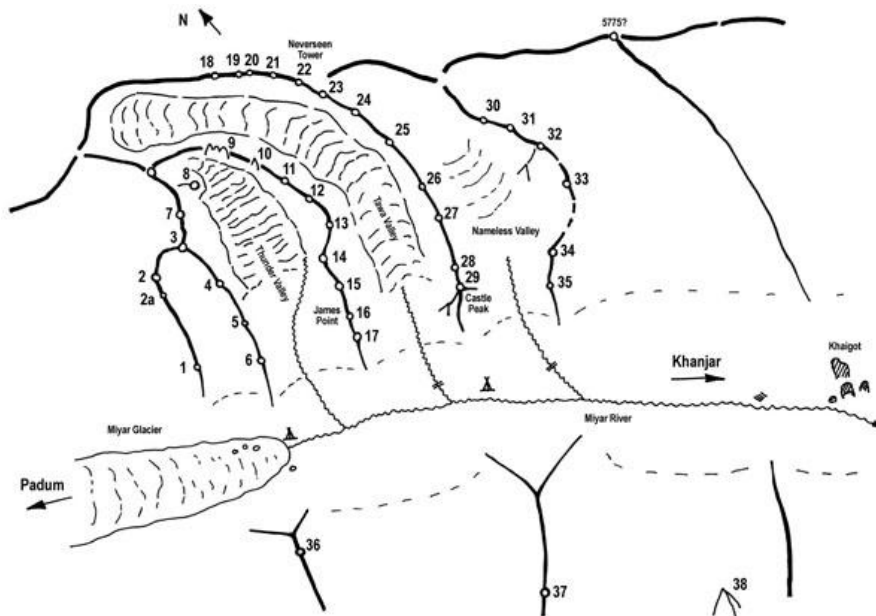


Figure 13. Sketch map of Miyar Valley, beyond the watershed on the northern edge of the map is the Reru valley.

## 10. RISK ASSESSMENT AND SAFETY PLAN

The risk assessment and safety plan are in Appendix A and D respectively.

### SAFETY BRIEFING

Nearer the expedition a safety briefing will be held at a notified date and time to discuss aspects of the safety plan and procedures in detail to ensure all team members and home contacts are fully briefed.

## 11. POST EXPEDITION

After the completion of the expedition a report will be compiled providing full details of the expedition. This will be submitted to the Imperial College Exploration Committee and expedition archives of the RGS and mountaineering associations. In addition a presentation of slides from the expedition will be produced and presented at Imperial College through the Exploration Society and to funding bodies as requested.

Media coverage will be sought within Imperial College; the college web site, Reporter and Felix will be utilised alongside presentations through the Imperial College Exploration Society to engage and entertain interested students. Outside of Imperial College, reports will be sent to UKclimbing.com, The BMC and relevant alpine journals.

## 12. ACKNOWLEDGEMENTS

The team would like to acknowledge Kimikazu Sakamoto for his assistance and photographs, and Jonathan Phillips and Phil Leadbeater for their advice and assistance.

## 13. BIBLIOGRAPHY

Below are some of the institutions, companies and websites the Team has been in touch with, looked at and/or visited while putting together these expedition proposals.

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### INSTITUTIONS AND RESOURCES

- The Alpine Club
- Foreign & Commonwealth Office

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### RESEARCH CONTACTS

- Kimikazu Sakamoto
- Jason and Julie Bailey at Peak Aspect

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### WEBSITES

- <http://www.thebmc.co.uk>, British Mountaineering Council
- <http://www.phdesigns.co.uk>, Equipment.
- <http://www.flykingfisher.com>, Flights.
- <http://www.theoutdoorshop.com>, Equipment.
- <http://www.outside.co.uk>, Equipment.
- <http://www.ukclimbing.com>, General Information.
- <http://www.rgs.org>, Research past expeditions.
- <http://www.mef.org.uk>, Mount Everest Foundation.
- <http://earth.google.com> Google Earth, Aid to researching mountains.
- <http://maps.google.com>, Google Maps, for mapping target area.
- <http://www.avtraining.org>, The American Institute for Avalanche Research and Education
- <http://www.avalanche-center.org>, Avalanche Center

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### AGENCIES

- Rimo Expeditions: [www.rimoexpeditions.com](http://www.rimoexpeditions.com)

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### BOOKS

- American Alpine Journal 2010 (The American Alpine Club)

- The Avalanche Handbook, David McClung, Peter Schaerer (The Mountaineers Books, 1993)
- Mountaineering – The Freedom of the Hills, Steven M. Cox and Kris Fulsaa (The Mountaineers Books, 2003)
- Medicine for Mountaineering, James A. Wilkerson (The Mountaineers Books, 2001)
- The High Altitude Medicine Handbook, Andrew J. Pollard and David R. Murdoch (Radcliffe Publishing, 2003)
- Extreme Alpinism: Climbing Light, Fast, and High, Mark Twight, Mountaineers Books; 1st edition (1999)
- Ice & Mixed Climbing: Modern Technique, Will Gadd (The Mountaineers Books, 2003)
- Expedition Handbook, Shane Winser (Royal Geographical Society, 2004)
- The High Altitude Medicine Handbook, Andrew J Pollard & David R Murdoch (Radcliffe Medical Press, 2003)
- Imperial College Obra Valley 2010, Jonathan Phillips, Phillip Leadbeater, Boris Korzh, Andy MacLellan

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#### INDIAN AUTHORITIES

- Indian Mountaineering Federation <http://www.indmount.org/>
- Indian High Commission [www.hcilondon.in](http://www.hcilondon.in)

## APPENDIX A - RISK ASSESSMENT

This risk assessment has been divided into two broad categories that encompass the risk involved with an expedition of this type, namely the risks associated with high altitude and the risks associated with general mountaineering in a glaciated region. The general risks associated with travel to this region have been dealt with in the main proposal and are omitted from this risk assessment. This risk assessment is intended to be dynamic and will be amended as required.

### NOTES ON RISK FACTORS

The idea behind using risk factors is provide a combined evaluation of the significance of a risk to expedition members and thus enable them to prioritize preparations and actions when trying to mitigate these. Both 'Likelihood' and 'Seriousness' of the consequences arising from a hazard are expressed on a scale between 0-5; these are then multiplied to give the combined 'Risk Factor', indicating the relative importance of addressing each risk.

### HAZARDS ASSOCIATED WITH HIGH ALTITUDE

Hazard	Symptoms	Consequences	Prevention	Response	Likelihood	Seriousness	Risk Factor
<b>Mild Acute Mountain Sickness (AMS)</b>	Headache Dizziness Fatigue Shortness of breath Loss of appetite Nausea Disturbed sleep General feeling of	Mild decrease in levels of concentration and performance	Increase altitude by max. 1000m every 3 days. Allow 1 rest day for every 1000m altitude gain.  Acetazolamide may be taken to aid acclimatisation, normally 250mg twice daily.	Rest at current altitude – no further ascent until symptoms resolve  Simple analgesia  If no improvement, descend  If worsens, descend and begin treatment with acetazolamide 250mg twice daily	3	3	9

	malaise.						
<b>Moderate/Severe Acute Mountain Sickness</b>	Mild AMS that is not improved with 24hr rest/analgesia  AMS symptoms of increasing severity	As above  Normal activity may become more difficult.  Member might have to be aided by others.	As above	Descend to altitude below that where symptoms began  Begin treatment with acetazolamide 250mg twice daily  Consider dexamethasone 4 mg four times daily	2-3	4	8-12
<b>High Altitude Pulmonary Edema (HAPE)</b>  Fluid build up in the lungs	Shortness of breath at rest.  'Tightness' in the chest.  Marked fatigue.  A feeling of impending suffocation at night.  Weakness.  A persistent cough bringing up white or pink, watery, or frothy fluid.  Confusion and irrational behaviour are signs that insufficient oxygen is reaching the brain.	As for Severe AMS plus:  Cyanosis  Impaired cerebral functions  Coma  Death	As above	<b>Immediate descent</b>  Maintain upright position  Dexamethasone 4 mg four times daily  Consider nifedipine 20 mg slow release four times daily  Evacuation to a medical facility for follow-up treatment.	2	5	10

<p><b>High Altitude Cerebral Edema (HACE).</b></p> <p>Increased pressures on Brain, due to swelling tissue as a result of fluid leakage inside the skull.</p>	<p>Symptoms can include headache, loss of coordination (ataxia), weakness, and decreasing levels of consciousness inc. disorientation, loss of memory, hallucinations, aggressive behaviour, and coma.</p>	<p>As for Severe AMS plus:</p> <p>Impaired Cerebral functions</p> <p>Coma</p> <p>Death</p>	<p>As above</p>	<p><b>Immediate descent</b></p> <p>Dexamethasone 4 mg four times daily</p> <p>Consider nifedipine 20 mg slow release four times daily</p> <p>Evacuation to a medical facility for follow-up treatment.</p>	<p>2</p>	<p>5</p>	<p>10</p>
<p><b>Periodic breathing during sleep</b></p>	<p>Periodic breathing during sleep, in the absence of cranial trauma, is normal at high altitude</p>				<p>4</p>	<p>1</p>	<p>4</p>



## GENERAL MOUNTAINEERING CONSIDERATIONS

These have been subdivided into three sections:

1. Risks of equipment failure
2. General risks associated with the outdoors
3. Risks associated with steep ground
4. General Travel Risks

### 1. EQUIPMENT

Risk	Consequences	Preventative Measures	Likelihood	Seriousness	Risk Factor
<b>Stove breakage</b>	Inability to cook and melt water.	Take maintenance and repair kit for stove, including spare parts. Take two identical stoves, so should one fail within the group one operational stove may be constructed. All equipment will be checked to make sure everything is operational and in good working order, prior to expedition.	2	3	6
<b>Fuel loss / leakage</b>	Unable to cook or melt snow. Potential fire or explosion causing serious injury.	Visual and frequent checks of stoves and fuel bottles. Use several fuel containers and fill stove bottles with funnels. Stoves filled with fuel every morning where possible. Only use appropriate fuel containers.	1	3	3
<b>Tent fire</b>	Loss of tent: all persons in one shelter. Potential burns.	Never cook inside tent. Make sure the tents are sufficiently separated and away from source of fire. Refill fuel bottles well away from the tents and cooking area.	1	5	5
<b>Suffocation</b> (from CO or burial)	Death.	Ensure tent is well ventilated. Never do tent zips up fully or cook inside snow holes or other unventilated refuges to prevent carbon monoxide poisoning.	1	5	5

		Clear heavy snowfalls regularly from tents to prevent the danger of asphyxiation and damage to the tent.  Do 'dig-up' snowholes rather than cave-style 'dig-ins' when possible.			
<b>Tent loss / breakage</b>	Breakage: Repair. Loss of tent: More persons in each shelter.	All persons will assist with tents in bad weather. In extremely high winds a snow hole or bivouac bags will be used. Appropriate spares and repair kits to be carried. Tents will be checked long before we depart to ensure they are fit for the mountain environment and tents will be secured using snow stakes / ice screws.	1	4	4

## 2. OUTDOOR RELATED RISKS

<b>Risk</b>	<b>Consequences</b>	<b>Preventative Measures</b>	<b>Likelihood</b>	<b>Seriousness</b>	<b>Risk Factor</b>
<b>Disorientation and loss of Direction on the mountain</b>	Possible exposure.	Frequent reference to compass and GPS units. Ensure navigation is shared amongst group and that those not on the mountains know your route and plans. Navigational skills will be refreshed and improved prior to departure.	2	3	6
<b>Exhaustion, fatigue, dizziness</b>	Lowered core body temperature. Irritable and irrational behaviour. Possible stumbling or falling.	Frequent and adequate rests. Agree flexible climbing schedule. Party moves at the slowest person's pace. Over-compensate on food and fuel supplies. Take lightweight and high energy food products to ensure weight is minimized and calorific value is maximized.	2	3	6
<b>Dehydration</b>	Headaches, dizziness, stumbling.	Regularly and frequently take in liquid. Drink at least 3-4 litres of fluid per day. Ensure group has sufficient fuel to melt snow.	2	3	6
<b>Sun/Snow/wind burn and blindness</b>	Sores, scars, blisters, open wounds, blindness.	Wear sun cream or sun block, lip balm, sunglasses, and sunhat. Team members check each other visually for exhaustion, hypothermia, frostbite and snow burn. Keep limbs covered while on snow/ice, even on cloudy days.	3	2	6

<b>Hypothermia and exposure</b>	Erratic and irrational behaviour, uncontrollable shivering, pale and blue extremities, lowered core body temperature, possible death.	Wear sufficient warm, waterproof and windproof clothing. Always carry spare clothing, and change out of any wet clothing. Do not stay exposed to the wind, and insulate any affected persons. Suitable clothing will be carried to ensure all team members will be sufficiently warm in the harshest of conditions.	2	3	6
<b>Bad Weather</b>	Difficult navigation. The team may become tent-bound.	Refer to compass and GPS units frequently. Share navigation between the group and plan for contingency days, ensuring adequate food / fuel is on the mountain. Take plenty of GPS batteries and carry emergency communication equipment.	3	2	6
<b>Unable to adapt to high altitude physical demands</b>	Impact on climbing schedule.	Undertake physical training to ensure all members are physically capable to endure the expedition [using training schedule developed by the Team]. Preparedness to adjust altitude gain schedule and descend if necessary before going higher. Undertake suitable acclimatization schedule [outlined in 'the Climb section'].	2	4	8
<b>Tripping over guy lines / equipment</b>	Sprained, twisted, fractured or broken ankle or knee. Other injuries.	Never venture out alone. Be observant. Use markers to map designated walking areas around the camps.	3	3	9
<b>Frost bite</b>	Inability to walk or climb effectively. Pale, blue, purple or black and swollen extremities. Potential loss of affected extremity.	Wear sufficient warm and waterproof clothing on extremities. Change out of wet clothes. Get out of wind. Maintain blood supply to extremities.	2	4	8
<b>Small accidents (e.g. cuts, sprains)</b>	Inability to use affected part of body.	Exercise caution at all times, all members will be proficient with the equipment and the techniques used and in first aid techniques.	2	2	4
<b>Larger injuries (e.g. severe bleeding, fractures)</b>	Possibly serious and permanent injury if no medical assistance sought.	Never 'work' alone, exercise caution at all times, all members will be proficient with the equipment and the techniques used and in first aid techniques.	2	4	8

<b>Injury sustained by lifting heavy packs</b>	Strain and or muscular damage. Inability to complete daily tasks and load carrying.	Distribute loads between the group based on abilities of each member. Be prepared to porter equipment. Use of trekking porters while carrying heavy loads when terrain is appropriate.	2	4	8
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### 3. STEEP GROUND

<b>Risk</b>	<b>Consequences</b>	<b>Preventative Measures</b>	<b>Likelihood</b>	<b>Seriousness</b>	<b>Risk Factor</b>
<b>Avalanche / Serac fall</b> See attached Appendix F Avalanche Safety	Destruction of climbing camps. Burial of, or impact with, an expedition member. Possible death.	Awareness of weather conditions and snow stability. Cautious route planning. Avoid crossing and camping under seracs, check camp and tent locations with regards to avalanche risk and seracs fall risk. Be prepared to descend to avoid hazardous snow conditions.	2	5	10
<b>Slipping / falling on ice</b>	Grazes or cuts.  Possibility for a sustained fall leading to Larger Injuries (see Outdoor Related Risks)	Always wear gloves on snow/ice. Wear long sleeved tops. Wear sturdy boots. Use crampons and ice axes. Extreme mixed/ice climbing will be avoided whenever possible.	2	5	10
<b>Falling in a crevasse</b>	Becoming cold, hypothermia, going into shock, cuts & grazes, fractures, unconsciousness, death. Inability to rescue ones self.	Careful route choice across and around crevasse fields and ice falls. Everyone to be competent in crevasse rescue techniques. Rope up where the terrain dictates. Refresher session to be run prior to expedition [see improving skills, advanced rope work].	2	4	8

#### 4. GENERAL TRAVEL RISKS

Risk	Consequences	Preventative Measures	Likelihood	Seriousness	Risk Factor
<b>Car Crash</b>	Serious Injury or death, loss of equipment	Use recommended drivers from Rimo, remain alert during journey	2	5	10
<b>Theft/Mugging</b>	Loss of property, personal injury	Travel in towns according to FCO advice and use common sense. Remain in a group at all times.	1	2	2
<b>Road Crossings in Delhi</b>	Injury or death	Take extra precaution whilst crossing the roads.	1	4	4
<b>Accidents to Porters</b>	Delay or possible termination of expedition.	Adequate equipment and attire for porters. Ensure Rimo arrange insurance for their porters.	2	4	8
<b>Theft from BC</b>	Loss of property	Hide sensitive materials or carry on person during the climbing phases	1	3	3

## APPENDIX B - LAKE LOUISE SELF ASSESSMENT SCORECARD

The Lake Louise Self Assessment Scorecard was established as a method of quantifying altitude sickness. Due to its compact format it has been used by mountaineers for the assessment of AMS.

Each category is scored individually. A total score of 3 or more constitutes AMS plus a headache and.

Repeated scoring is used to monitor progression of AMS.

Headache	0 No headache
	1 Mild headache
	2 Moderate headache
	3 Severe headache, incapacitating
Gastrointestinal Symptoms	0 No symptoms
	1 Poor appetite or nausea
	2 Moderate nausea or vomiting
	3 Severe nausea and vomiting, incapacitating
Fatigue and weakness	0 Not tired or weak
	1 Mild fatigue/weakness
	2 Moderate fatigue/weakness
	3 Severe fatigue/weakness, incapacitating
Dizziness and light-headedness	0 Not dizzy
	1 Mild dizziness
	2 Moderate dizziness
	3 Severe dizziness, incapacitating
Difficulty sleeping	0 Slept as well as usual
	1 Did not sleep as well as usual
	2 Woke many times, poor night's sleep
	3 Could not sleep at all

## APPENDIX C - BUDGET

Item	Unit Cost (£)	Number	Total Cost (£)
<b>TRAVEL</b>			
Flights London – Leh	£700.00	7	£4,900.00
<b>EQUIPMENT</b>			
Sleeping bag	£372.00	4	£1,488.00
Ground insulation	£90.00	4	£360.00
Duffel bags	£79.00	4	£316.00
Overboots	£80.00	3	£240.00
Down Jacket	£200.00	1	£200.00
CAT4 sunglasses	£45.00	5	£225.00
Climbing hardware (pegs, maillons, ab cord etc.)	£100.00	1	£100.00
First aid supplies and medication	£100.00	1	£100.00
Satellite Phone with minutes	£250.00	1	£250.00
Stove fuel	£50.00	1	£50.00
<b>SUBSISTENCE</b>			
Food above base camp	£150.00	7	£1,050.00
Food not included in agent fee (other food in country)	£40.00	7	£280.00
<b>Logistics</b>			
Agents fee	£1,200.00	7	£8,400.00
Visas for India	£39.05	7	£273.35
	£28.86	7	£202.02
Excess baggage	£50.00	7	£350.00
Tips for porters and staff	£200.00	1	£200.00
Reru Valley camping fee	£1.39	80	£111.20
<b>OTHER</b>			
Report printing and binding	£100.00	1	£100.00
Miscellaneous expedition expenses	£50.00	7	£350.00
First aid training (wilderness first aid for the team)	£255.00	5	£1,275.00
<b>TOTAL</b>			<b>£20,820.57</b>

## APPENDIX D - SAFETY PLAN

This safety plan has been prepared to ensure that all risks have been fully identified and understood, all reasonable measures to control these risks have been put in place and all remaining risk is as low as possible. Additionally, in the case of an accident, all required information is readily at hand. Much of the safety plan has been based on the safety plan for the previous Imperial college expedition to Obra valley, due to similar objectives and location.

### PARTICIPANTS

<b>Name</b>	<b>Role</b>	<b>First Aid</b>	<b>Mobile</b>
Robin Jones	<i>Logistics</i>	To be trained	00 44 7733325225
Hal Watts	<i>Alpine rock leader</i>	Yes	00 44 7764799675
Joe Prinold	<i>Treasurer</i>	To be trained	00 44 7984078554
Dominic Southgate	<i>High summit leader</i>	Yes	00 44 7837537557
Kunal Masania	<i>Liaison</i>	To be trained	00 44 7985194862
Jonathan Bull	<i>Equipment officer</i>	To be trained	00 44 7525176868
Jonathan Moodie	<i>Expedition planner</i>	To be trained	00 44 7734929652

### EMERGENCY CONTACT AND PROCEDURES

Whilst travelling:

Emergency number in UK: 999 or 112  
Emergency number in India: 100 – Police  
101 – Fire  
102 – Medical

NB. 112 from any GSM handset gets redirected to the local emergency contact number.

**Please see appendix E for details of the incident response.**

### MEDICAL AND TRAVEL INSURANCE

Travel insurance will be acquired through British Mountaineering Council insurance, at “Expedition” level, which covers (per person):

Medical Emergency Expenses:	£10,000,000
Rescue/Recovery/Repatriation:	£100,000
Overseas Hospital Benefit:	£1,000
Personal Accident:	up to £25,000
Personal Liability:	£2,000,000



Personal Belongings (inc. cameras/watches):	£2,000
Cancellation:	up to £5,000
Delayed Departure:	£100
Missed Departure:	£500
Legal Expenses or advice:	£25,000
Curtailment of journey or trip:	£5,000
Catastrophe Cover:	£500
Personal Money:	£500
Loss of Passport:	£500
Hijack:	£1,000

## EVACUATION PROCEDURE

### STEP 1: MEDICAL ADVICE

- If medical advice is required, call UK based emergency contact doctor (to be confirmed)
- BMC medical emergency helpline: 00 44 23 8064 4633

### STEP 2: BRIEF EXPEDITION STAFF AT BASE CAMP

- Inform the Base Camp staff of the situation and seek advice.
- They may take over with the arrangements of the rescue.

### STEP 3: CONTACT INSURANCE COMPANY

- Call insurance company: BMC Telephone: 00 44 23 8031 2323
- State intention to evacuate and brief insurance company on the situation, including:
  - Reason evacuation is necessary
  - Assessment/diagnosis of casualty
  - Whether medical contact has been sought/consulted.
  - Provide contact details of Rimo Expeditions (to be confirmed).  
- Telephone: 00 91 98 10067952 / 00 91 98 10009291
- **Before proceeding, you must obtain authorisation to evacuate.**
- **If unable to contact insurance company, and evacuation is time-critical, proceed to Step 4.**

### STEP 4: CONTACT IMPERIAL COLLEGE

- Leave message with Imperial College Security, who will contact Dr. Lorraine Craig.
  - Telephone: 00 20 7594 8910
- Include:
  - Casualty location

- Your location
- Action being taken (e.g. if casualty on hill, are they being evacuated to BC, treatment being administered).
- If you have not spoken to insurers, instruct home contact to establish contact with and brief insurers.
- Instruct home contact to keep you informed of developments.

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#### STEP 5: CONTACT RIMO EXPEDITIONS (IF USED AS EXPEDITION SUPPORT)

- Call Rimo Expeditions and brief on situation:
  - Telephone: 00 91 124 4051640  
00 91 124 2806027/28/29
- Include:
  - Assessment/diagnosis of casualty
  - Whether medical contact has been sought/consulted.
  - Casualty location
  - Your location
  - Action being taken (e.g. if casualty on hill, are they being evacuated to BC, treatment being administered)
  - Name and Sat Phone Number
  - Contact numbers of insurance company
- Inform Rimo whether you have been obtained authorisation to evacuate from insurers.
- State that you have briefed home contact (and what they are doing).
- State the nature of assistance that you require (doctor, search and rescue teams, etc).
- State that this is a British Expedition, as they may need to contact the UK Embassy.
- **Rimo will now make the arrangements for evacuation. Standby and wait for further instructions.**
- **Avoid unnecessary use of satellite phone to allow emergency services to contact you.**
- Should you be unable to contact Rimo, contact the following and brief as above:
  - East West Rescue: 00 91 11 24699229  
00 91 11 24690429  
00 91 11 24698865
  - East West Rescue Medical Director, Dr Chawla: 00 91 98 11029283

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#### STEP 6

- Standby and await instructions, it may be necessary to move the casualty to a suitable landing site.

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#### STEP 7: IN CASE OF SATELLITE PHONE FAILURE

- Brief Rimo staff at base camp of the situation and provide them with all of the relevant information (see step 5).
- They will send a runner to the nearest road head or telephone point to get help.
- Refer to evacuation plan and continue to attempt to establish contact through the steps. Continue until you establish contact.
- Await help.

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## TELEPHONE NUMBERS:

Imperial Sat Phone	00 88 1632 523 381 (subject to change with new SIM)
Medical contact	---
Insurance BMC	00 44 23 8031 2323
Imperial College Security	00 44 20 7594 8910
Rimo Expeditions	00 91 124 4051640
East West Rescue	00 91 11 24699229
Dr Chawla (East West Rescue)	00 91 98 11029283
British High Commission, Delhi	00 91 11 24192100
Sonam Norbu Memorial Hospital, Leh	00 91 01 982252012
Maha Bodhi Hospital, Leh	00 91 19 82264372
Indian Mountaineering Foundation	00 91 11 24111211
Indraprastha Apollo Hospital, Delhi	00 91 11 26925858
Jessa Ram Hospital, Delhi	00 91 80 41903714

## APPENDIX E - INCIDENT RESPONSE

### STEP 1: INITIAL RESPONSE

- Are you safe?
- Think carefully: assess the situation, what you want to achieve, your immediate assets and limitations.
- Can you locate the casualty? If not, then find him (safely).
- Is the casualty conscious and able to move? If so, go to step 2a. Otherwise, step 2b.

### STEP 2A: MOBILE CASUALTY

- You have assessed the situation; formulate a plan and act upon it.
- Discuss the plan with the casualty, but consider the extent of their injuries and factor this into how much they input.
- If separated from the other team members, consider whether you need them and their assets.
- Should you be unable to reach them via the radio, send out a distress signal by sounding six sharp blasts with a whistle. Repeat this every minute until you hear six whistle blasts in return.
- If you are unable to use a whistle, then send out six flashes every minute using a head torch.
- If you detect a return signal, continue sending out the distress signal so those responding can pinpoint your location.
- If it becomes dark try to use both a head torch and whistle as this will make it easier to pinpoint your location.
- If you receive no response, continue to send out the signal.
- Continue to assess the ability to get to your destination (ideally to base camp where satellite phone is held). Remember, a tired injured casualty can easily become an immobile or a dead casualty.

### STEP 2B: IMMOBILE CASUALTY

- Don't try and be a hero, it requires real manpower to move an injured casualty.
- Stay where you are and apply all your efforts to keep the casualty alive.
- Should you be unable to reach them via the radio, sound six sharp blasts with a whistle. Repeat this every minute until you hear six whistle blasts in return.
- If you are unable to use a whistle, then send out six flashes every minute using a head torch.
- If you detect a return signal, continue sending out the signal so those responding can pinpoint your location.
- If it becomes dark try to use both a head torch and whistle as this will make it easier to pinpoint your location.
- Severe pain is not a reason to move a casualty to base camp under any circumstance. Give what pain relieving drugs are being carried in the personal first aid kits.
- Get the casualty:
  - Out of the wind and wet.
  - Apply first and advanced medical aid.
- Use the casualty's equipment first.

- For a cold, wet casualty, if carrying sleeping bags, put casualty in their sleeping bag, then a bivvy bag, then your sleeping bag and another bivvy bag.
- The rest of the team will come.
- Continually assess the casualty and document on the chart in the first aid kit; this information will be very important once evacuated.
- Don't forget to keep your kit together, eat their chocolate, drink lots, and keep warm.

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### STEP 2C: ACTIONS ON DETECTING A DISTRESS SIGNAL

- If you detect a distress signal it means one or more members of your team is in trouble. Acknowledge by returning six blasts of a whistle or six flashes of a torch, then return to base camp and pick up:
  - Tent
  - Sat phone
  - Snow shovels and saw
  - 6 food packs, stove, pans, and fuel
  - Medical kit
  - Climbing gear (plenty of screwgates), tape and abseil tat
  - Personal climbing equipment
  - Digital camera
- Brief Rimo Expeditions staff at base camp of the situation (Rimo to be confirmed as expedition support).
- Get to the casualty/casualties and listen to their plan. Appoint one person to record information on the charts and to communicate to the casualty. Record BP, BPM, temperature, decisions made at what time and location as well as any drugs given. Keep the communicator out of the decision making loop to act as a filter.
- If the medical emergency is serious, call UK contact for medical advice.
- For the first 30 minutes work with the on-the-scene plan as is, and then develop from there. Do not assume or second guess.
- Remember that everyone involved with the initial incident is a potential casualty.

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### STEP 3: STABLE SITUATION

- Get a brew on and start making some food.
- Form a plan, you have travelled from base camp to the casualty being aware that you may have to evacuate on a stretcher on the way back. Use that knowledge.
- Break the operation down into smaller bits. Communicate the plan and execute.
- Continually appraise the situation and develop the plan as required.
- Remember to work at half pace; exhaustion will only make the situation more difficult.

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### STEP 4: MEDICAL ASSISTANCE AND EVACUATION

- Document the following:
  - Name and satellite phone number
  - Position – latitude and longitude
  - Accident/illness description (e.g. frostbite)
  - Clinical description:

- Conscious level – AVPU
  - Airway
  - Breathing – respiration rate, depth
  - Circulation – bleeding, skin colour, pulse
  - Disability - obvious injuries
- Treatment given (e.g. splinting)
- Next course of action (e.g. relocating to base camp)
- Assistance required (e.g. evacuation, priority if more than one casualty)
- Additional information (e.g. weather, other relevant information)
- Establish casualty priority:
  - Priority 1A Immediate evacuation, if possible from accident area
  - Priority 1B Immediate evacuation but can transfer from accident area (e.g. to camp)
  - Priority 2 Urgent evacuation
  - Priority 3 Evacuation needed soon
  - Priority 4 Evacuation needed, but not life threatening
  - Priority 5 Evacuation not needed, advice required
- Should evacuation be required, follow the evacuation procedure.

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#### STEP 5: POST INCIDENT

- Each team member will write a personal report.
- As a group, document the list of decisions made with approximate times and locations. Use the list to discuss how you felt prior to, during and after the incident.
- Complete Imperial College incident reporting form.
- If required, speak to UK contact to discuss incident.
- Any major incident will involve a full debriefing on return to London. Debrief to be led by Expedition Leader.

## APPENDIX F - AVALANCHE SAFETY

This appendix is a summary of relevant knowledge and protocols related to avoiding and, in the unfortunate case, dealing with avalanches and appropriate rescue protocols. It is based on that used by previous mountaineering expeditions as the protocols are equally relevant.

The major sources of information for the compilation can be found in the bibliography.

1. **PREDICTION** is the single most effective way of avoiding avalanches. The importance of this cannot be overstated, as burial by an avalanche would most probably result in death, even if professional search and rescue teams were available in the area. Since the team is going to be entirely self reliant this is the single most important factor in minimising the risk from avalanches.

The most important factors related to avalanche hazard are:

- a. *Angle of slope*: anywhere between 20° - 60° is prone to avalanches, 30°-40° is generally the worst.
- b. *Profile*: i.e. shape of slope; convex slopes are worse, because snow pack is in tension, and thus it is likely to crack, inducing failures. Additionally, contact surface beneath snow should be considered; slope stability worsens when moving from grass and scree to rock slabs (very bad).
- c. *Snow Modifying Processes*, these include:
  - i. *Equitemperature (ET) metamorphism*:  
Occurs when temperatures are below 0°. Decreases snow crystal sizes into rounded shapes. In the first instant this creates unstable powder snow. Later re-bonding can start leading to the formation of more stable *firn*, this may take a few hours – day.
  - ii. *Thermal Gradient (TG) metamorphism*:  
Happens in places with a high temperature gradient, for example grass to snow, or rock to snow interfaces. Destabilizes those interfaces in a few days – few weeks time.
  - iii. *Melt – Freeze (MF) metamorphism*:  
When temperatures are varying from above to below freezing point multiple times, bonds between snow particles can consolidate until *firn* turns into *neve*; this stabilising process takes a few days.

Main types of snow + related Avalanche types			
	Type of snow	Description	Affiliated type of Avalanche

<b>A</b>	<b>Powder</b>	Loose, unconsolidated; forms when $T < 0^\circ$ , no wind	Avalanches can occur when powder overlies more consolidated layers, i.e. spindrift avalanche in gullies; these can knock a climber over
<b>B</b>	<b>Windslab</b>	From fresh or redistributed snow; forms in wind; there is a characteristic squeaky noise when sticking axe into windslab	When such weakly bonded snow – most commonly wind deposited – detaches from surface below, while leaving a fracture line. Significantly stronger than A.
<b>C</b>	<b>Firn</b>	Well consolidated, older snow, ET has occurred	Generally stable
<b>D</b>	<b>Neve</b>	Ideal for climbing, formed from firn by MF; it is firm enough to support climbers well but still allows easy penetration of ice tools	Generally stable
<b>E</b>	<b>Snow formations</b>	Serac, cornice etc collapse	Often triggered by climbers. Impact on climber is significant. Can also trigger further A or B type avalanches.
<b>F</b>	<b>Wet</b>	When $T > 0^\circ$ , wet, i.e. water droplets form when squeezed into snowball.	Comes down in big rubbles and blocks which can crush a climber

## 2. AVOIDANCE:

- a. Constantly check and re-evaluate conditions; beware of past weather history and watch out for signs of avalanche risk, such as:
  - i. Recent/current avalanches
  - ii. Whether they were natural or human triggered
  - iii. Heavy snow build up (i.e. more than 2cm/hour rate of deposition), especially if windy
  - iv. Highest risk is during and immediately after (i.e. 24-48hrs) storms
  - v. Rain or warm temperatures?
  - vi. Shooting cracks, 'whoomp' noises when walked upon
  - vii. Leeward slopes
  - viii. Dig *test pits* and do *shear tests*, as often as necessitated by changes in conditions, to gain further knowledge of underlying layers and identify overlying layers with significantly different properties.
- b. Most of the time when the above are observed, the avalanche-prone slope can be avoided by choosing an alternative route or by retreating. Otherwise it is important to



remember that, according to The Mountaineering Council of Scotland, 90% of avalanches involving humans are triggered by their victims. Thus, if it is essential to proceed, the following should be borne in mind:

- i. No one should travel solo.
- ii. Avoid areas of heavy snow build up; i.e. use ridges rather than faces; generally a direct descent or ascent is safer than traversing.
- iii. Avalanche *transceivers* are suggested to be used in addition to carrying collapsible *probes* and *shovels* which play a crucial role in effective rescue.
- iv. Go one at a time on any suspect slope – the others should closely observe the progress of the person on the slope.
- v. Close up clothing, wrap scarf or other item round mouth and nose.
- vi. Belay if possible – this might be unfeasible on many wide, open slopes.

### 3. SURVIVAL TACTICS:

1. *Delay the fall*: 'The more goes before, the less is left to bury.' Try to move above or to the side of the fracture line.
2. *Look, orientate* yourself and *shout*: aim to move towards side of the avalanche; others might hear you.
3. *Fight to Stay on Surface*: once dragged away by the avalanche try to swim, ride, roll, surf, etc as staying on top gives the best chance for survival. Keep head upslope and shut mouth.
4. *Try to get any part of the body above the surface*: easier to be found by the others. If buried, take a deep breath, cover mouth and nose with one hand, while creating an air space with the other hand. Dig upwards – can determine direction by spitting – only if you know which way is up, or wait to be found by others.

### 4. RESCUE

- a. *Watch* where victim is driven rather than dash after victim. Establish observed burial point (OBP) and mark it once safety of the area is evaluated.
- b. *Dig ASAP*, search narrow cone area under OBP with as many people as possible. Look for signs of victim and use *transceivers*, if available, to locate and *probes* to test and accurately determine position of victim.
- c. *First 15-30min*, the victim has a good chance for survival. After 45min chances of survival are minimal BUT do still exist, hence search should go on for a few hours.
- d. If victim is found, first clear mouth and nose from snow, free chest then proceed with first aid protocols; also assume some degree of hypothermia.

### 5. EQUIPMENT RECOMMENDED:

- a. Due to the very tight time frame in which a rescue can be effective, the use of appropriate equipment can decide the victim's chances of survival. Transceivers, although expensive, provide the single fastest way to locate buried victims; when

appropriately operated by experienced users. Probes and shovels are necessary to ensure the exact location and a speedy excavation of the victim.

- b. Shovels are also very useful for other tasks during the expedition, including digging emergency snow shelters or building protective snow walls around tents or bivouacs.
- c. Below is a list of recommended equipment for a 4 man mountaineering expedition, in which light weight travel is essential. As the Exploration Committee already owns these items, due to purchases for previous expeditions.

## 6. Expedition training:

- a. Since most skills associated with avalanche prediction and rescue, especially efficient usage of transceivers, can only be obtained by practice in the field, the team is planning to try out all related safety equipment and *practice snow evaluation and rescue protocols* during the *two week training expedition* in the French Alps, as it has done in the previous year.
- b. The team also sees the expedition as being an opportunity to gain valuable mountain safety knowledge which can later be passed on not only to later expedition teams run through the Exploration Board, but also to relevant clubs and societies of the union, such as the Outdoor and Mountaineering clubs.

## 7. Bibliography:

- AIARE – The American Institute for Avalanche Research and Education - <http://www.avtraining.org/StudyMaterial.pdf>
- BMC – British Mountaineering Council - [http://www.thebmc.co.uk/safety/train/skill\\_0.htm](http://www.thebmc.co.uk/safety/train/skill_0.htm)
- BMC Winter skills talk – 2010 December
- CSAC, Avalanche Centre - <http://www.avalanche-center.org/Education>
- MCoFS - The Mountaineering Council of Scotland - <http://www.mountaineering-scotland.org.uk/leaflets/avalanche.html>
- The Avalanche Handbook, David McClung, Peter Schaerer (The Mountaineers Books, 1993)
- Imperial College Obra Valley 2010 Proposal, Jonathan Phillips, Phillip Leadbeater, Boris Korzh, Andy MacLellan