

Bulletin

of the Rutherford Appleton Laboratory

12 Aug 1985 No 11

World's First KrF Target Facility Established at RAL

The first Krypton Fluoride laser target facility in the world has recently become operational at RAL.

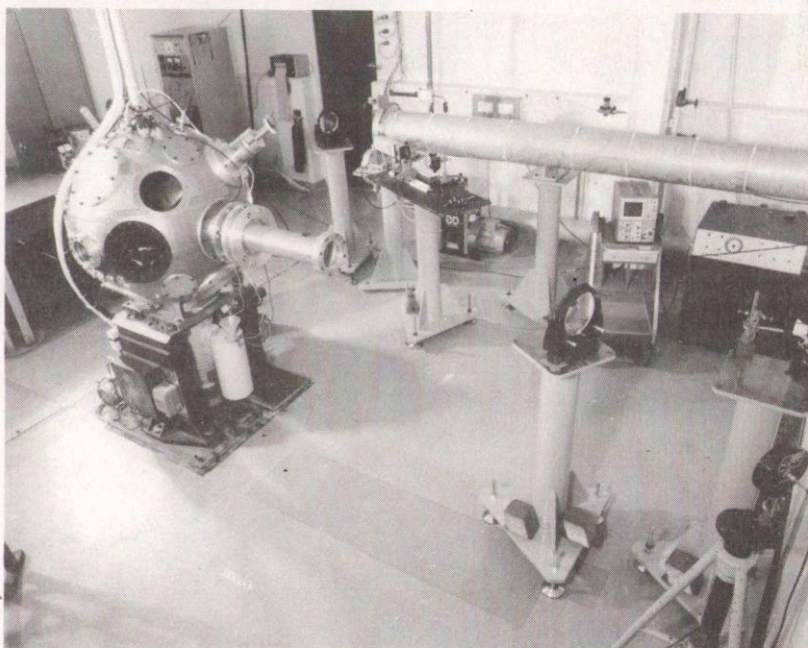
Using the high-power single beam laser Sprite, the new target facility results from six years of major research and development effort by the Gas Laser team. This project began at the Laboratory with the first demonstration of a high-efficiency short-pulse electron-beam-pulsed KrF laser in 1979 and has now reached fruition with the establishment of a unique facility for plasma physics researchers.

For the past four months a series of preliminary target experiments have been performed on the new facility, by various university groups and RAL staff. These experiments were aimed at fully characterising the facility and at assessing the usefulness of the KrF laser for generating x-rays from laser produced plasmas. An increasingly large amount of the work at the Central Laser Facility is concerned with the use of laser plasmas as high brightness pulsed x-ray sources and the Sprite experiments demonstrated, as expected, that the short wavelength KrF laser was very efficient at generating high intensity x-ray pulses.

Most of these recent experiments have concentrated on generating x-rays using carbon targets. With these targets x-ray emission from the plasma is very intense especially at wavelengths in the range 2.3 to 4.4 nanometres, with the conversion efficiency from laser energy to x-ray energy in this wavelength range being approximately 2%.

Novel Biological Application

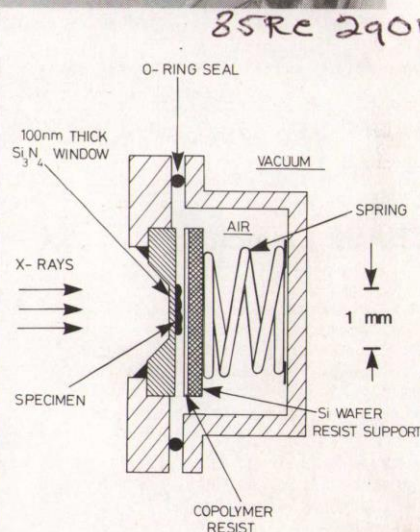
During the experimental run the carbon x-ray source on Sprite was used by biologists for microscopic imaging of biological specimens. With this newly developed technique, images are made by placing the specimen in a sample cell (see diagram) close to the pulsed x-ray source. A contact image of the specimen is recorded in x-ray resist which is then developed chemically to give a relief pattern corresponding to the x-ray opacity of the original specimen. This relief



Sprite

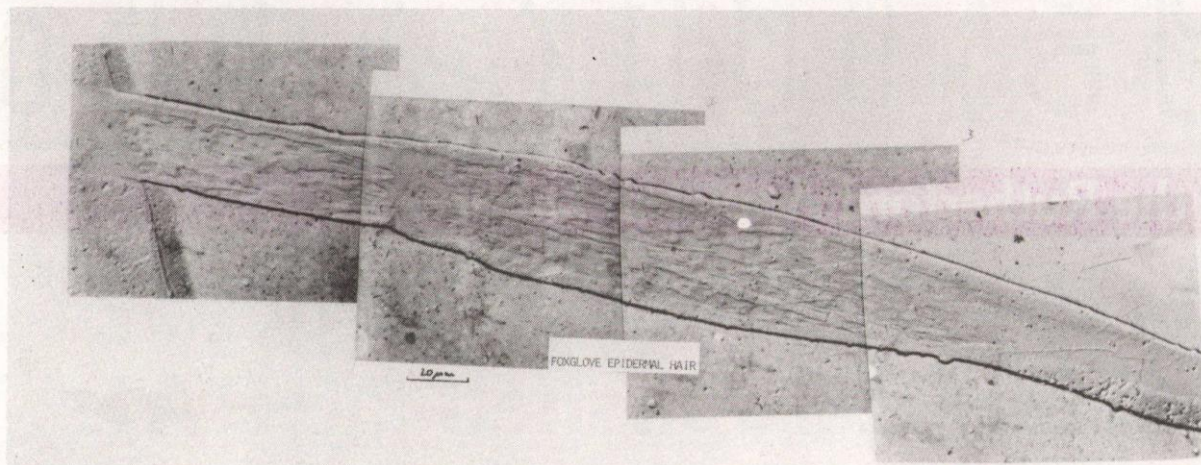
The Sprite laser operates at a wavelength of 0.25 microns and along with the new target area, augments the range of existing plasma physics facilities on the VULCAN Neodymium - glass laser where experiments are performed at wavelengths of 1.06, 0.53 and 0.35 microns.

Sprite delivers pulses of 100 J energy and 50 ns duration into the target chamber (Photo). The beam is focussed onto the target using an f 10 aspheric fused silica lens. A peak power of $5 \times 10^{13} \text{ W/cm}^2$ is achieved in a focal spot of 40 microns diameter.



(Continued over)

KrF Laser Facility



Soft X-ray contact image of Foxglove hair recorded in X-ray resist, viewed using an optical microscope.

Experimental results by Dr T Stead, Potany Dept. Royal Holloway College, London.

image can then be viewed in an optical or electron microscope. One such image, of a fresh Foxglove epidermal hair, is illustrated here. The thread-like features are provisionally identified as transcellular strands of cytoplasm which may indicate continuity from cell to cell. The possibility of the existence of such internal structures in plant tissue has been conjectured, but until now have never been seen.

High contrast images such as these are possible with this technique because all biological materials, being mainly protein and water, possess an in-built natural contrast mechanism for x-ray imaging in the 2.3 to 4.4 nanometre range. This contrast arises because these wavelengths lie between the oxygen and carbon K-edges and the x-rays are absorbed almost ten times more strongly in protein which contains carbon and nitrogen, than in water, which contains oxygen. High contrast images can thus be obtained without resort to the normal techniques of desiccation and staining, which result

in structural deformation of the material. It is now possible, using x-rays, to produce images of live specimen cells with a spatial resolution which approaches that achievable with a Scanning Electron Microscope (SEM). In addition comparatively thick (1-10 microns) specimens can be imaged, something which cannot be achieved with the SEM. Thus, soft x-ray microscopy combines the advantages of optical microscopy - the ability to view thick, live specimens - with the superior resolution (about 10 nanometres) of the SEM. The resolution achievable in soft x-ray microscopy is limited by the wavelength used and by the resolution of the x-ray resist recording medium.

One final point concerns the ability to image live specimens. The x-ray intensity necessary to expose the 2 resist is in the range 10-20 mJ/cm². This level of exposure causes irreversible radiation damage to a specimen, but because of the short duration (about 50 nanoseconds) of the x-ray pulse, structural damage occurs only after the pulse, and the

image of the specimen is recorded before damage becomes manifest.

Future Plans

The target work with Sprite has been highly successful and user time is now scheduled on this new facility in the same way as on VULCAN. Now, a long period of development work aimed at producing KrF pulses of less than 10 nanoseconds duration has been planned. The next period of scheduled experiments starts in November when more users will join the KrF target programme to capitalise on the availability of this unique UK facility.

Whilst KrF laser facilities are being constructed in the USA, Japan and Canada these will not be operational for some time and it is expected that the UK plasma physics community will, in the meanwhile, establish a clear lead in this new area of target interaction physics.

For further information contact Dr F O'Neill Ext 5481.

CHASE Launch

Disappointment engendered by the news media's gloomy reports on the launch of Spacelab 2 on the Space shuttle "Challenger" on Monday 29 July was quickly dispelled on Wednesday when first class data from the CHASE experiment was received at RAL.

It was also learned that IPS can be controlled from the CHASE sun-sensors and that ESA is working on software changes to alleviate the problem.

The Birmingham University x-ray telescope experiment has been activated and data is being received.

Obituary

Ken Freeston

We regret to announce the death of Mr Ken Freeston on Friday 5th of July. Ken died at home on Friday morning having suffered a period of illness from April this year.

Ken came to Harwell in 1959 and transferred to NIRNS in 1961 where he helped in the build up and commissioning of the PLA. When the linear accelerator was closed down in 1968 Ken joined the newly formed PAG and worked on the preparation and installation of many of the large experiments mounted by HEP groups including both TASSO and JADE at DESY. He was currently involved in the final commissioning

stages of the Ring Imaging Detector at CERN when he was taken ill and his contribution to this project was much appreciated by everyone on the RICH group.

Ken will always be remembered by his many friends and colleagues at the Lab and especially by all those who worked with him on the I.P.C.S. committees to which he gave a great deal of time and effort.

We extend our deepest sympathy to his wife Eileen and to his two sons Stephen and Michael on their sudden and sad loss.

into extra-time for the third match running. Nick Moore again put Atlas ahead with a solo-run to complete a memorable hat-trick, his fifth goal of the day. Again Atlas despite having gone slightly off the boil, took control but could not finish off a number of fine moves. Daresbury's lively forwards, who seemed to improve all day took full advantage of the crumbs which came their way to score twice in the last three minutes. The final score being 4-3 to Daresbury.

Special thanks to all the referees who kept their heads during a few fiery moments. I did not get to see many of the rest of the events, but we all enjoyed the peepshow on the way home.

Kevin Lewis

SERC Golf Tournament 1985

On Friday 21st June, 51 golfers arranged in nine teams from four SERC establishments met at the Burford Golf Club to do battle for the Brian Flowers Trophy. The trophy is awarded to the team with the best four scores out of six players. (Stableford points) over 36 holes. Last year the trophy was won from us by Daresbury Laboratory, this year it was brought back to the RAL by our 'A' Team captained by John Delury and ably supported by Dale Faircloth, Robin Walters, Doug House, John Connolly and Joe Paxton.

First four places were:-

RAL 'A'	capt. John Delury
RAL 'C'	capt. Gordon Walker
Swindon 'A'	capt. Phil Burnell
RAL 'B'	capt. Geoff Manning

Altogether a very good result for RAL.

The Chairmans Trophy for the best gross score (strokes) was won for the second year by Dale Faircloth, the best morning round by Eddie Fitzharris, the best afternoon round by George Spalding and the RGO Trophy for most points over 36 holes was won by Jim Sadlier of Central Office.

Most players had been influenced by the weather forecast to expect a thorough soaking but in the event the drizzle and odd shower were barely noticed and all declared it to be a great day with the course in fine condition and the hospitality in the clubhouse excellent.

For the first time a runners up medal was presented to each of the RAL 'C' team by Central Office; it was a pity Swindon 'A' were pipped by one point.

Our grateful thanks to Central Office for organising the tournament, we hope to do as well next year when its our turn.

Roy Bell

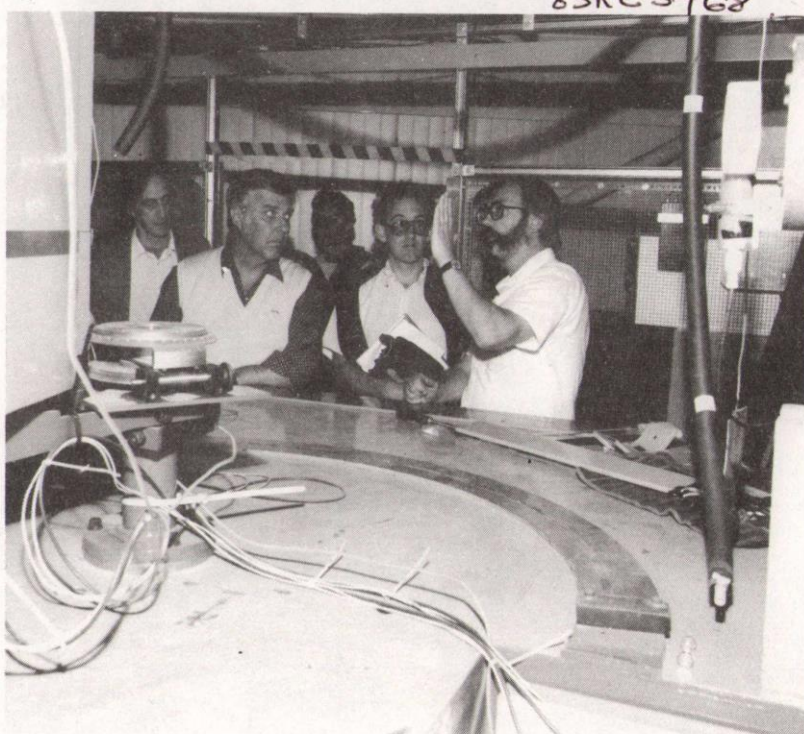
ICANS at RAL

The eighth meeting of the International Collaboration on Advanced Neutron Sources (ICANS) was hosted by the Laboratory and held at Keble College Oxford 8 - 12 July.

The collaboration consists of a consortium of eight laboratories concerned with the provision of new neutron sources and meets periodically to exchange information and ideas for the future.

Some 50 overseas participants attended ICANS VIII and visited RAL to see the SNS on 10 July.

The photograph shows Colin Carlile explaining the UK/Indian spectrometer IRIS to (from left to right) Francis Atchison and Walter Fischer (SIN), Francesco Cilloco (Frascati) and Rob Robertson (Los Alamos). The Laboratory was widely complemented at having the SNS "on the air" and already starting to produce its first scientific results.



In Memory

The collection recently made in the Laboratory in memory of Ken Freeston raised a total of £299.54.

In accordance with the wishes of his family, the money is to be used to purchase equipment which will help ease the suffering of cancer victims in the Newbury area.

Alexander Rose Collection

The collection made at RAL by our Messengers amounted to £117.38 this year, an increase of £25 on the total for 1984.

Thank you all for being so generous and special thanks to the ladies who collected.

Are These Yours ?

Would the person who ordered the following goods please contact Stores on Ext 5412 or 6663.

1. 35421M Roxy Torch set - Nozzle
1. 35429m " " " - Bend

Rothenberger (UK) Ltd. Northampton.

Film Badge Notice

It is Period 9. Colour strip BLUE Please be sure you are wearing the correct dosimeter, and that old ones are returned.

NEXT FILM ISSUE

Monday 9 September

Table Tennis Club

The new evening league table tennis season starts in September and lasts until April. The club enter teams in both the Didcot & District, and Oxford and District Leagues.

RAL RecSoc members interested in playing please contact one of the committee.

Tim Pett	R27	Ext. 5332
Peter Horn	R66	Ext. 5541
Peter Kent	R31	Ext. 6325
John Varley	R25	Ext. 6308

not later than 20th September 1985.

All standards of players, most welcome.

Allan Grant Retires

Allan and escort.



The name Allan Grant may be unfamiliar to some at RAL, but the person is certainly well known. As one of our proud band of security wardens, there can be few of us who have not appreciated his friendly greetings as we passed the Security Lodge, on fair mornings or on foul. So, naturally at Allan's retirement presentation, the coffee lounge was packed with well-wishers.

A man of many talents is Allan; watch and clock repairer, instrument mechanic, vacuum expert, and a one-time member of the Nimrod radiation team.

"We have appreciated your work in all your roles at the Laboratory," said Nick Lawrence who was making the presentation on behalf of Allan's many friends and colleagues. "We wish you very well in the future - all the best from all of us."

Allan thanked everyone for the gifts, for the immense card and for their good wishes. "I have enjoyed the work and made many friends, he said. I have started my retirement well, the weather is awful and will keep me out of the garden," he ended, with a touch of his usual humour.

arranged to join one of their guide groups. The final party of ten included three guides! These guides are rather like the Wild West cowboys, going to wherever they are needed, carrying rucksack and ice axe instead of saddle and gun. We were led by a Liverpuddlian, there was a Swiss as second in command and a Scots trainee working his ticket. The remaining seven included an Australian doctor, a South African dentist, two British engineers and two "Amazons", one an American body builder (one hundred press-ups before breakfast) and the other an English fell-runner.

The trip itself was quite magnificent; the food in the huts was super and the weather got better and better. The long climbs up hill weren't too bad, the downhill was bliss and I'm trying not to think of some of the drops we had to cross.

I learned a lot; like, one can't retire to the nearest bar in the event of bad weather; like, its no use complaining of being hot, cold, thirsty, hungry, blistered or why as no-one gives a damn - they've got their own problems anyway; like, one pullover is worth four shirts; that 'piste' equipment isn't good enough for 'Haute Montagnes' and that if you can't take even one more step upward - you can. And another and another -----.



Halfway across the roof of Europe with the Matterhorn in the distance.

Why, I wondered, did the rest of the party keep calling me Grandad? I may be twice their age but I'm still not that old, for goodness sake, and I was able to keep up with them in any case. I realized why when we finally reached civilisation and saw that my beard, which when I had last grown it had been black, had turned white in the intervening years.

The scenery was breathtaking and looking back, now that tan, fears and blisters are all fading, it was such a rewarding experience that I am now wondering, just wondering, if my wife, boss, bank manager and fitness, would run to letting me do the second Haute route over the Berner Oberland next year!

Martin Evans

Thanks

Allan and Barbara Grant would like to thank their many friends for the wonderful send off, and for the lovely gifts.

"We would like to have seen all of you before leaving. No doubt we shall bump trolleys in the Supermarket sometime", wrote Allan.

RecSoc Bar

The Bar is proving very popular, with drinks at competitive prices. Opening times are from 12 - 1.30 pm every day, and new customers are always welcome.

The bar can also be opened for official functions, on site. Contact A Forster Ext 6363 for information.

On Top of the World

To do "The Haute Route" from Chamonix to Saas-Fee, over the top, has long been my ambition, though expectation of achievement was low. However the sad loss of one of our Opal group colleagues made many of us realise that we should try to fulfill some of the dreams and ambitions of our youth.

I am probably not now going to become P.M and Bridgit Bardoe is still unobtainable ----- never-the-less the Haute Route would still be within reach, for a year or two yet, but better sooner than later, as it's a very strenuous six day trek across the Swiss/French Alps.

The first problem was to get fit. Opal seems to be blessed with a group of fitness fanatics, so it was easy to join them for the lunchtime run over the Ridgeway. I did a sponsored slim (for cancer care in Newbury) - and I will be round for the money. Thanks to all my sponsors,

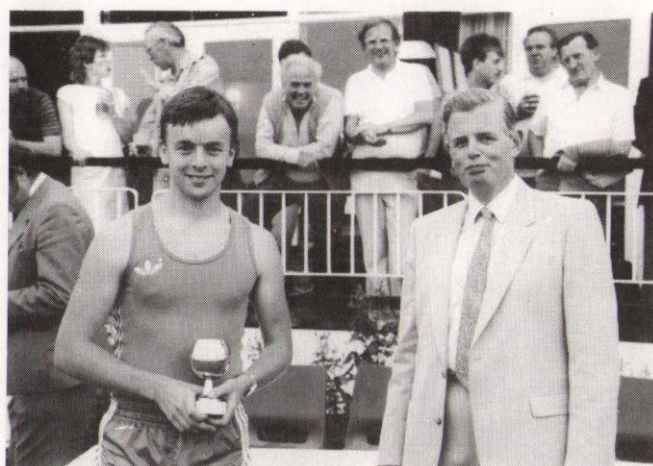
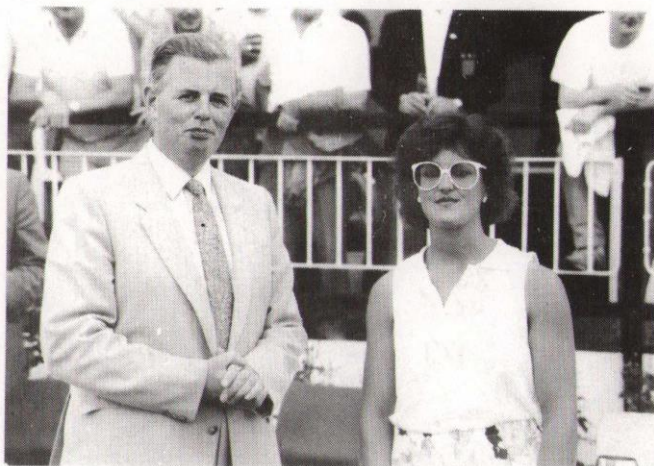
Next I had to find someone able to take me. I contacted the International School of Mountaineering in Leysin and

Bulletin

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Prizewinners



Sir John Kingman, SERC Chairman, pictured with the RAL prizewinners.

From top left, clockwise, Helen Dorsett (100 metres), Alan Saxby (100 metres), Lorna Claringbold and Tim Pett (Tennis), Peter Craske, in the centre of things as usual (Angling), C Wakeford and N Ferguson (Bowls pairs) and Bob Young (Captain, Rounders).

Sportsday at Birmingham

About 140 personnel from RAL attended this year's Outdoor Sports Day, and again we all had a fine day as far as the weather was concerned. As for the sports events, all the establishments had a share of the spoils, RAL winning the Bowls (pairs) Rounders, Tennis (mixed) and 100 metres (mens and ladies). Daresbury took away the honours for soccer, angling, croquet and tug-of-war; Central Office the cricket, bowls (triples) and the 3000 metres and RGO won the men's tennis title.

Funny story:- In the bowls triples competition two of the RAL teams played-off for the Wooden Spoon and the match ended in a draw - half a spoon each we suppose!

Angling

Daresbury again proved too good for the RAL and Central Office teams, but it was a good enjoyable contest. The CO Team didn't catch one fish between all four of them, but enjoyed it.

In the individual contest, defending champion, Colin Watson, (Daresbury) just managed to win again with 51b-10oz of fish with Peter Craske (RAL), 51b-3oz running him a close 2nd.

Bowling

The Bowls competitions were again held at Solihull Municipal Bowls Club where the hospitality we received was much appreciated! The weather too behaved itself until the last end of the pairs final when some large drops of rain fell.

The event was well attended with teams from RAL, Central Office, RGO and Daresbury Laboratory taking part. There were five teams entered for the triples competition and this was won by a triple skipped by T Hinde from Central Office (one of the organisers!). The runners up were Daresbury.

The pairs competition had eight entries divided into two leagues. The standard of bowling was good this year with the league winners not known until after the last games had been played. The final was between two Rutherford pairs, RAL(B) and RAL(D). RAL(B) N Ferguson (R3) and C Wakeford (R2) were the victors with RAL(D) L Barker (ret) and C Grindrod (R2) as runner-up. The two RGO teams were 3rd and 4th.

It proved to be a very enjoyable day for all those who participated in the bowling and the hospitality!

We would like to congratulate Mrs Mary Shepherd (RAL) and her ladies of the Wantage Bowling Club in winning the County Championship by beating Hagbourne in the final on the 29th July at Windsor. Good luck at Birmingham on 5th August.

Cricket

Once again I have to report from the Civil Service Sports Ground, Birmingham that the Cricket Trophy was retained by Swindon Office. The invincible Mr Hassan was at his best, for most of the day hitting the ball on both sides of the wicket whenever he felt the need.

Rutherford 'A' battled on well reaching the semi-final only to fall to a slightly stronger Daresbury 'A' side. Daresbury batting first scored 68 of 5 eight-ball overs, Rutherford started well scoring 15 off the first over, but a run out soon followed and in the end they finished 4 runs short. One point of interest was that Rutherford 'A' may have set a record for Sports Day. In one game they reached 99 runs for no wicket off the allotted 5 overs, B Blowfield scoring (40) together with D Rippington also scoring (40) with (19) extras.

The Rutherford 'B' team also put up a good showing. In the game against Daresbury 'A'. the scores were very close. At one point it seemed that Rutherford had pulled off a well earned victory but after careful consultation it was found that they needed six runs off the last ball. This was due to a mix up over the scoring and it proved to be too great a task in the end.

At the end of the day everybody enjoyed a generous helping of chicken and chips, well worth £2.00, and then made their some what weary way back to RAL.

A Napper

Rounders

Rutherford-Champions Again!
(or Give it some stick, Part 2)

Look, if you didn't read my report last year which included the basic ideas behind this ancient and noble sport, it is not my fault is it? Do you really expect me to go through it all again? No, I thought not.

This year saw the rounders pitch situated next to the main building which turned the competition into a spectator sport with the obligatory crowd trouble. (the demon drink, you know!). Three teams entered:- RAL, Daresbury and Central Office, each team comprising of 7 women and 3 men (very lucky men, indeed!) and yes, RAL did it again by playing with one short women, at least, I think that's right.

All three teams were very competitive and the resultant final between RAL and Daresbury lived up to all expectations ending up (eventually) in the narrowest of victories for RAL.

Same again next year?
B.Y.

RESULTS

RAL	9	Daresbury	6½
Daresbury	8½	Central Office	1½
RAL	13	Central Office	3

FINAL: RAL 6½ Daresbury 6

TEAM

Helen Dorsett	- "nothing to do with me....."
Clare Williams	- Bodyline
Penny Whitehead	- Strawberries provided
Ann Oxley	- Courtesy of MH
Gill Brett	- "where's my bike?"
Lisa	- Liza, Leesa,
Bob Young	- released from EBW
Colin Uden	- The Arm
Steve Johnston	- Shorts next year?

Soccer

Eleven teams turned up, one Rutherford side withdrew due to a number of last-minute drop-outs. RGO were the only establishment not represented. The competition consisted of preliminary leagues followed by a knock-out tournament.

After a great deal of arguing and bargaining we were finally given the pitches we had asked for. The only problems being a slope in one goal-mouth and overhanging trees in which several people lost their balls.

The Rutherford 'X' and 'Y' teams from R18 and the Heavy-Gang were eliminated at the first stage. The latter did hold Central Office, the reigning champions, to a 2-2 draw. Appleton reached the quarter finals where they lost 4-3 to the Rutherford 'W' team who had earlier beaten ROE 8-0 and were looking confident. The other quarter-final results were:- Daresbury 'B' 6 Daresbury 'A' 3 after extra-time. Central Office 4 Daresbury 'D' 0 Atlas 4 Daresbury 'C' 0

Central Office did well to fight back from 2-0 down after their substitute had broken his leg, but tired during the extra-time period, and Daresbury 'B' took advantage of the extra-time to win 3-2. Atlas beat Rutherford 'W' team in the other semi-final with a Steve Cooke winner in the final seconds. The students' team had come back from 2-0 down to equalise with a Peter Norman header, his eighth goal of the day.

Atlas after losing an early goal took command of the final to lead 2-1; and looked like sewing the game up on numerous occasions until a break-away equaliser took the Daresbury 'B' team into extra-time for the third match running. Nick Moore again put Atlas ahead with a solo-run to complete a memorable hat-trick, his fifth goal of the day.

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