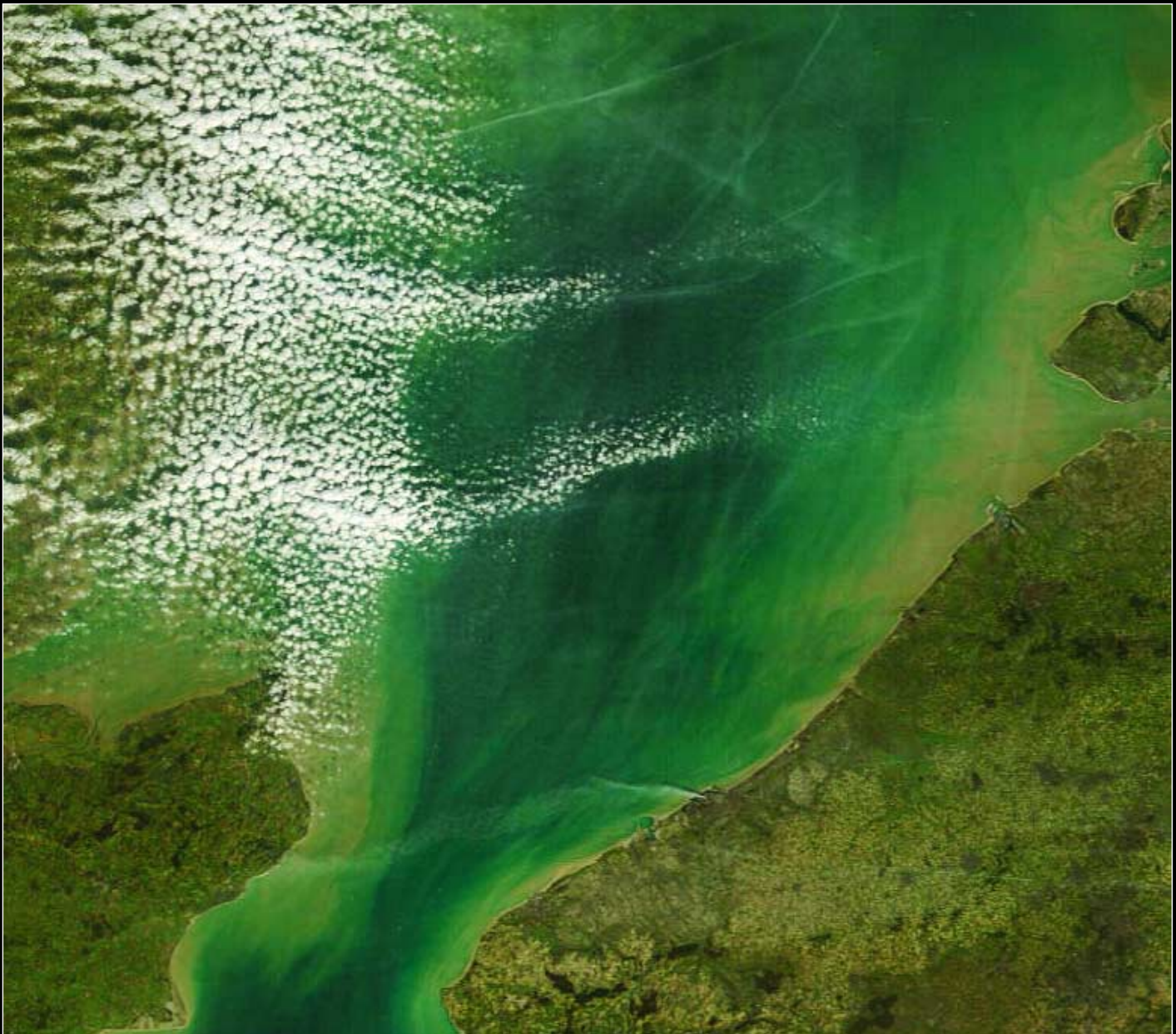*Inside this issue . . .*

Climate Change is a topic that is seldom far from our minds these days. A season of unprecedented ice melt in the Arctic Ocean is documented by Les Hamilton, while a year of turmoil on the European weather scene, particularly in the UK, is described by John Tellick.

Our star article this issue is John Silver's Lightning Radar construction project. Taking advantage of available free software, John describes how to build hardware to capture lightning signatures and display them on your PC.

Regular feature writer Peter Wakelin has produced a real gem for this issue, reminiscing on his years spent as a professional meteorologist based in the Falkland Islands. Lavishly illustrated with his own colour photographs, this article provides a revealing insight to this remote corner of the planet.

And to complete this eclectic issue, David Taylor evaluates an alternative USB receiver for the reception of EUMETCast on computers running 'Vista'.

Plus many more features ...

The striking MODIS image on our front cover shows Foxe Basin in the Canadian Arctic as it appeared to NASA's *Terra* satellite in late September 2007, just when the summer's unprecedented ice-melt had reached its peak. Not only did the infamous *Northwest Passage* become entirely ice-free for the first time in recorded history but vast swathes of the Arctic were opening up as never before. Our article, *Arctic Meltdown*, which appears on page 4, investigates the recent increasing dynamism beyond the Arctic Circle.

And to complement this, Peter Wakelin casts his gaze to the southern hemisphere as he draws on his experiences as a meteorologist based in the Falkland Islands to paint a vivid picture of this distant and generally inaccessible part of our planet.

With four full years under our belts, GEO would like to offer readers the opportunity to say what they think about the Group. Are we satisfying your needs in the world of satellite imaging? Are there areas in which you feel we could do better? Are there particular topics you would like to read about more regularly in GEO Quarterly? Maybe there are topics we cover that do not interest you at all! Help GEO to tailor this periodical more to your tastes and to plan the Group's future by logging into

www.geo-web.org.uk/survey08.html

and completing our *On-line Survey Form*. Results from the survey will be published later in the year.

Since last issue, Ed Murashi has been busy completing the second instalment of his series on obtaining LRIT images from the GOES geostationary satellites. In this issue, Ed documents his home-brew hardware and provides everything needed by readers who would aim at duplicating his efforts.

GEO has featured several articles on the topic of lightning detection in the past. Commercial detection systems tend to be somewhat expensive, however, so John Silver has developed his own. Full details of his Lightning Radar System can be found in his article on page 31, which features full details of his design project, using surface-mount components.

By the time the next issue of GEO Quarterly appears, another GEO Symposium will have taken place at the National Space Centre in Leicester. These events prove popular every year, particularly for the opportunity they provide to readers to meet up and exchange ideas. This is the opportunity where every GEO reader can contribute to the Group, actively, by making a talk or demonstration, or simply by providing GEO's Management Team with ideas they would like to have included. Turn to page 3 to learn the latest news about this year's Symposium.

Contents

The **GEO Report**

Francis Bell

As usual I would like to extend a welcome to new members and thanks to those who have renewed their existing membership. In each Quarterly I do ask that renewals are done promptly. Following up expired membership is time-consuming and expensive. I have just completed this exercise for 134 lapsed members. The response rate is looking good at the moment so it is a worthwhile exercise though still a lot of work. Currently our membership numbers are:

- UK   391
- Europe   120
- Rest of World   50

To maintain a healthy bank balance we need to retain or increase our membership numbers. If you have a friend, or belong to a group or club which you think may be interested in joining GEO, please let me know about them and I will dispatch them an encouraging letter together with a recent GEO Quarterly. Just let me have the details of the prospective member by email to

francis@geo-web.org.uk

Nostalgia

I have recently received my latest *ESA Bulletin* and nostalgically noticed that they have republished the very first image they received from Meteosat-1 on December 7, 1977. At the time, it took me about a year to recognise that quite low-cost equipment was available for the direct reception of Meteosat in ones own home. I duly bought a 90 cm dish, a *Dartcom* downconverter, a receiver and a hybrid computer interface. I remember being so pleased with my first image of Madagascar! I was hooked, and from then on worked my way through all the subsequent Meteosat series. My equipment failures have been few, mainly due to nearby lightening strikes which blew the top off my downconverter's GAsFET, my APT preamp and computer modem. I expect other members have had similar experiences.

Congratulation.

On behalf of GEO, congratulations are in order for Meteosat's almost faultless technical achievements over 30 years and also for their policy of making their data available to users other than national meteorological services. Thanks!

ESA Bulletin

I know I wrote something similar in our last issue, but the *ESA Bulletin* always contains something to interest me. The recently issued Bulletin No 132 contains 18 pages relating to Earth observation and weather satellites and pages 42-56 show three spectacular images of algal blooms in the sea. The growth of these algae is an important dimension in the carbon balance of the planet. The cell walls of some of these algae contain deposits of calcium carbonate. When the algae die they finish on the floors of the oceans, hence removing carbon dioxide from the atmosphere. There are some excellent electron micrographs of coccolith algae on page 26 of *GEO Q2*.

The Bulletin also contains some stunning images of the Earth (pp 88-9). The image of California taken in October 2007 was particularly frightening to me as I was in that region not many months before it was taken. Page 91 shows the very first image from Meteosat-1 while pages 79-80 give the latest news about the Meteosat and Metop programmes.

The ESA Bulletin may be obtained free of charge from:

ESA Communication Production Office
PO Box 299
2200 AG Noordwijk
The Netherlands

As well as your address, please write a few words on why you want to receive the Bulletin: for example,:research, home experimentation, GEO member—or whatever reasonably describes you activities. The Bulletin is circulated to 59 countries so anybody could reasonably ask to be put on the mailing list.

Forthcoming Events

GEO's annual Symposium takes place on Saturday, May 10, 2008. Details appear on the following page.

GEO also hopes to be at the following events

- April 6, 2008 for the London Electronics and Computer rally. Location Kempton Park race course.

- April 25, 26 and 27. We hope to be invited to the AMSAT-UK colloquium held at Guildford University.

- June 27-28 - GEO hopes to be at Friedrichshafen, Germany for Europe's largest amateur radio, electronics and computer rally. **If any German members can help with GEO's** stand please contact me at

francis@geo-web.org.uk

- October 23-23: Leicester Amateur Radio Show LARS at Donington Park.

It is worth noting that our friends in The Netherlands, *Werkgroep Kunstmanen*, will be holding their meetings in Utrecht on May 10, Sept 6 and November 8 this year. Visit their web site at

www.kunstmanen.nl

Conclusion

Of course my thanks to our talented membership for sharing their skills within our group: also to those who contribute to our Quarterly publication and to the dedicated management team who oversee the running of GEO.

QUARTERLY QUESTION

Question 16

September's Question related to ESA's *Sentinel-1* satellite which, together with further satellites in the series, will meet the Earth observation needs for the Global Monitoring for Environmental Security (GMES) programme. The launch of *Sentinel-1* is currently scheduled for 2011. The satellite will carry synthetic aperture radar (SAR) capability; hence it will have to transmit a powerful radar signal to irradiate the Earth's surface and then receive the reflected signals.

The Quarterly Question related to the available power from the satellite's solar cell array. The answer can be found on page 17 of *ESA Bulletin 131*, which gives a figure of 4800 W end-of-life power. I only received a small number of replies but I chose as the winner Storm Dunlop. I have sent him his calendar as his prize.

The Quarterly 17 Question

This Quarterly Question has been generated by me looking at images of Iceland. See page 49 of *Bulletin* 132 and the front cover of *GEO Quarterly* 14 as example images.

The question is straightforward: '*Does any part of mainland Iceland fall within the Arctic circle?*'

You can answer just yes or no, or offer a numeric qualification if you wish. Answers to me by email, at

francis@geo-web.org.uk

by the copy deadline for GEO Quarterly 18.

GEO Symposium

Saturday, May 10, 2008

The National Space Centre, Leicester will once again be the venue when GEO stages its 2008 Symposium on Saturday, May 10. Doors open at 9.00 am in preparation for a 10.00 am start, and we must be clear of the building by 6.00 pm at the end of proceedings.

> GEO hopes to host the British National Space Centre at the Symposium and to welcome BNSC's Earth Observation Programme Manager for the day.
>
> BNSC co-ordinates UK civil space activities and promotes advances in space technology and science and believe space can inspire young people in key areas such as science and maths. BNSC collaborates across government and external organisations including the European Space Agency and NASA. More details about BNSC can be found by visiting their web site at
>
> **www.bnsc.gov.uk**

Following requests two years ago for more time between talks to enjoy the workshops and chat with other delegates, the less formal programme adopted in 2007 will be repeated, with more time earmarked for practical workshops and group tutorials rather than lengthy presentations.

Program

The Symposium still lies four months in the future as this was written so the programme is not yet finalised. But we already have two key speaker lined up. Professor Grant Bigg, head of the Geography Department at Sheffield University, will be talking to us on a weather-related topic while Dr Michael Rose, Earth Observation Programme Manager at the British National Space Centre will speak on ' The rôle of BNSC in Earth Observation'. Also present will be David Taylor (SatSignal Software), who will be prepared to demonstrate his software and answer queries. This is a programme not to be missed!

As far as the remainder of the program is concerned, there is still a great deal of flexibility. Parts of the day will be devoted to

Delegates at an EUMETCast dish pointing demonstration outside the NSC
Photo: John Wiggins

talks but there will also be workshops and demonstrations. As usual we will finish the day with our AGM, presenting our accounts and reports, and concluding with general discussions.

A full programme for the day, which will include our ever-popular raffle with its bargain 'goodies', will be published on our website when final details have be confirmed.

Member Input

Remember: our Symposium is the principal opportunity of the year where you, the members, can become involved in GEO's activities. There are two ways in which you can do this:

- Any reader who would like to give a presentation, a short talk, or run a workshop, can contact Francis Bell at

  francis@geo-web.org.uk

  and you will be fitted into the day's programme.
- Alternatively, if there is a specific topic that you would like to see covered during the Symposium, again, contact Francis Bell and we will do our best to organise it for you.

Clive Finnis on duty at the GEO Shop table
Photo: Ferdinand Valk

The location at the NSC is ideal because it is situated in central England with excellent communication links. Leicester main line railway station is less than two miles from the NSC with bus and taxi links. Access by road is easy as the NSC is well signposted. Every major road artery leading into Leicester displays brown signs bearing this 'spaceship' logo, which also appears on direction signs at junctions within the city. These lead you to a turning off the A6, two miles north of the city centre, leading to the NSC, located on Exploration Drive. There is ample free parking for those attending our symposium.

Please Check at our registration desk for your car park pass.

For more information about the NSC you can visit their web site at

www.spacecentre.co.uk

The centre contains extensive exhibition halls which illustrate different aspects of space and

its exploration. For example, they have the original engineering model of Meteosat-1 and they have a live *EUMETCast* receiving station. Delegates will be provided with free tickets for the exhibition areas.

Refreshments

As ever, food, travel and accommodation are the responsibility of each individual delegate. There is a cafeteria within the NSC which delegates are welcome to use and also an area where you can eat your own packed lunch.

Delegates involved in a software workshop
Photo: Ferdinand Valk

Overnight

For readers wishing to stay overnight in Leicester, we recommend the Campanile Hotel which is conveniently located a little over a mile from the NSC. GEO members have used this hotel before.

Campanile Hotel,
St Matthews Way,
Bedford Street North,
Leicester LE1 3JE
Tel: 0116 261 6600
Fax: 0116 261 6601

There is an email link on their website:

www.a1tourism.com/uk/campanile.html

Cost and Registration

The cost for attending the Symposium is £12, payable on the day, and includes an entry ticket to the NSC's impressive exhibition area. In order to ensure that we are prepared for the numbers attending the Symposium, we would appreciate you registering in advance (although you do not pay till the day of the event): Please register by sending an email to Peter Green at

international@geo-web.org.uk

or direct from the GEO website. You *can* register on the day if required, but pre-registration is preferred so that we can have a name badge ready for you on May 10.

> ### Keep Up To Date
>
> To learn the latest news regarding the Symposium, keep consulting the GEO website at
>
> **http://www.geo-web.org.uk/sym08.html**
>
> from mid March onwards.

Arctic Meltdown

Permanent Arctic Sea Ice falls to new Low

Les Hamilton

The very first feature article in GEO Quarterly's Launch Issue [1] highlighted the persistent summer decrease in permanent sea ice cover in the Arctic Ocean between 1978 and 2003. Since then, the retreat of the permanent ice has continued apace. New summer minima were recorded in 2005 and more recently 2007, when it had shrunk to a 29-year low. Figures 2 and 3 illustrate how this permanent ice has diminished by almost one quarter in the past two years alone.

Satellites have been monitoring the Arctic continuously since 1978, during which time their sensors have recorded a continuing recession of the permanent sea ice summer minimum. At the end of each summer, sea ice cover retreats to its minimum extent. The ice that remains, which is upward of three metres thick, is termed perennial ice, and consists, mainly, of thick multi-year ice floes that endure from one season to the next (as opposed to the much thinner seasonal ice that reforms over open water between late summer and the following spring). The area of this perennial sea ice has been steadily decreasing by about 6.5% per decade since the satellite record began.

Beginning in 2002, however, this decline steepened to an estimated 8.5% per decade following the early arrival of springtime melting north of Siberia and Alaska—and it continues to accelerate. The 2007 minimum on September 16 was considerably less than the 2005 record, showing a decrease of 24% in just those two years! NASA scientists are working to understand this sudden speed-up in sea ice decline and what it might mean for the future of Earth's northern polar region (figure 1).
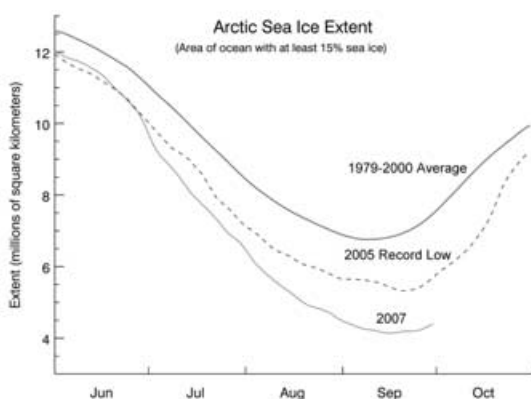
Figure 1 - Monthly Arctic Ocean Ice Minima (1979-2007)
Credit: National Snow and Ice Data Center, Boulder, Colorado.

The actual loss of sea ice between the 2005 and 2007 minima, illustrated by figures 2 and 3, was in excess of 1.2 million km^2, five times the area of the United Kingdom. These images were created using information from the *Advanced Microwave Scanning Radiometer for the Earth Observing System* (AMSR-E) which was launched aboard NASA's *Aqua* satellite in 2002. AMSR-E is a scanning passive-microwave radiometer which senses radiation at six frequencies ranging from 6.9 to 89 gigahertz (GHz). The determination of Arctic ice cover is achieved using the 89 GHz

frequency which, being relatively insensitive to atmospheric effects, can observe the entire polar region, even through clouds and snowfall, to provide a view of sea ice dynamics in greater detail than ever before. The images depict the AMSR-E data overlain on a NASA *Blue Marble* [2] image of the Arctic Ocean and its environs.

Sea ice, depicted as a white mass at the centre of each image, stretches across the Arctic Ocean from Greenland to Russia, but large areas of open water are apparent as well. Although the 2007 melt season started out with slightly greater sea ice extent than 2005, melting accelerated during the second half of June, especially in the East Siberian Sea, where warm temperatures and clear skies hastened the ice's retreat. By early August—more than a month before the end of the melt season—ice extent had already dropped below the minimum reached in 2005. Melting culminated around September 16 when the area of permanent ice had fallen to just 4.13 million square kilometers, 38% below the 1979-2000 average and 24% below the 2005 record.

> **Given that the reduction in ice cover over the preceding decade had averaged some 100 000 km^2 per year, this decrease of over a million km^2 compared with 2005 is extreme!**

The Northwest Passage

In 1497, King Henry VII of England sponsored Venetian explorer John Cabot's expedition to search out a suspected east-west sea route north of Canada that would, hopefully, shorten the journey between Europe and the Orient. But Cabot got no farther than

Figure 2 - Permanent Arctic Sea Ice minimum on September 21, 2005
Image: NASA/Goddard Scientific Visualization Studio, based on data from AMSR-E

Figure 3 - Permanent Arctic Sea Ice minimum on September 16, 2007
Image: NASA/Goddard Scientific Visualization Studio, based on data from AMSR-E

Figure 4 - This *Terra* MODIS image dating from September 15, 2007 shows the Northwest Passage completely open.
NASA image courtesy Jeff Schmaltz, MODIS Rapid Response Team, Goddard Space Flight Center

Figure 5 - This *Terra* MODIS image dating from July 27, 2007 shows the East Siberian Sea with the New Siberian Islands prominent.
NASA image courtesy the MODIS Rapid Response Team, Goddard Space Flight Center

making the discovery of Newfoundland. Nevertheless, Cabot's effort inspired a succession of adventurers, including Davis, Hudson, Foxe, Cooke and ill-fated Franklin, who would continue the search; but it was not until 1905 that Roald Amundsen became the first to achieve the feat. Even so, Amundsen's accomplishment has rarely been repeated in modern times, as navigating from the Atlantic to the Pacific through Canada's Arctic archipelago has always proved difficult. However, during late summer 2007, results from the Advanced Synthetic Aperture Radar (ASAR) instrument aboard ESA's *Envisat* satellite (figure 6) confirmed the channel to be fully navigable, the retreat of the sea ice having created an ice-free opening through its waters that lasted five weeks

On September 15, 2007, the Moderate Resolution Imaging Spectroradiometer (MODIS) flying aboard NASA's *Terra* satellite captured a largely cloud-free image of the Northwest Passage (figure 4) showing it to be ice-free for the first time since satellite records began. Although this sea route had been characterised as 'nearly open' several weeks earlier, persistent cloud cover had prevented acquisition of a MODIS true-color view of the open route. In this image, clouds are confined to areas north and south of McClure Strait and navy blue ocean waters stretch all the way east into Lancaster Sound, north of Baffin Island. McClure Strait does sport some remnant fragments of sea ice, the blocky, broken-up shapes suggesting old sea ice undergoing melt.

Foxe Basin

The extraordinary extent of melting is evident throughout the Canadian Arctic, and the *Terra* MODIS image gracing our front cover, dating from September 23, spotlights an ice-free Foxe Basin—the shallow extension of the Atlantic Ocean that acts as the 'gateway' to the Northwest Passage.

Sandwiched between Baffin Island and Hudson Bay in the territory of Nunavut, Foxe Basin remains ice-covered for much of the year. Landfast ice shelves normally hug its northern coastline until late in the summer while its southern reaches bristle with shattered pack ice. The Basin is named after Luke Foxe, who explored the area in 1631-32 in the hope of finding a Northwest Passage across North America. Roughly 500 kilometres across at its widest point, Foxe Basin is home to the last large landmass to be discovered in North America. The prominent, low-lying, almost circular island in the centre of Foxe Basin was only identified as such following an aerial survey in 1948, when it was named after Prince Charles, who was born that same year.

Sea Ice Retreat in the East Siberian Sea

Arctic sea ice melted at an unprecedented rate during the summer of 2007, especially in the East Siberian Sea. Figure 5 is a MODIS image acquired on July 27; this shows a stretch of coastline from the Lena delta in the west and threading past the New Siberian Islands, in which open water dominates the scene. The channels between the Siberian coast and the New Siberian Islands are largely ice-free, with only a rim of ice lingering against the southern shore of Kotel'nyy Island. The water is almost completely open to the islands' immediate northwest whilst what sea ice remains to the northeast is sparse and fragmented.

A Historical Anomaly in the Context of Long-Term Prognosis

It is tempting to jump to the conclusion that runaway Arctic melting could result in summer ice cover in the Northern Ocean dwindling to zero within the next few decades. If the acceleration recorded in recent years is maintained, this will become a certainty. But we must be wary of interpreting what is a very brief snapshot of time in this manner. Arctic waters have been known to open up then close again spectacularly in the past.

In 1829, John Ross, fired by the ambition of discovering the elusive Northwest Passage, set sail in the *Victory*, a 150 tonne paddle-driven steam packet boat specially strengthened for service in the Arctic. Privately funded to the tune of £18 000 by the gin magnate Felix Booth, the expedition included James Clark Ross, nephew of the expedition leader, a man destined for future greatness in the Antarctic arena.

Icemelt and Positive Feedback

The accelerating decline in sea ice may be due to changes in climate brought about by the very lack of sea ice itself. Sea ice has a bright surface which reflects most of the incident solar energy back into space. When this ice melts, dark-coloured ocean water, which absorbs rather than reflects radiation, is exposed. As the ice continues to recede during the summer months, the Arctic Ocean absorbs ever more heat from the sun. The increasing reservoir of warmed water makes it harder for the ice to recover during winter, bringing an increased likelihood of an even greater ice retreat the following year. As this process repeats itself year after year, the reduction in summer ice may become self-sustaining. It may well be that, before the end of the current century, permanent Arctic sea ice could disappear completely.

The party was provisioned with food and fuel for an expedition that could last as long as three years, and overwintering in the far north was fully intended. That year the Arctic had enjoyed a particularly warm summer and progress was rapid; ice-free seas leading all the way south down Prince Regent Inlet where a bay Ross christened 'Felix Harbour' was selected for his winter base.

That October the seas froze and the party sat out the winter confident that they would complete their quest the following summer. But it was not to be. 1829 had been a truly remarkable Arctic summer and it was not until August the following year that *Victory* finally broke out from Felix Harbour. But she was able to

Figure 6 - *Envisat* used its side-looking radar to image McClure Strait in the Northwest Passage on July 31, 2007
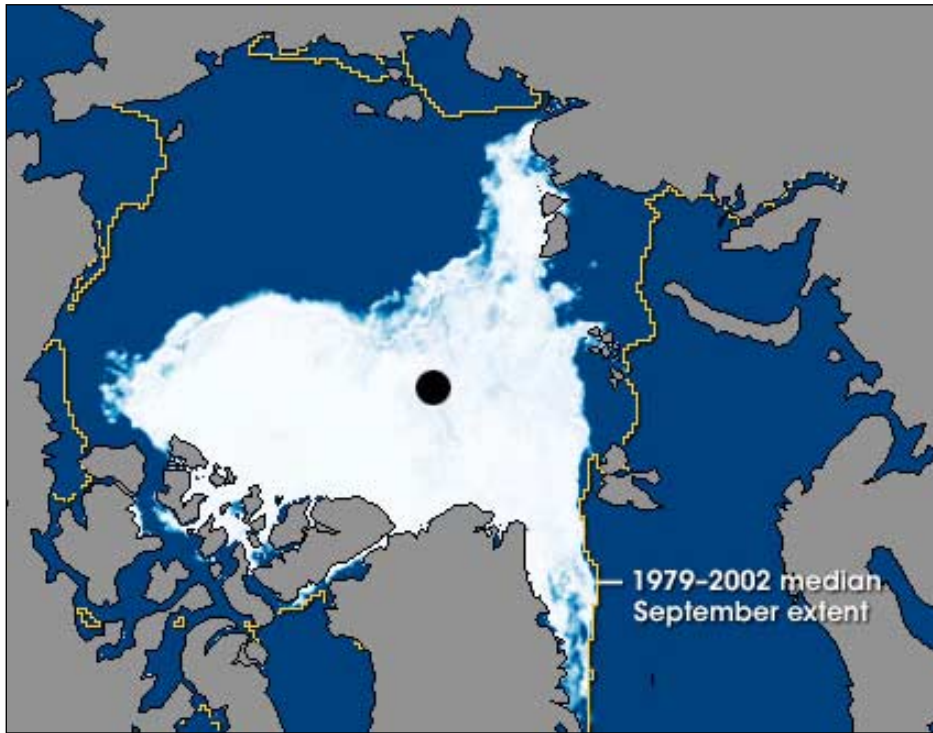*Image: ESA*

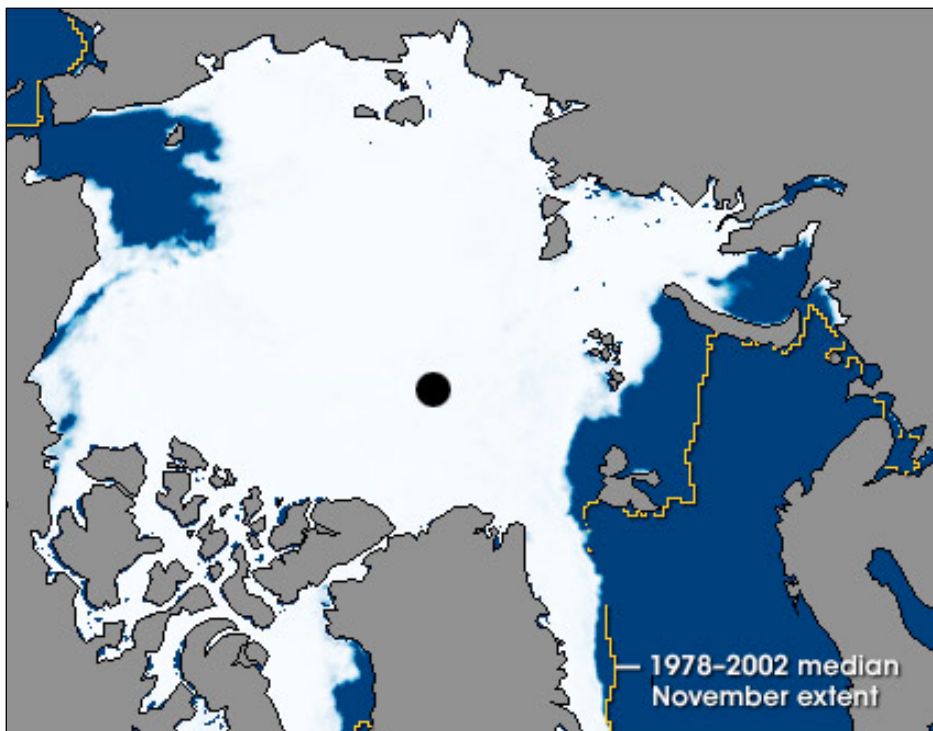Figure 7 - The ice at its record minimum extend - September 16, 2007

Figure 8 - The ice makes a rapid return - November 14, 2007

of the ice remained at record-low levels throughout most of October, suddenly, late that month, the sea ice started to reappear with unprecedented speed. During a ten-day spell, ice cover increased at a rate of over 150 000 km2 per day, the fastest ever regrowth observed throughout all the years of satellite observations. Nevertheless, overall sea ice extent throughout the Arctic remained below normal throughout November.

Figure 7 shows a close-up representation of the record minimum of September 16, 2007, using data from the AMSR-E instrument flying aboard NASA's *Aqua* satellite. Figure 8 shows how the ice cover had already reasserted itself by November 14. The irregular line drawn around the Arctic zone in each image indicates the region where there was at least 15% ice cover during at least half of the months of November during the long-term record (median sea ice extent).

This long term record is based on satellite observations collected between 1979 and 2002 by sensors on the Nimbus-7 satellite and three DMSP satellites.

It is apparent that the September ice extent was a long way below normal, and that by November the sea ice had increased significantly compared with two months earlier. The area of persistent open water north of Alaska and eastern Siberia, though not unprecedented, was unusual for the time of year. It was also predominantly ice-free during the November months of 2002 and 2006.

> A particularly rapid sea ice regrowth rate following a record low may initially appear to be surprising, but it is not completely unexpected. Where large expanses of ice survive the summer melt, less open water is available over which new ice can form.

> When summertime ice extent has diminished to record minimum, on the other hand, much larger large areas of open water are available for regrowth once temperatures drop sufficiently.

So, while summer warming of the ocean surface initially tends to hold back the regrowth of wintertime sea ice, diminishing sunlight as the seasons advance means that the nett rate of energy loss from the ocean eventually increases. That heat loss, in conjunction an unusually large area of open water, creates ideal conditions for the rapid growth of new sea ice on a large scale.

The NASA images reproduced in figure 8 and figure 9 were created by Jesse Allen, using data obtained courtesy of the National Snow and Ice Data Center (NSIDC).

References

1 The Disappearing Arctic Perennial Sea Ice GEOQ 1, page 5

2 Blue Marble - GEOQ 9, page 13

sail a bare five kilometres north before ice forced the ship to a standstill. And that was about it for the season as a mere 300 metres of further advancement proved possible before winter reasserted itself in early November.

The one tiny success that year was James Clark Ross' discovery of the North Magnetic Pole. Three further winters were spent in the confinement of the ice until, in desperation, John Ross decided to trek overland to gain safety, the party dragging three of the ship's boats with them. Eventually, on August 14, 1833, the ice in Prince Regent Sound relented sufficiently to launch the boats, and the party fled north, to be rescued in Lancaster Sound on August 25.

Is the current opening of the Northwest Passage a similar freak of Nature; or will it similarly turn out to be a one-year wonder. The answer to this should become clear later this year..

Return of the Ice

After its record retreat during September, the Arctic sea ice made a slow start to its winter recovery. Although the mean extent

News in Brief

Meteosat-8 Orbit Anomaly

On Tuesday May 22, 2007, around 00:50 UT, Meteosat-8 experienced an unplanned orbit change which included a decrease in spin rate, change in attitude, nutation, temperature changes and a small drop in solar array power.

Intensive investigations revealed that damage had been sustained close to one of the radial thruster pairs and it seems likely that Meteosat-8 suffered a collision with a micro-meteorite or particle of space debris. Subsequent tests have shown the imaging system to have been unaffected by the incident.

The Unified Propulsion, Thermal Control and the Electrical Power sub-systems were all affected; in particular, one of the thrusters used for east-west station-keeping manoeuvres was damaged but the redundant thruster has been tested and is performing well.

The external surface of the satellite has been damaged with the consequence that some internal components are now directly exposed both to the cold of Space and solar illumination as Meteosat-8 spins. This means that a new thermal configuration will be required to minimise the impact on the satellite and to allow safe operation during eclipse.

Overall, there should be no impact on Meteosat-8's ability to serve as the in-orbit backup satellite and to provide the Rapid Scanning service. However, a level of redundancy has been lost and this could have a longer-term impact on the satellite's availability.

Nearest the Sun

We received an email from **Hann Redwin** regarding Peter Wakelin's explanation of the point on Earth that comes closest to the sun (GEO Q16, page 3). He has discovered a number of references on the Internet stating that the point on Earth nearest the Sun is Aucanquilcha (6186 metres, at 20°40' south) and not Licancabur. Haan quotes several references, including:

- www.climbfortibet.org/no_shadows.cfm
- www.alpine-club.org.uk/news/ newsletters/2000/April-2000.doc

The gist of all the reports (which simply cross reference each other) is a climb to the mountain's summit on December 30, 1999 by an eight-strong 'Climb for Tibet' team. The team chose this mountain because they believed that, for a few seconds that day, it would be the point on

Earth nearest the sun. However, no justification for this belief is given.

Without boring readers with the maths, the facts are that both mountains lie north of the Tropic of Capricorn, and hence of the sun itself at local midsummer. Additionally, Aucanquilcha lies 1°37' of arc farther north than Licancabur. This may seem trifling, but equates to 113 kilometres due north on the ground. Over this distance, the Earth's curvature carries the entire mountain of Aucanquilcha, from base to summit, in excess of a kilometre (1405 metres) farther from the sun than Licancabur, more than sufficient to swamp its nominal height advantage of 256 metres [*Editor*].

Iceberg

While browsing through his full-world Metop-A images on November 7 last year, Alan Banks spotted this large iceberg, designated A53a, drifting in the Southern Ocean at 58°S, 46°W.
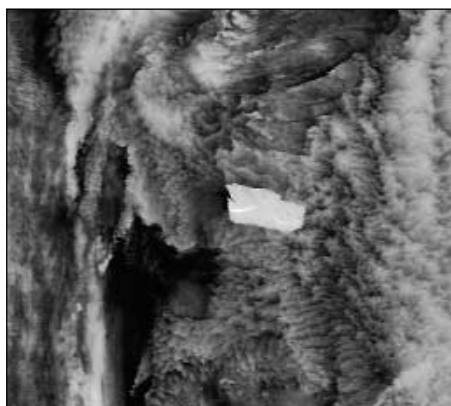
Iceberg A53a
Image © EUMETSAT 2007

Missing Images

There was a reference in Robert Moore's 'Kamchatka' article last December to 'spectacular webcam images appearing overleaf.' Readers who looked in vain need not worry. Although it was originally planned to incorporate such images, repeated e-mails requesting permission to do so went unanswered: so the images had to be removed.

But all is not lost. Live webcam images of Kliuchevskoi are available from

http://data.emsd.iks.ru/video/video.htm

Some of the best images of the volcano can be viewed by following the 'Best Image' link on the page above.

Second Warmest Year

Although GEO readers in western Europe might find it surprising in view of the wet,

cloudy summer they recently endured, NASA climatologists have reported 2007 as equal with 1998 as Earth's second warmest year during the past hundred. The greatest degree of warming occurred in the Arctic, as you can read in Arctic Meltdown (p 4).

Script Snippets

Simulating Real-Time Data Delivery

David Taylor

The Problem

In a previous Script Snippet we explained how a set of Metop AVHRR data could be compressed into Zip files fitting on to multiple DVDs. The DVD recipient wanted a way to play out these files into a directory, one by one, over a period of one day, so as to simulate the experience of receiving the data in real-time.

The Solution

```
FOR %%F IN (C:\MetopData\*.zip) DO (
  PKZIP25 -extract %%F
  SLEEP 160
)
```

Explanation

Here we are using the FOR command to loop over all the Zip files in a particular directory (C:\MetopData\) and act on each Zip file. As before, I'm using PKWARE's PKZIP (in a 32-bit Windows version) except this time I am using the "-extract" command to extract the Metop data contained in the Zip file into the current directory. The %%F variable is replaced by the full Zip file name as the second parameter to the PKZIP25 command.

The difference here is that inside the FOR loop I have two command lines.

You can have as many command lines as you need inside a FOR loop. The second command is the SLEEP command. This causes the script to pause for the specified number of seconds, and hence emulates the delay between the successive Metop data chunks. You might want to use the SLEEP command in a script which collects live WebCam images - where the WebCam changes every five minutes or so.

The SLEEP command is not built into Windows. Whilst there are many versions of SLEEP.exe on the Internet, I used the one from the Windows 2000 Resource Kit which can be downloaded for free at

http://www.microsoft.com/ windows2000/techinfo/reskit/default.mspx

How to Create Automatically Updated
GeoSatSignal Animations
with Meteorological Chart Overlays

Terence Smith

Introduction

Without doubt, many professionals and experienced GEO members alike are already well conversant with David Taylor's GeoSatSignal (GSS) software, its command file operation, syntax and task scheduling. It is hoped that this article may enthuse and encourage readers, particularly the less experienced, to extend their use of the software and experiment in areas not yet explored. There is a significant learning curve to much of GSS, and for quite a while I had been using it solely for particular, basic imaging tasks; it was only fairly recently that I began to delve more deeply into what else could be achieved.

I had previously relied upon *MSG Animator* for live Meteosat animations and, although GSS was not conceived to produce these, this did seem a possibility. In his inimitable manner, David Taylor has been instrumental in making adjustments to GSS to facilitate this.

These notes relate specifically to my attempts to satisfactorily automate GSS animations, initially of the 15-minute channel-09 Meteosat-8 and Meteosat-9 images, overlain with the *Bracknell* Mean Sea Level Pressure 6-hourly isobaric charts, something outwith the scope of *MSG Animator*.

Configuring GSS for Animations

Start by running *GeoSatSignal*, clicking **<Job>** on the menu-bar and selecting a new Job number—in my case, Job-4. Next select **<Options Job → setup>** and configure each of the five tabs as follows.

Processing Tab

Select **False colour** as either '*Normal*' or '*Day and Night*' (to taste), uncheck the **Thermal FC** and **Fire** boxes and select either '*Stretch*' or '*Histo equalise*' depending on personal preference. I prefer to make my animations from images from a single infrared channel such as Channel-09 as this involves less demanding processing. Should you prefer to create animations from a visible channel (Channel-01 or -02) the associated thermal and water vapour images are also loaded by default to create colour composite images. This results in much more demanding processing while the animation is being created, which may exceed the capability of some older PCs.

Remapping Tab

The **Enable remapping** box at top left <u>must</u> be checked if you are to create an animation. GSS automatically adjusts the mapping to 1065 x 718 when Bracknell charts [1] are used as overlays but it is still a good idea to check this under **Remapped image size** for conformity, should you acquire differently sized charts from elsewhere.

For the same reason there is no need to alter the **Map projection** or to enter any **Meridian/Parallel/Span** co-ordinates—the Bracknell overlay automatically dictates all such matters. Now select the Bracknell option from the **Overlay** drop-down menu; you may wish to select a colour for it to make a suitable contrast with your Meteosat image's palette.
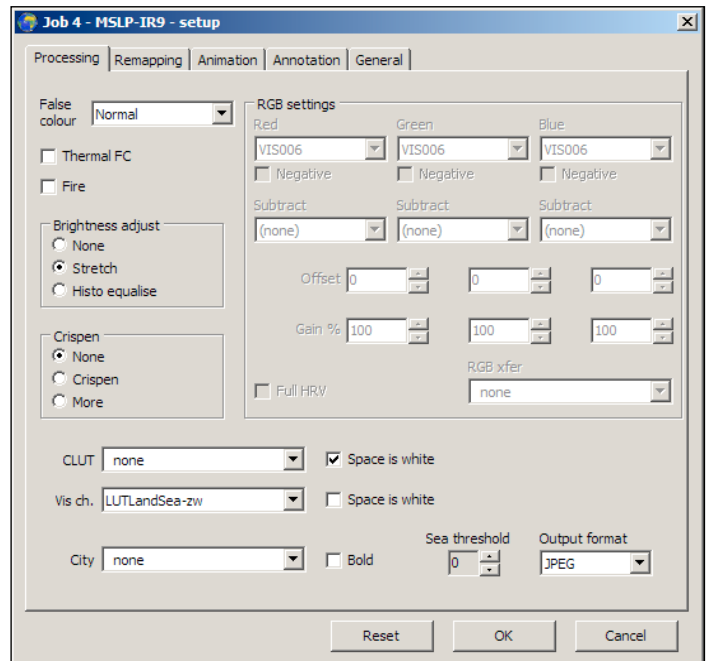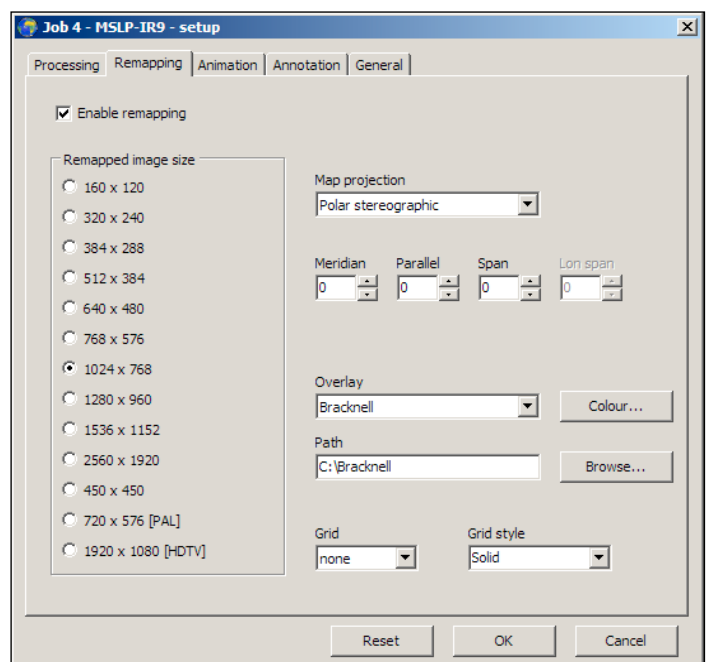

Figure 1 - the *Processing* tab

Figure 2 - the *Remapping* tab

- Finally, browse to the directory where your overlay files are saved and ensure that it displays correctly in the **Path** field. Leave **Grid** set to '*none*' because a latitude/longitude grid is incorporated in the charts themselves.

Animation Tab

- If you are receiving 15-minute data from MSG-2 (Meteosat-9) select the '*15 mins*' ***Take picture every*** radio button; should you also be receiving the Rapid Scan (MSG-1 RSS) 5-minute data, then you can select '*5mins*'. A ***Loop delay*** of five to six seconds (e.g. 5500 ms) can be useful to give an obvious break if the animation is to be looped. The default ***Animation speed*** should be satisfactory for 15-minute data but can be increased to 5 frames per second or more if you wish for RSS.

- The ***Number of pictures*** figure should be chosen to reflect the duration of animation you require, bearing in mind the available RAM. For instance, 24 hours worth of 15-minute data (four frames per hour) equates to a total of 96 frames: for 5-minute data (12 frames per hour) this would amount to 288 frames. In any event, it would be wise to start small with only a few frames for testing, then increase this once everything is working properly.

- Another point worth mentioning is that selecting ***Smooth animation*** adds interpolated intermediate images, which affords kinder transitions between the six-hourly charts.

- Generating a 100-frame animation of 15-minute data takes my PC approximately 5 minutes (because a frame is added to the animation every three seconds). For 5-minute RSS data an animation covering the same duration will therefore take nearly 15 minutes (three times as many frames per minute). This is close to your likely animation update period, which might possibly interfere with the processing. *A more modern PC should accomplish this considerably faster*.

- If GSS is running continuously in the background, it might prove safest to start the program at a specific time; noting that the refresh period will commence from that time. You can set the time for the scheduled animation build to a point just after this, which will not interfere with a refresh.

- I have found that there is a propensity for the processes to lock up on my P4 computer, requiring a restart, and suspect that this may occur because of some conflict between refreshing and animation builds. This is another reason I set refresh to 15 minutes, even when processing 5 minute data.

The RSS trial period is now over, but these transmissions may become fully operational some time during 2008.

Annotation Tab

- The most useful feature of this tab (not illustrated) is the option to add country boundaries. Check the ***Country boundary*** box and select a colour that shows well against your images.

- Whilst not strictly necessary, since the Bracknell chart has this anyway, there can be justification for a coloured boundary which shows up land masses more clearly when they are cloud-covered.

General Tab

- First, assign this ***Job*** a name, '*MSLP-IR9*' in my case (figure 4) then use the 'Browse' button next to ***Path to data files*** to select the path to your HRIT image files (usually processed by *MSG DataManager*). Likewise, set ***Path to result files*** to the directory where you plan to store your animation files. The ***Wildcard specification*** box permits easy loading of the latest image into the program. Figure 4 shows the setting I use for my latest Meteosat-9 image.

  '*C:\MSG-2\Images\HRIT\%yyyy\%mm\%dd*ch09.jpg*'

- Finally, set the ***Refresh minutes*** field to '15'. If this option is missing, you must update to the current version of GSS. This option provides the foundation for automating your animations, which will refresh at the chosen intervals. It is a really useful facility which will regularly update a static image as well as any associated overlay. Your displayed picture will always be the latest one while GSS is running.

- Unless you wish to adjust the ***Temperature range*** (applicable if you select a thermal false-colour image for your animation), all remaining items under this tab can be left with their default settings.

- Although it is possible, with a fairly up-to-date and fast computer, to build RSS animations (with a limited number of frames) at five minute intervals, this is not always practicable. Even with the ***Take picture every*** setting (figure 2) set at five minutes for RSS, it is perhaps more sensible to 'refresh' only every 15 minutes, to ensure that the current animation is fully built <u>before the program tries to</u>
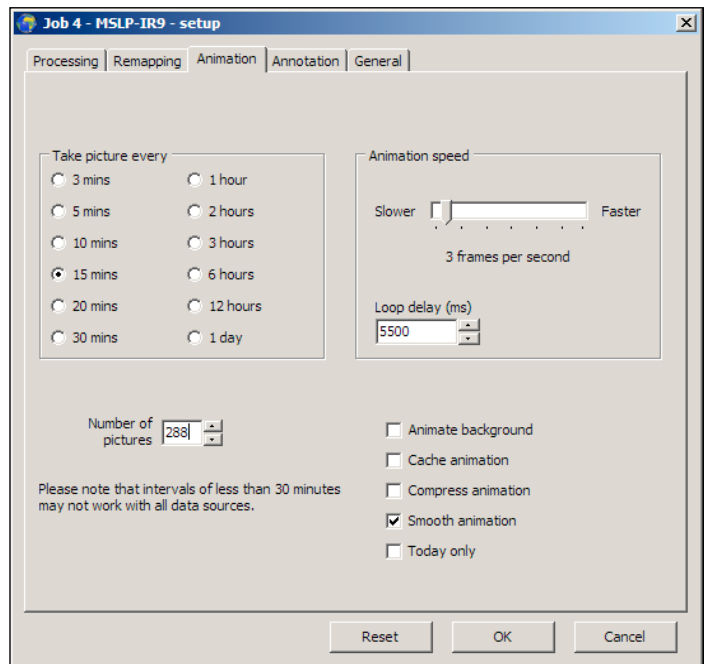
Figure 3 - the *Animation* tab
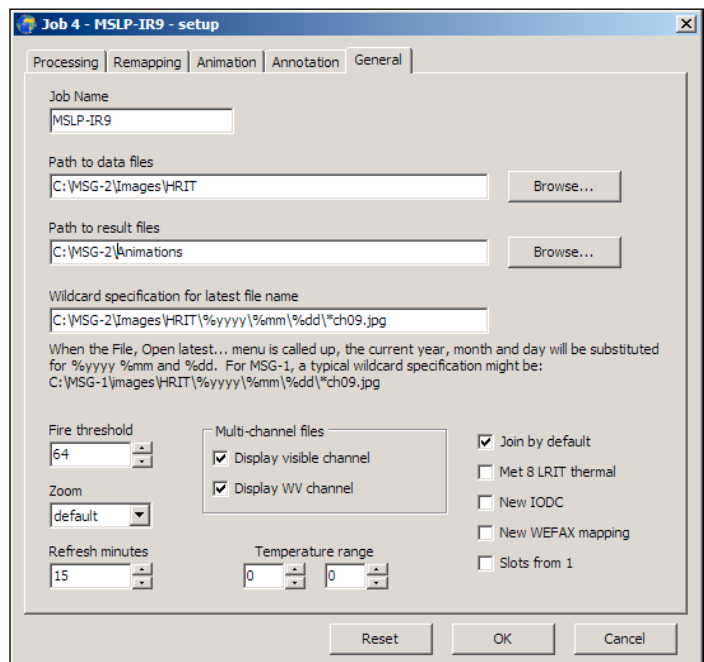
Figure 4 - the *General* tab

<u>start the next build</u>. On my 2.4 GHz P4 PC with 1.5 GB RAM, it can take nearly ten minutes to build a 200+ frame animation. For 15 minute data this ceases to be a problem unless you are animating a very large number of frames.

Obtaining the Bracknell Overlay Charts

The easiest method to achieve this is through the *Autoget* utility bundled with GSS. Charts can be downloaded manually by ticking the box beside 'Bracknell' on the ***Weather data*** tab and clicking 'Run'. Autoget automatically creates the directory 'C:\Bracknell' and saves the charts there, using the same 'year/month/day' tree structure that *MSG DataManager* uses for its images. GSS will collect its overlays from this 'Bracknell' directory. More usefully, *Autoget* can be activated automatically four or more times per day via the MS Windows **Task Scheduler** and a **Command File** as discussed below. Once you are reliably downloading the Bracknell charts, the four files each day, namely 'bracka_0000.gif', 'bracka_0600.gif', 'bracka_1200.gif' and 'bracka_1800.gif' will be saved in the designated folder.

One small point to note is that old data are not automatically deleted from the Bracknell directory. You have to manage this task manually from time to time. You can use David Taylor's free *TrimTree* program to do this for you.

Making an Initial Test

Now that the setup procedures are complete, run GSS for a spell and check for the correct opening of the 'Latest file'. Check also that the first build of the animation has occurred and that it plays back correctly.

By this stage, you should have an image, refreshing with the latest data at the chosen intervals, and creating an animation that can be replayed later, but only by manual selection.

Updating the Animation

What is lacking at this point is an underlined updating animation. To achieve this requires use of a **Command File** and the **Microsoft Windows Scheduler**. Being somewhat conservative, I am still happily using Windows 2000 Pro SP4 for most of my image reception and processing but I do have some experience of scheduling with XP Pro on a laptop. The scheduling method is effectively the same for both. If Vista scheduler operates differently, perhaps readers can write in and explain.

Command Files

Two separate command files are necessary, one to activate *Autoget* at least four times a day to download the Bracknell Chart, and another to run the **Animate** command in GSS, ideally every 15 minutes. These command files are easily created using your *Notepad* utility, which can be found from the *Windows Start Menu* under '*Programs/Accessories*'.

The Autoget Command File

Open *Notepad* and type in the command instructions for *Autoget*. This does not need a full path because the command file will be saved in the same directory as the *Autoget.exe* file (the GSS directory). The line should read something like

<div align="center">

Autoget.exe -brack -close
</div>

which opens *Autoget*, downloads the Bracknell chart file then closes *Autoget* again. Save this file into the GSS directory as 'Autoget.cmd'.

The Animation Command File

Open a new file within *Notepad* and type a line such as

<div align="center">

Geosatsignal.exe C:\MSG-1\Images\HRIT*.ch09.jpg j4 -anim:C:\MSG-1\animations\MSLP-IR9.avi -min -close
</div>

(**Note**: this is really a single line, but wraps round two lines when printed on this page. It contains two underlined space characters, one either side of the 'j4'.)

Save this file as 'GSSanim.cmd' into the GSS directory.

This command opens GSS in 'minimised' configuration (as an icon on the Taskbar), opens the latest Channel_09 IR file, activates Job 4 and builds the animation set up within it, then closes GSS.
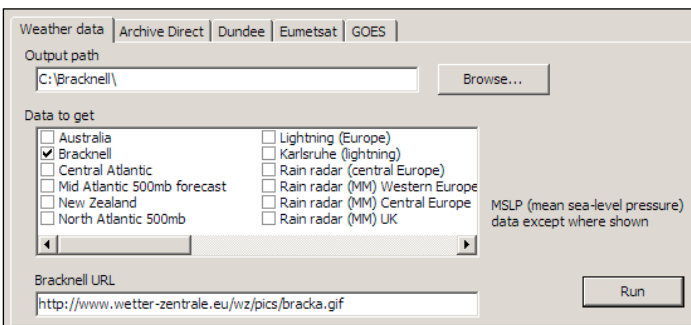

Figure 5 - Downloading Bracknell charts with *Autoget*

The job number used must be the one that you gave the identifying name 'MSLP-IR9' and which assumes the file name 'MSLP-IR9.avi' for the animation. The '-min' command runs the programme minimised, but can be temporarily removed while testing and checking that the command file operates satisfactorily.

Scheduling the Command Files

Access to the Scheduler via Windows **<Control Panel → Scheduled Tasks>**. There are two methods one can use when preparing a schedule to run a command file: a 'multiple schedule', where each program run is listed separately for the required times, or the task can be entered once only with its repetitions occurring at specified intervals defined under 'Advanced Schedule Options'. For reasons which I do not actually understand, I have found the former arrangement to be more reliable, even though it is a little more tedious to set up.

Scheduling Autoget

Open the **<Scheduled Tasks>** window and double-click 'Add Scheduled Task' to open the **Task Wizard**, click 'Next' and browse for the GSS directory (where the Autoget.exe and Autoget.cmd files lie) and double-click on 'Autoget.cmd' to select it. Select 'Daily' and click 'Next' again.

The next screen shows the current date and time as defaults. Select 'Every Day' and continue to the next dialogue box where you must enter your **Username** and **Password**; if you do not do this, the schedule may not operate. Click 'Next' for the last time and you will be informed that the task has been successfully scheduled . . . but **do not** click the 'Finish' button yet!

Check the **Open advanced properties** box underlined then click the 'Finish' button to reveal a fresh dialogue box with four tabs. The **Task** tab confirms the path to Autoget.cmd as well as the **Username** selected earlier. At bottom left is a check-box where you can enable or disable the schedule once it has been configured. Leave this checked.

The **Schedule** tab should confirm the 'Daily' schedule. You should change the default value for **Start Time** to '00:10'—ten minutes after the hour. The **Schedule Task Daily** box should show its default value of **every '1' day(s)**.

Click the adjacent **Advanced** button which will show a dialogue box (figure 6) indicating the current date as the **Start Date**. Check the **Repeat task** box to activating the fields beneath.

The Bracknell files are not reliably available at the expected hours of 0000, 0600, 1200 and 1800, so I hedge my bets and ensure up-to-date downloading by activating *Autoget* underlined more than just four times each day. The download is so quick that I suggest setting
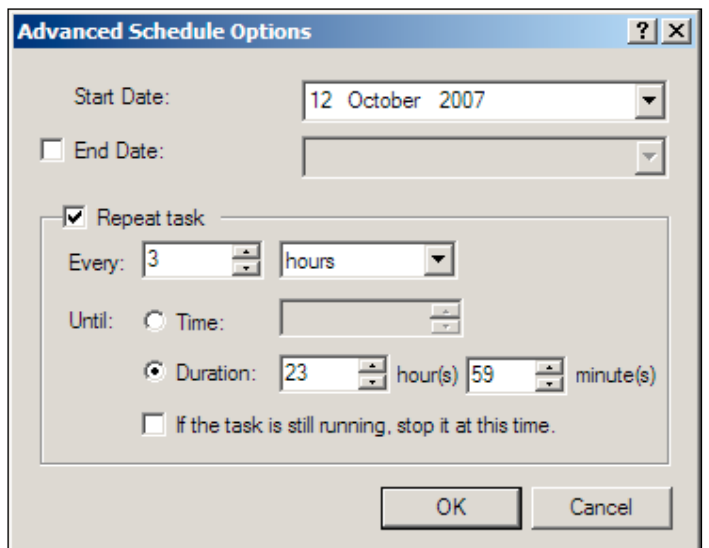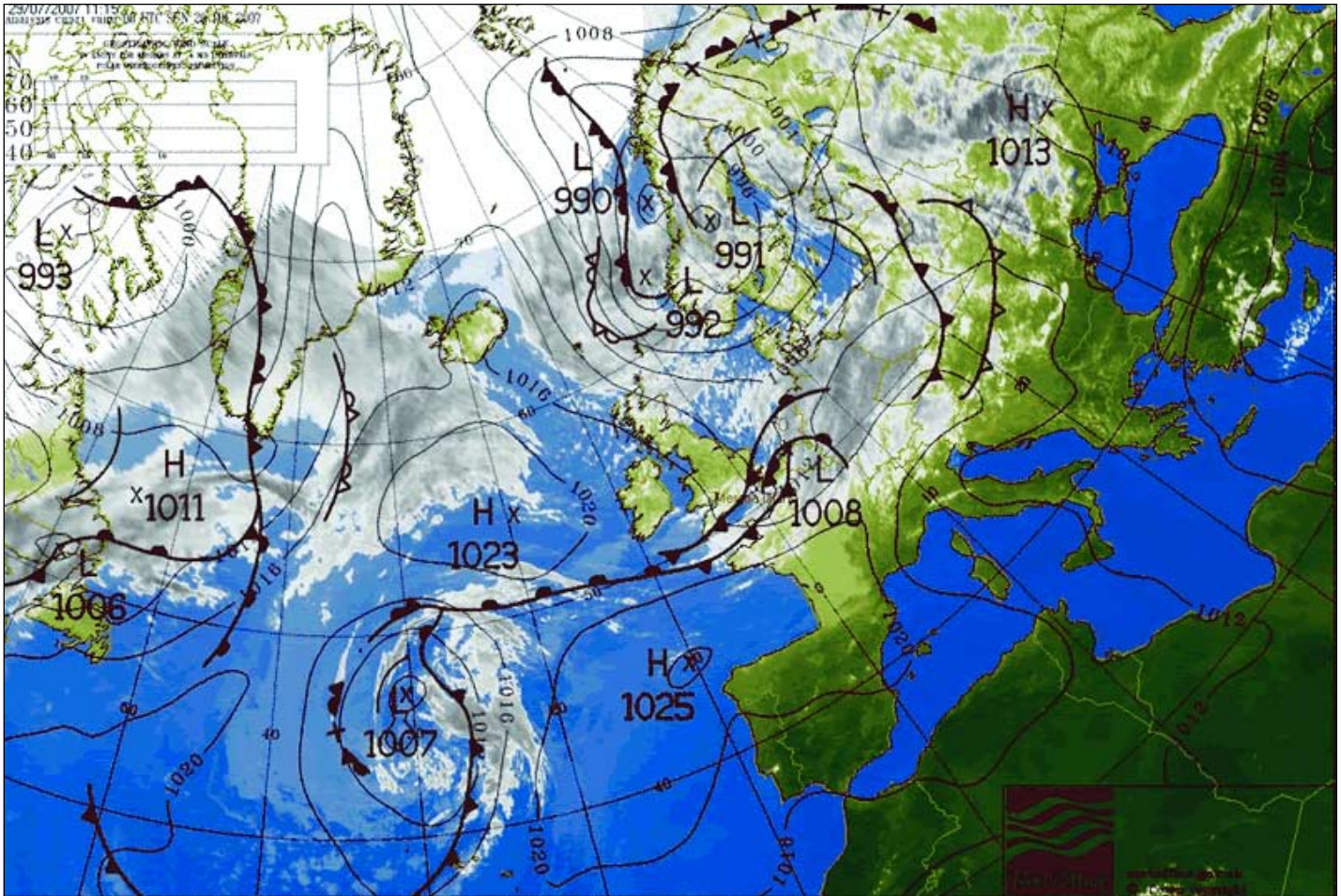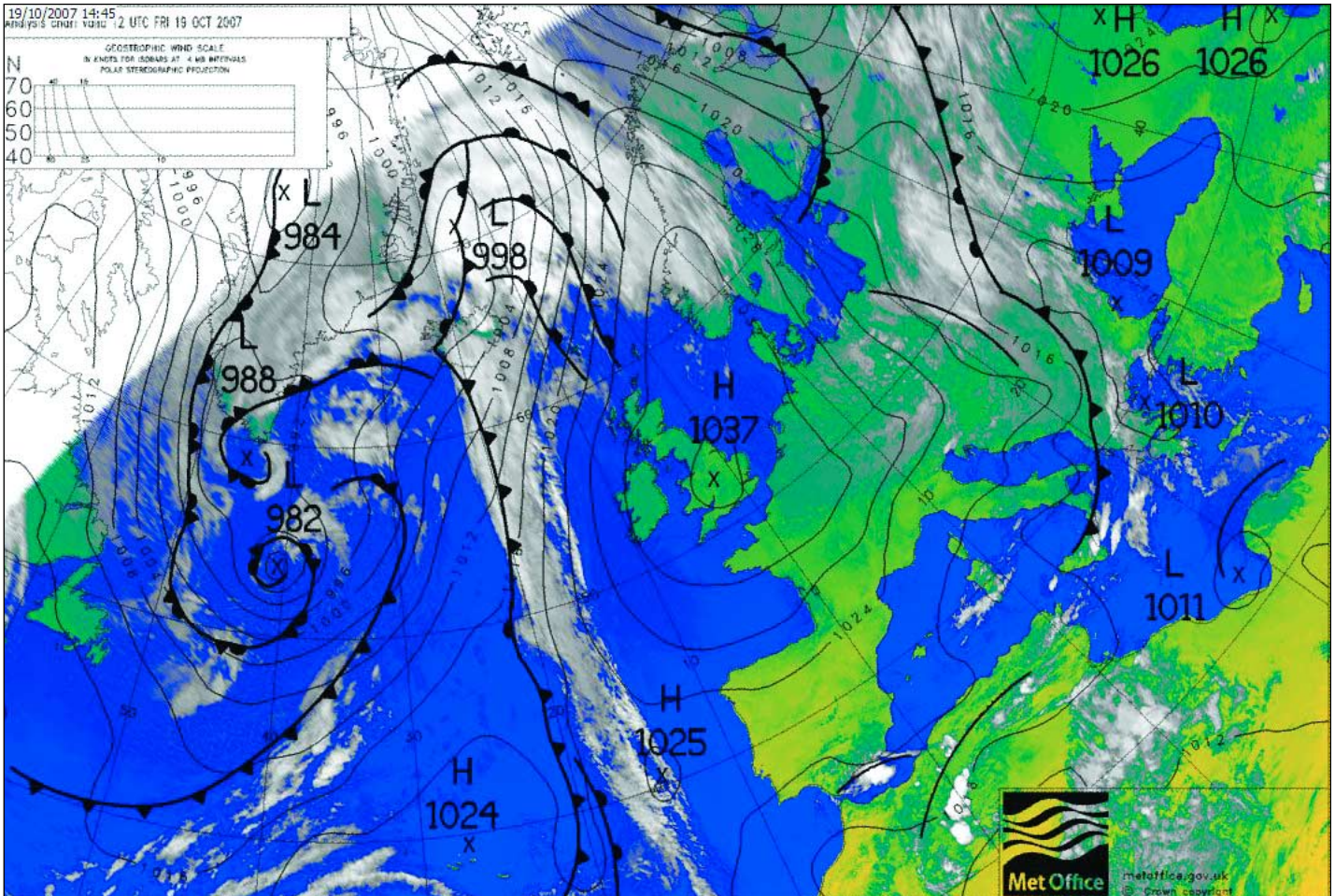

Figure 6 - The Advanced tab in *MS Scheduler*

This July 29, 2007 Meteosat-9 Channel-9 IR image was processed using a modified LUTLandSea-zw2 palette (*image © EUMETSAT 2007*)

This October 19, 2007 Meteosat-9 Channel-9 IR image was processed using the 'Normal' false-colour option (*image © EUMETSAT 2007*)

Repeat task to 'Every 3 hours' (or even every hour) to make absolutely certain.

Next check the *Duration* button and enter 23 hours 59 minutes; this is the total period during which these activations will take place every day. Click 'OK' to return to the main *Scheduled Tasks* window showing, for example, your new task 'Autoget' scheduled as 'Every 3 hours from 00:10 for 23 hours every day, starting dd/mm/yyyy'. Make sure that <View → **Details**> is checked on the 'Scheduled tasks' menu bar and columns will display showing '*Next Run Time*', '*Last Run Time*' and '*Status*' (figure 7).

At this stage, the Last run time will say 'Never'. In the left hand column, <u>right</u> click *Autoget* then click 'Run'. If all is well, the program will activate and download a Bracknell file. Should any problem manifest itself, use *Explorer* to locate and double-click the *Autoget.cmd* file in order to run it. If this works satisfactorily, then the difficulty lies within the Scheduled Task configuration. Usually, any failure of the scheduled task to run shows up in the Status column as 'Could not start'.
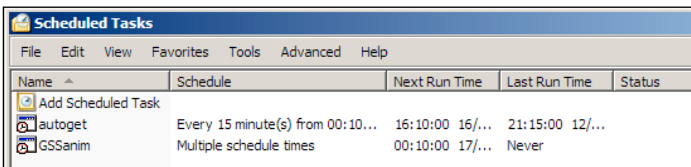

Figure 7 - Schedule status information

Note: If you run a single-PC system, avoid timing this task while the animation is building.

Scheduling GeoSatSignal

Now we can repeat the above for the scheduled activation of the GSS command file, which will build a new animation every 15 minutes. This will be done using the 'Multiple Schedule' method (figure 8).

Add a new scheduled task, this time based on the '*GSSanim.cmd*' command file. The task will be called 'GSSanim'. Repeat everything in the previous paragraph until reaching the *Schedule* tab, where you must check the *Show multiple schedules* box. This opens a hidden dialogue line at the top of the window where you may add new lines, one for each task in the day's schedule.

To allow time for the addition of each updated image to the animation, I suggest that the first task again starts at 00:10 hours. Add new lines for 00:25 hours, 00:40 hours and so on, for each successive 15 minute interval. This will take a few minutes but, once done, is there for good. Once the list is complete, click 'OK' and the schedule will be added to the Scheduled Tasks list. The only difference will be that the <u>Schedule</u> column (figure 7) will show as 'Multiple schedule times', and <u>Status</u> will state 'Running' once the first activation has commenced. Again, the command file can be tested on its own, and the Schedule can be checked by forcing a 'Run' as described for the *Autoget* schedule.

The Command Window

By now you should have noticed an irritating problem when running command files. While each task is running, a command window pops up smack in the middle of your screen, regardless of whether that task itself is minimised.

This annoyance is surmountable however. Open a new command window via <**Programs/Accessories/Command Prompt**>. Right-click the title bar then click *Properties* on the drop-down menu. In the dialogue box which opens, select the *Layout* tab, adjust the *Size* and *Position* parameters as preferred and uncheck the *Let system position window* box. As a guide, a width of 100 and height of 10 will produce a shallow window. If using 1024x768 screen resolution, a *left* position of 50 and *Top* position of 760 will centre the window, almost out of sight at the bottom of the screen,
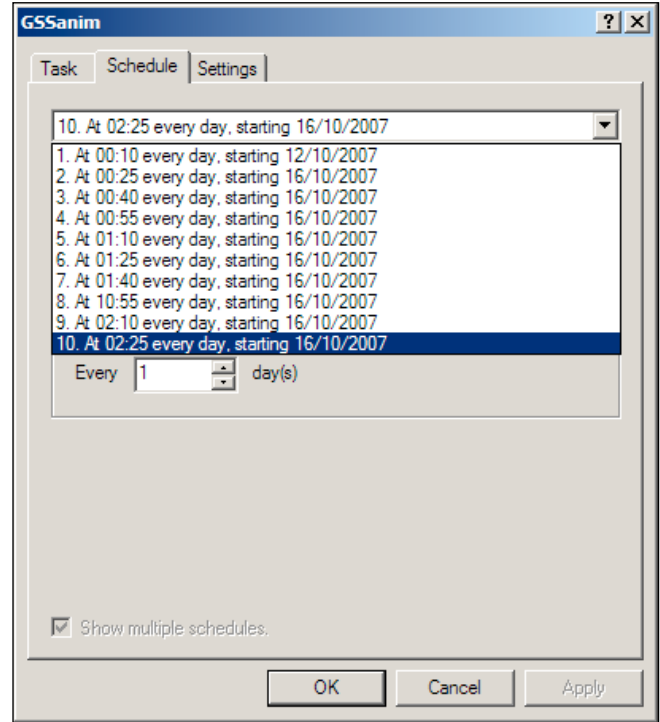

Figure 8 - Multiple option in *MS Scheduler*

where it can be raised or extended upward with the cursor if required. In everyday use its presence will scarcely be noticed.

Displaying Animations in GeoSatSignal

You ought by now to have an automated animation which only needs to be displayed. You can view your animations using a second installation of *GeoSatSignal*, either on the same PC or on a second networked computer.

The second instance of GSS must be installed in its own unique folder and its executive file renamed—as Geosatsignal2.exe for example. This is configured with a new *Job* as follows.

General Tab

*   The job name must be identical with that used in the original *Job* setup, in this case 'MSLP-IR9'. The *Path to data files* field should be browsed to the home of the AVI file; the *Path to results files* is, for convenience, set to the location of the AVI animation file (whether on the same computer or on a remote networked one).
*   The important entry is the *Wildcard specification*, which should carry the path to the AVI file and its name—e.g. 'C:\MSG-2\Animations\mslp-ir9.avi'. The final significant setting is that of the *Refresh minutes* box which should be set to 15 minutes (or 5 minutes if animating RSS). See figure 9.

Processing Tab

*   Here, *False colour* should be set to 'none', *Thermal FC* and *Fire* should be unchecked, *CLUTs* set to 'none'—indeed, all fields set to minimum.

Remapping Tab

*   *Enable remapping* must be <u>un</u>checked.

Animation Tab

*   Select 5 mins or 15 mins (but this is unimportant, even the number of pictures can remain at '1').

Annotation Tab

*   Leave in default settings.

Important Finalisation Step

It is vital that, once these specific job settings have been entered, and that window has been closed, you open the <**File**> menu and click *File/Open Latest*. This ensures that the path to the animation file is saved correctly.
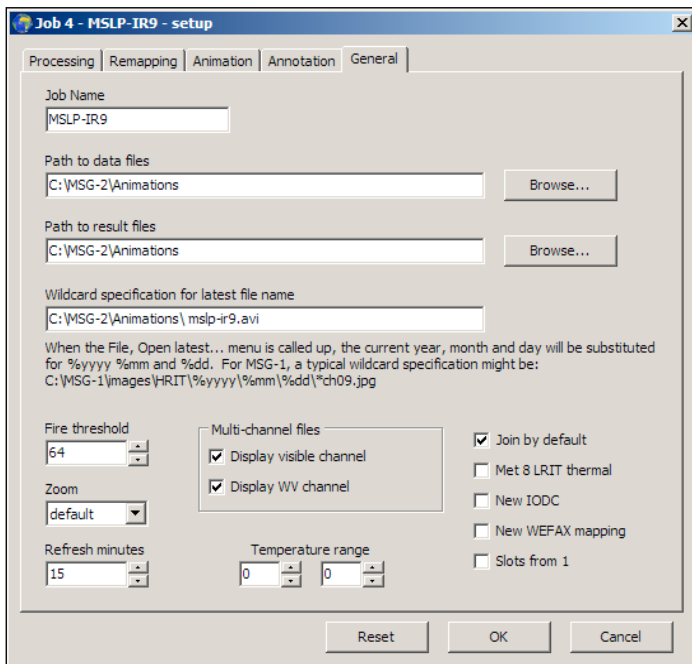
Figure 9 - the *General* tab for playing back animations

There seems to be a glitch in GSS which may otherwise return the path to default or clear it from its field altogether. Unfortunately, the **Open latest** command will not actually activate until a <u>different</u> *Job* is briefly selected and the MSLP-IR9 job is reselected. Following this manoeuvre, it should be possible to access the **Open latest** command. I do not pretend to understand this slightly odd behaviour, but it manifests itself on each copy of the program installed on several different computers. It may also prove expedient to just once open the animation by means of the **Open** button under the job's *Animation* tab.

If the displaying program is remote from the computer which builds the animations, then mapping that network drive could speed matters up.

Finally, close the setup window and click the **Animation** tab, the last on the right in the GSS main window. All things being equal, the animation should run. If, for some reason, it does not, then just click the **Open** button and browse to the location of the AVI file and open it, and your overlaid images should be displayed in all their glory. This should update to the latest animation build every 15 minutes without further intervention. In the unlikely event that there is a report that it cannot find or open the file, this indicates that the last animation build failed to complete, for some reason or other, and may need restarting manually.

When the <u>display installation</u> of GSS is run for the first time (refreshing every 15 minutes), it must be started between the end of one animation build and the commencement of the next to prevent conflict between the two running instances of GSS, otherwise the display version will each quarter-of-an-hour, attempt to load a file <u>that is still being written to disk</u>.

Teething Troubles

With both Windows 2000 and XP there has been a tendency (whether networked or on the same PC) for either the animation build or the display installation of GSS to freeze after a while. This requires either task to be ended via Windows Task Manager—and this by means of ending the process rather than just the application. Oddly, I have also noted that, when 5-minute RSS data is being animated, such a lock-up returns the frames to 15 minute data, despite the job setup still requesting 5 minute frames. After a lock-up, I also experience intermittent error messages relating to permission to view the animation file and refusing to overwrite the file; this can necessitate a reboot/restart.

Additionally, when initially opening the display installation of GSS, the menu tabs work as expected. But after a while these become ineffective: the 'Open' button blacks out and, even though the animation is still running and updating, it is impossible to control it or close it without resorting to Task Manager.

All these tendencies seem most notable with single processor PCs, even P4s with 1.5 GB of Ram. A new 2.13 GHz C2D Intel computer with 3 GB RAM keeps the displayed GSS animation running and updating without problem thus far for about twelve hours, although all control via the menu tabs has been lost.

Behind these idiosyncrasies there may well be software or programming reasons which are obvious to the professionals, but beyond comprehension to the likes of me.

Manual Display of Animations in IrfanView

These difficulties led me to seek an alternative means of displaying the animation using the freeware image handling programme *IrfanView*. This can be downloaded from

http://www.irfanview.de

Once installed, click **<File/Open>** and browse to the location of your animation file. A double-click on the file will open and start the animation. A press of the 'Enter' key will immediately hide the status, tool and caption bars and display only the animation on-screen. **<View>** on the menu-bar reveals 'hide' options for the various bars and affords a full-screen view with a useful slide-bar at the bottom.

Under the **<Options/Properties>** 'Video/Sound' tab is the 'Loop' option. A really useful feature of *Irfanview* version 4 is a slide bar that shows at the bottom of the screen in full-screen view. If you have a fast processor with plenty memory, it is possible to hold the cursor on the slide and run a smoothed 300 frame animation backwards or forwards very quickly. On a *Core2Duo 6420* 2.13 GHz PC with 3 GB RAM this is almost instantaneous, but a 1 GHz Pentium 4 struggles somewhat. The very handy *HotKey* 'Shift+R' immediately reopens the animation with the latest frame added.

Automated Display of Animations in IrfanView

To achieve a fully automated animation display using *Irfanview* you must create a command file (named e.g. 'IrfanMSLPanim.cmd')

i_view32.exe C\MSG-2\animations\mslp-ir9.avi /hide=15 /one

and schedule this as described above for automating GSS. This command string will open *Irfanview*, display the animation and, after the chosen interval (15 minutes being the ideal here), close it down then immediately reopen *Irfanview* displaying the updated animation (with the latest frame newly added).

The 'IrfanMSLPanim.cmd' file <u>must</u> be placed in the *Irfanview* directory. The command '/hide=15' effects full-screen viewing with the removal from the display of the tool, menu, status and caption bars, whilst the '/one' suffix forces the closure of the displayed instance of *Irfanview* as the fresh one opens. (See the *Irfanview* Help file for alternative command options).

Timing Considerations

It is imperative that the repetition times for the schedule are set to fall **after** completion of each GSS animation build, otherwise failure to start and accompanying error messages will occur. As with almost all satellite real-time imagery reception, **accurate time setting is crucial**, particularly if networked computers are involved. I would recommend automatic computer time-setting by an NTP program such as *Tardis 2000*, which can be downloaded from

www.kaska.demon.co.uk

For reliability, the schedule would also best be of the <u>multiple</u> variety rather than a simple 'repeat task' format. To obviate laborious multiple 15 minute schedule construction, it is worth

GEO company secretary Nadine Bell
on the *News 14 Carolina* presenters' desk

Francis Bell in front of the 'green screen' practising a mock weather
presentation (but really just learning his left from his right).

The newsroom at *News 14 Carolina*

Francis Bell giving some GEO Quarterlies to Gary Stevenson,
News 14 Carolina's senior weather forecaster
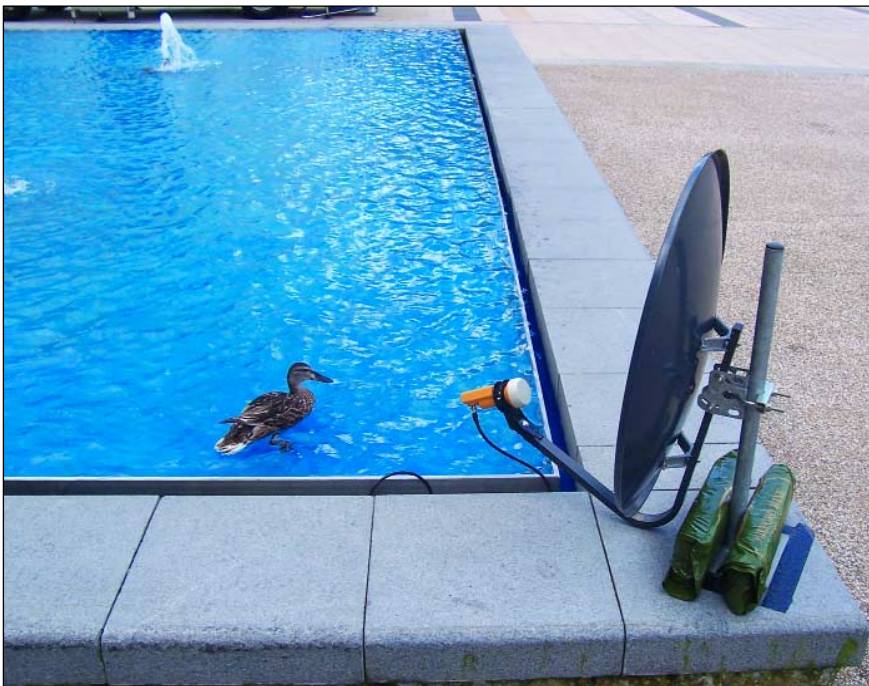
Here is another example in our occasional series featuring unusual photographs of
reception antennas. The photo was taken outside the University of Surry's School of
Management building by Francis Bell during the AMSAT-UK colloquium last July. GEO had
been invited to demonstrate the reception of weather satellite signals and the best view of
the sky proved to be from a corner of the ornamental pool. The photograph was taken
while the dish was providing excellent live signals into the meeting area for two sets of
computers. And yes: the cable did run underwater for several metres!

Neil Thackrey, who resides six kilometres into the
mountains some 25 km east of Malaga, Spain, sent GEO
this splendid photograph of a waterspout. Neil wrote: "We
had severe electric storms over the Christmas period,
culminating in this wonderful waterspout on the morning
of the December 26. The only downside of the storms
was the power cut we experienced on Christmas Eve.
The power did not came back on for 12 hours.

News 14 Carolina

Francis Bell

Regular readers of *GEO Quarterly* will know that I sometimes report my experiences in America. In the past I have taken my portable APT system with me and received some excellent live NOAA 17 and NOAA 18 APT images [1]. On one of our outward flights I took some interesting aerial photographs of Greenland and Canada which were subsequently published [2].

The background reason for our regular visits to America is to see our son Christopher, his wife and young family: our grandchildren. Christopher moved to America in 2003 following his career in computing and IT.

He settled in Raleigh, North Carolina, in a region loosely bounded by Raleigh, Durham and Chapel Hill which has communications, pharmaceutical, computer and IT companies located within it and is aptly described as the 'Research Triangle'. The region has the assets of good communications, physical space for development, adjacent universities and an equable climate.

Christopher's job was initially connected with the computing side of the *Time Warner* group, who run the CNN station which can be received by satellite in most parts of the world. But early in 2007, he moved to a *Time Warner* TV station called *News 14 Carolina*. Christopher's job seems to be to trouble-shoot anything relating to the station's hardware or software which needs immediate attention. Of course, when I discovered what his new job was, I asked him if it would be possible to arrange an opportunity for us to look around the station when we next visited. This was duly agreed.

The control room at *News 14 Carolina*

News 14 Carolina is a 24 hour cable station based in Raleigh but has sister stations in Greensborough and Charlotte, serving a total potential audience of about two million people. The output from the station is mainly weather forecasting, weather related topics and news, the balance being determined by the dynamics of the weather. In settled times this area does have a delightful climate, so perhaps only 15% of air time is spent covering the weather. However, the region is also on the edge of possible Atlantic hurricanes coming from the southeast and thunderstorms with potential tornados arriving from the west. When these extreme weather conditions prevail, the TV station can go into 100% weather mode.

Forecasters

The station has four permanent weather forecasters, at least one being on duty at all times. We were pleased to meet Gary Stevenson, the station's senior forecaster, who briefly showed us around his office and described the background sources of data which he uses for weather forecasting. We looked around the forecasting team's studio and sat at their desk, where we offered a mock weather forecast—which, fortunately, was not broadcast!

A forecaster stands in front of a plain green background where his image and the weather map or diagram are combined. The green from the background of the forecaster's image is then electronically removed, making it look as if he is standing in front of the subject map. The most gymnastic mental exercise I tried was standing in front of this green background.

Now that sounds simple enough, but what the forecaster sees of the combined images in the monitor is a mirror image of himself. Presentation skills have to be learned, because in these circumstances, when you move your right arm (as viewed via the monitor), it looks to be the left one. I briefly had a go at this and, after a minute or two, began to get the hang of a reflected image of myself appearing on the monitor. Well, I shave every morning so I do know my mirror image.

The comments here are not trivial: apparently Gary Stevenson, experienced as he is, will, when giving a live forecast, sometimes gently shake his left wrist as if to adjust the position of his wrist watch. In fact he told me he does this to check the orientation of his image on the combined screen.

Later in the evening, after leaving the station, I had this cunning idea: instead of the forecaster looking directly at a monitor display of himself and the background map, why not look at the monitor via a mirror? The forecaster would then be correctly orientated. However, with a I little further mental analysis I recognised that if this were done the forecaster would be correctly imaged but the map would be seen as a reflection. It would be a bit tricky for the public if this was the transmitted image; it would also require more mental gymnastics from the forecaster to faultlessly and instantly sort out, for example, south east from north west looking at a reflected map. Eventually I concluded it was better to leave the system alone and let the forecaster mentally sort out left and right hands.

The station content and forecasts for North Carolina can be found at their web site

http//www.new14.com

My sincere thanks to Gary Stevenson and his colleagues at their TV station. All were friendly and allowed us to look around their busy facilities without obstruction. For my part I left Gary with a few copies of *GEO Quarterly* which I'm sure will be distributed to those who look after the weather forecasting at their busy *News 14 Carolina* station.

References

1 Peripatetic APT - GEO Q15, September 2007, page 45.
2 Cape Farewell - GEO Q13, March 2007, page 17.

GOES LRIT

Part 2 – The Hardware

(Low Resolution Image Transmission)

Ed Murashie

It's time to start focussing on LRIT. Just as GVAR (GOES Variable Format) was developed to meet the demand for more timely data and flexible scheduling for high resolution data, LRIT was likewise developed for lower resolution data. LRIT also has the added advantage of supplying more quantitative digital data.

LRIT is the digital replacement for analogue WEFAX, on the same transponder frequency of 1691 MHz. NOAA has touted that LRIT can be received with the same hardware by simply replacing the VHF FM receiver with a digital receiver and different software. They have provided a website,

http://noaasis.noaa.gov/LRIT/

with general LRIT information, sample data files, data format and receiver specifications and uncompiled software. They also provide an email address for general inquires,

lrit@noaa.gov

First Steps

When I became divorced 13 years ago, I moved from one apartment to another. About two years ago I actually moved back into the same complex where my ex-wife and I first lived before we bought a house. One of the few memories I have of that first apartment was sitting in the living room with my home-built *Hamtronics* receiver and a cable running through the dining room and out to the patio. There I had a *Microwave Modules* down-converter connected to a coffee-can feedhorn mounted to a 3 foot aluminum snow saucer (a circular child's toboggan). I sat tweaking the coils until I could hear a scratchy WEFAX signal while my then-wife looked at me dumfounded.

I knew that someday I wanted to get back to tweaking on weather satellite hardware, so when I moved back, I waited quntil one of the back apartments was open so that I had no neighbours behind me to complain about antennas. The apartments are all single-story, have large 8 foot by 20 foot patios—and my patio was on the north side of the apartment.

	WEFAX	LRIT
Subcarrier frequency	2400 Hz	none
Subcarrier modulation	80% maximum AM	none
Data rate	Comparable 30 kbps	128 kbps
Carrier frequency	1691 MHz	1691 MHz
Carrier modulation	FM - analogue	BPSK - digital
Bandwidth	30 kHz	300 kHz
EIRP (power)	54.4 dBm	48.5 dBm
Error correction	None	Viterbi/Reed-Solomon
Data Framing	Start signal 300 Hz for 3 sec Phasing signal for 5 sec Stop signal 450 Hz for 5 sec	32-bit sync. pattern Header blocks
Video	800 pixels × 800 lines	[2853 × 983] to [5199 × 4734]
Minimum spatial resolution	7 km	4 km (Vis, IR); 8 km (WV)
Max greyscale resolution	64 level for C/N > 10dB	256 levels

Table 1 - A quick comparison between WEFAX and LRIT

When I finally got permission to put up the antenna this year, I first had to figure out what size of dish was required. Decoding the LRIT signal is a complex task, with two forms of error checking, *Viterbi* at the bit level and *Reed-Solomon* at the block level. After understanding the LRIT decoding process, I realised that you <u>have</u> to perform the *Viterbi* decoding process but <u>not</u> the Reed-Solomon, provided you have a high enough signal-to-noise ratio. Realising that the 4-foot dish some companies use would be on the small and while my patio was 8 feet wide, I decided to try a 6 foot dish. Wouldn't you know it; I have a 10 foot, 4 foot, 3 foot and 2 foot dish! A quick search on *eBay* showed a new solid 6 foot *Fotec Star model FC-06* dish for $100, which included a ring base. After winning the auction, I drove two hours to San Diego and picked it up.

Mounting and Connecting the Dish

The next challenge was getting the antenna ring-mount on to a 5 foot platform so that it could 'see' over the apartment roof when at a 50° angle pointing at GOES-W (GOES-11). Dads are wonderful people and I am lucky to have such a nice one living nearby. This is the same gentleman who had the 'Weather Satellite Picture Receiving Stations' NASA publication, describing how to build that $30,000 station, in

his library at work when I was thirteen. He was a high school electronics and wood shop teacher and is very resourceful. He studied my problem and decided the best thing to do was to build a wood base and attach the base to ¾-inch conduit, bent in upside down U-shapes, for added support. Really, this just gave him another excuse to dig out the pipe bender. I have never seen a person make so

Figure 1 - The mounted 6-foot dish

many things out of conduit. When I got the base home, I quickly mounted the dish using cement anchors to get the right height and firmness even during the strong *Santa Ana* wind conditions.

I mounted a coffee-can style feedhorn with a *Down East Microwave* kit-built 1691 MHz LNA preamp on to the antenna and covered the assembly with a plastic bucket. A 20-foot length of RG9913 co-ax connected to this preamp passes through a spare bedroom wall to a 6 foot table that holds my equipment, where it links up with a 31 dB *Wilmanco model 1698* amplifier. I measured the GOES-11

Figure 2 - CM701 modem (top left) and Wilmanco preamp (bottom)

signal coming out of the Wilmanco amplifier at -58 dBm. This same combination was used many years ago for an old WEFAX station. My LNA has a 0.8 dB noise figure and a 14 dB gain. Nowadays, the kit form is long gone and *Down East Microwave* now sells only a pre-built version for $120.

Demodulating the Signal

Now I needed to BPSK demodulate the signal and perform the *Viterbi* error detection and correction process. I studied *Viterbi* and found it to be a long process; I really did not look forward to programming a Field Programmable Gate Array (FPGA) to perform the task. I had many BPSK/PSK demodulators from my work with GVAR, GMS and HRPT. One day I was looking through *eBay* (a recurring theme in this article) and I saw mention of satellite modems. A *Comstream/Radyne* modem caught my attention so I looked it up on the Internet and found the operator's manual. It mentioned 70 MHz, 140 MHz, L-Band, BPSK, QPSK, *Viterbi* and *Reed-Solomon*—all the right words. Next thing you know, I am the proud owner of two CM701 modems with the 70 MHz, 140 MHz and L-Band plug-in cards. The CM701 is a versatile modem built around a main frame with power supply and user interface and separate demodulator, modulator, *Reed-Solomon* and interface cards. I plugged in the L-Band demodulator card, connected the *Wilmanco* amplifier's output to the modem's input, turned on the modem, entered the carrier frequency (1691 MHz) and the symbol rate (293.000 ksymbol/s). To my disappointment, although I was getting a nice strong input reading, the modem did not lock on. Now what? Was the modem not

working? Did I have the wrong setting? Was it the wrong type of *Viterbi* decoding?

I have heard many things about needing the correct filtering (especially from my good friend George Isleib at *GTI Electronics*) to eliminate the EMWIN signal that is on the side skirt of the LRIT signal. Maybe it was interfering with LRIT and preventing the modem from locking on. Building a narrow filter at 1691 MHz is impossible so I figured the signal had to be down-converted to 70 MHz or lower. Fortunately I still had an old *Microwave Modules* 1691 MHz to 70 MHz down-converter in my junk box. As for a filter, I studied using either a SAW filter or a TOKO coil filter. Just about the time I was getting ready to order them, I saw a surplus 70 MHz bandwidth switchable SAW filter on *eBay* for about $50. I bought it and hooked up the down-converter to the *Wilmanco* amplifier and then to the filter. The results look promising on the spectrum analyser; however the modem still refused to lock

Figure 3 - Trace showing EMWIN (tallest peak) and LRIT (next tallest)

on. Playing with the modem settings I *could* get it to lock on randomly, but for no more than a few seconds at a time.

PC Interface
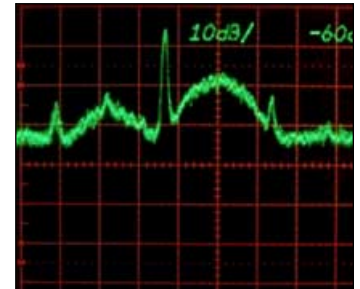
Lucky I still have a few friends in the industry like George at GTI and Rick and Allan at *Quorum Communications*. I called up Rick, told him my problem and he passed me over to Allan because he had remembered something about the data rate. Allan immediately knew what my problem was and how to fix it. All of the NOAA documentation refers to a data rate of 293 ksymbol/s when the exact rate is 293.883 ksymbol/s. I entered that rate into the modem and its green sync light immediately switched on. I was elated to say the least! I tried removing the filter, down converter and replacing the 70 MHz demodulator card with the L-Band card. Once again the system locked on. So the receiver chain is simple. I have a 6 foot dish with a preamp outside, a short run of co-ax to a line amplifier and *Comstream CM701* L-Band modem indoors. The block diagram for the system is shown in figure 4.

Long before my software defined radio (SDR) talk at the GEO Symposium in 2005, I had been reading and studying SDR technology. I had programmed with FPGAs for previous satellite ingest boards and knew that FPGAs were the heart of SDRs. I had programmed with the *Lattice* and *Altera* FPGAs but knew that I would be better using *Xilinx* FPGAs since they offer the largest free source of cores, including filtering and multiplier cores, that could be used to build a SDR. A core is a logical building block that can be very complex, thus saving you time from having to create that
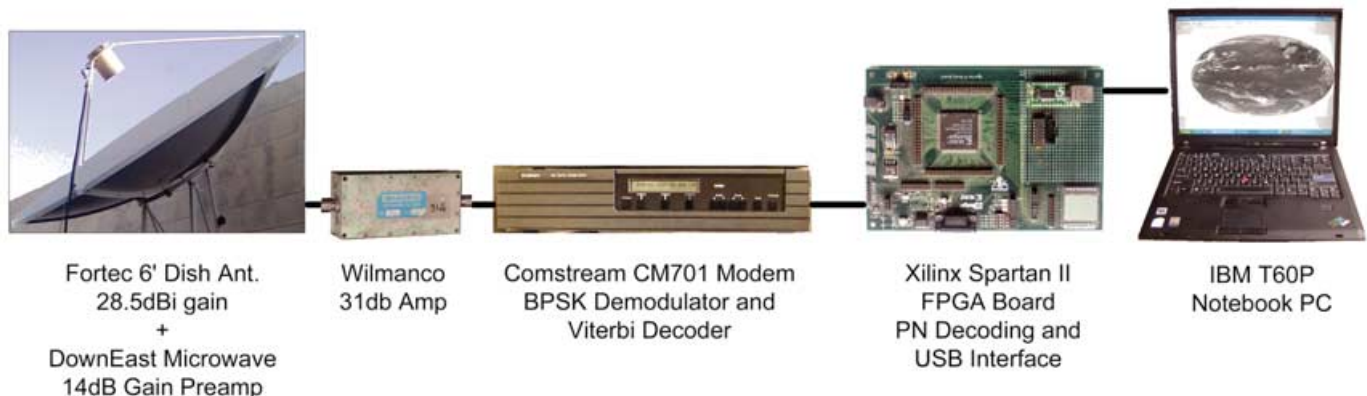

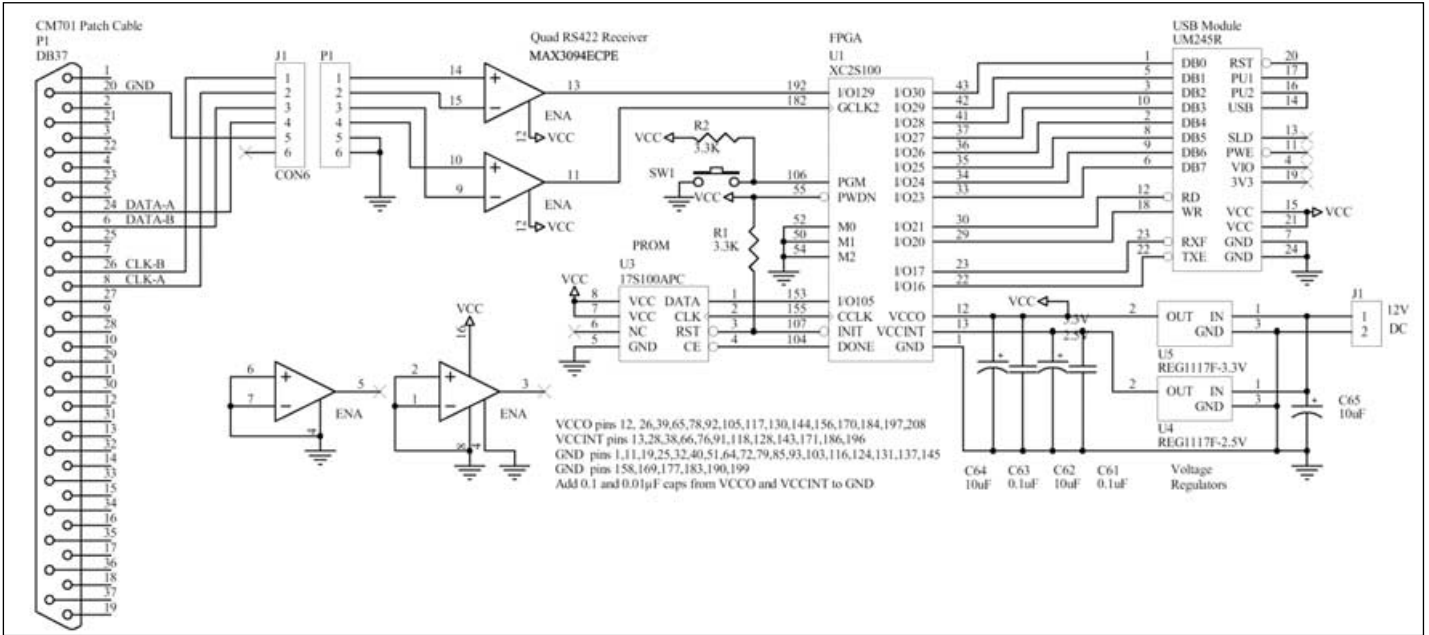Figure 4 - Block diagram of the author's LRIT system

Figure 5 - PC Interface Schematic

function yourself. Knowing that I wanted to build a SDR using *Xilinx*, I bought a *Xilinx SpartanII XC2S100* demo board for $79 years ago (figure 6). So I dug it out of my junk box, dusted it off and wired up a simple *Maxim MAX3094 RS422* interface integrated circuit to two of the FPGA I/O pins, one for clock and one for data. The CM701 modem has RS422 differential outputs on one of the 9-pin interface connectors. The *Maxim* chip converts the differential RS422 signals to single-ended inputs that can be connected to the FPGA.

Now how was I going to get the FPGA output into the PC so that I could process and save the data? I knew that I wanted to use a notebook PC for convenience, which ruled out ISA or PCI plug-in boards. Most notebooks today don't have RS232 ports and a few don't even have a parallel printer port—so these were ruled out too. This only leaves the universal serial bus (USB) port which could handle the speed and was being used in the *GTI* and *Quorum* designs. So I now had to become a USB expert in addition to a LRIT and *Xilinx* expert? I have worked with long time mentor and weather satellite expert, John Dubois, for years.

You may remember John as being the first amateur to receive GOES high resolution images and for designing an APT patch antenna using housing insulation material. John introduced me to an RS232 to USB interface chip from *Future Technology Devices International* (FTDI) and said it made it a snap to add USB functionality to a design. I looked the website over and found they not only made a USB to FIFO (first in first out) chip that came with the computer drivers, but they made it in a module form to. That allows me to simply connect power, 8 data lines, a read and write line plus a transmit buffer, empty and receive buffer full handshake line from the USB module to the FPGA. FTDI provides a DLL low level driver and high level driver that make the module look like a PC COM port. It could not be much
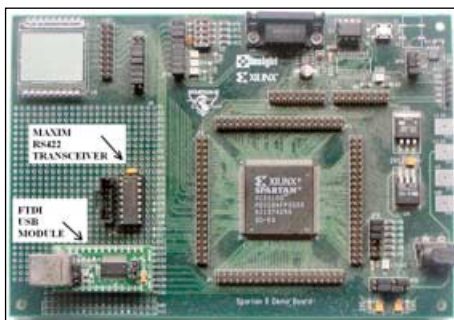
Figure 6 - The FPGA board

simpler. Now I must say this is probably overkill, and could be done with a cheaper USB microcontroller; but in the end I want to add the SDR capability to the board, so for me this is the way to go.

FPGA Code Development

The plan was simple: take small steps because the NOAA documentation is slim and I will have to learn a lot on the way. For the first test, I programmed the FPGA with an exclusive OR gate feeding a 32-bit shift register, a 32-bit comparator and a sync-detect latch connected to an LED. The modem data enters the FPGA, passes through the exclusive OR gate and then into the shift register. The output of the shift register is compared with the block synchronisation pattern, 1ACFFC1D hex.

The output the comparator is latched and will turn on an LED if the bit pattern is detected. The exclusive OR is used because of the nature of the NRZ-L bit data. The output of NRZ-L changes when the input changes. This is not to say that the output will be a '1' when the input is a '1' and change to a '0' when the input changes to a '0'. If the system starts with an output of '0' from an input of '1', the opposite will also happen. So the exclusive OR has one input tied to a switch on the demo board that can be toggled between a '1' and '0'. The nature of an exclusive OR is that' if the control input (the one tied to the switch) is '1' then the output will be the opposite of the input. If the control is a '0' then the output will be the same as the input. This is how the initial ambiguity of NRZ-L is removed. It was done manually at first but was later made automatic. When the system was turned on, the LED lit and I knew that I most likely had data, and was again elated.

Next I had to decide how best to share the processing between the FPGA and the PC. Being a slow data rate, I decided to keep most of it in the PC for flexibility and update convenience. I would have the FPGA only detect sync, remove the pseudo number randomisation that is applied to the data stream and count off the bytes until the next sync. I set off to program the FPGA and write the PC code, which I will describe in a future article. When all was said and done, I received my first images on the PC and knew that I had won the LRIT battle.
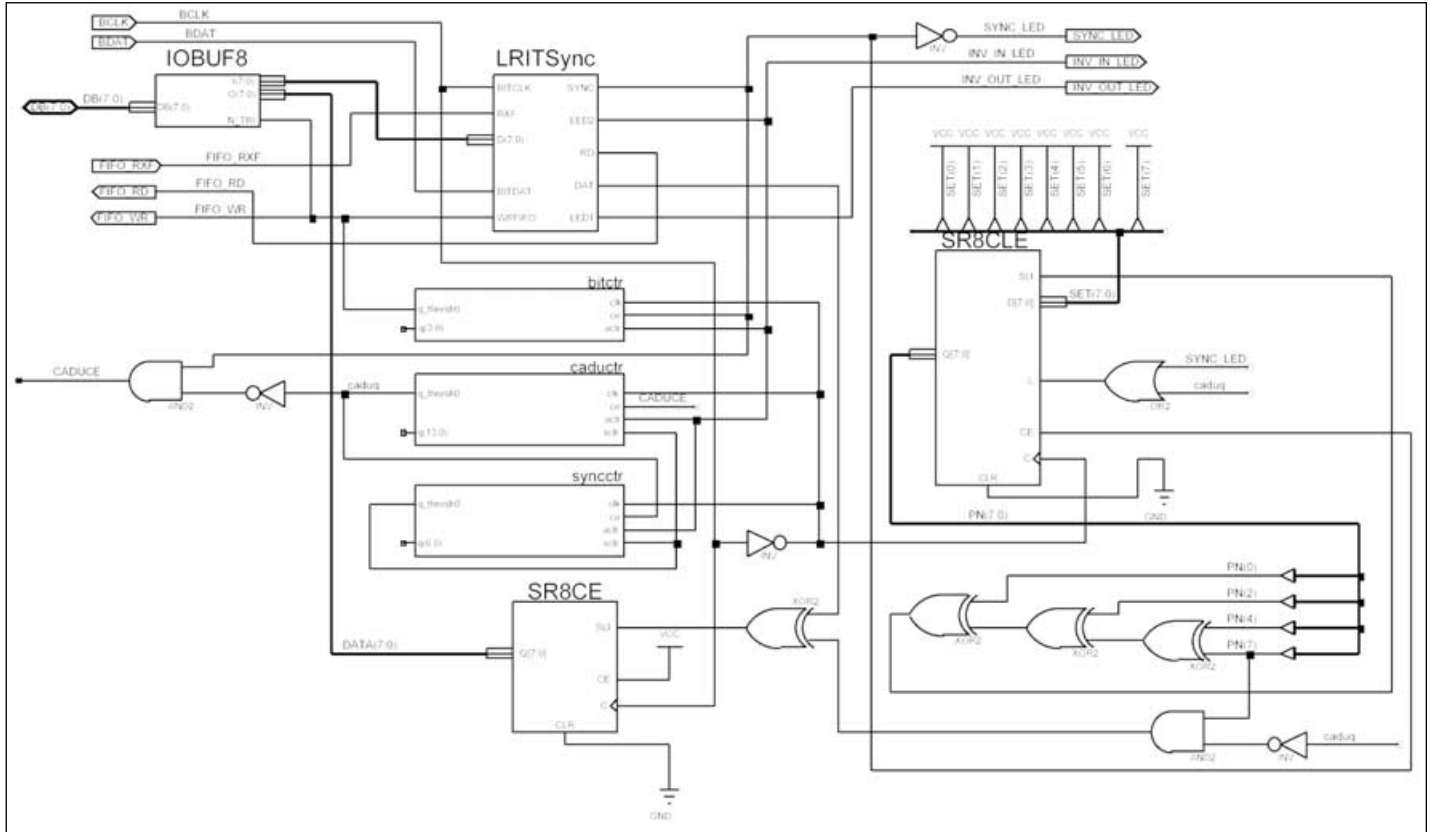
The FPGA schematic based code can be found at

http://home.att.net/~emurashie/

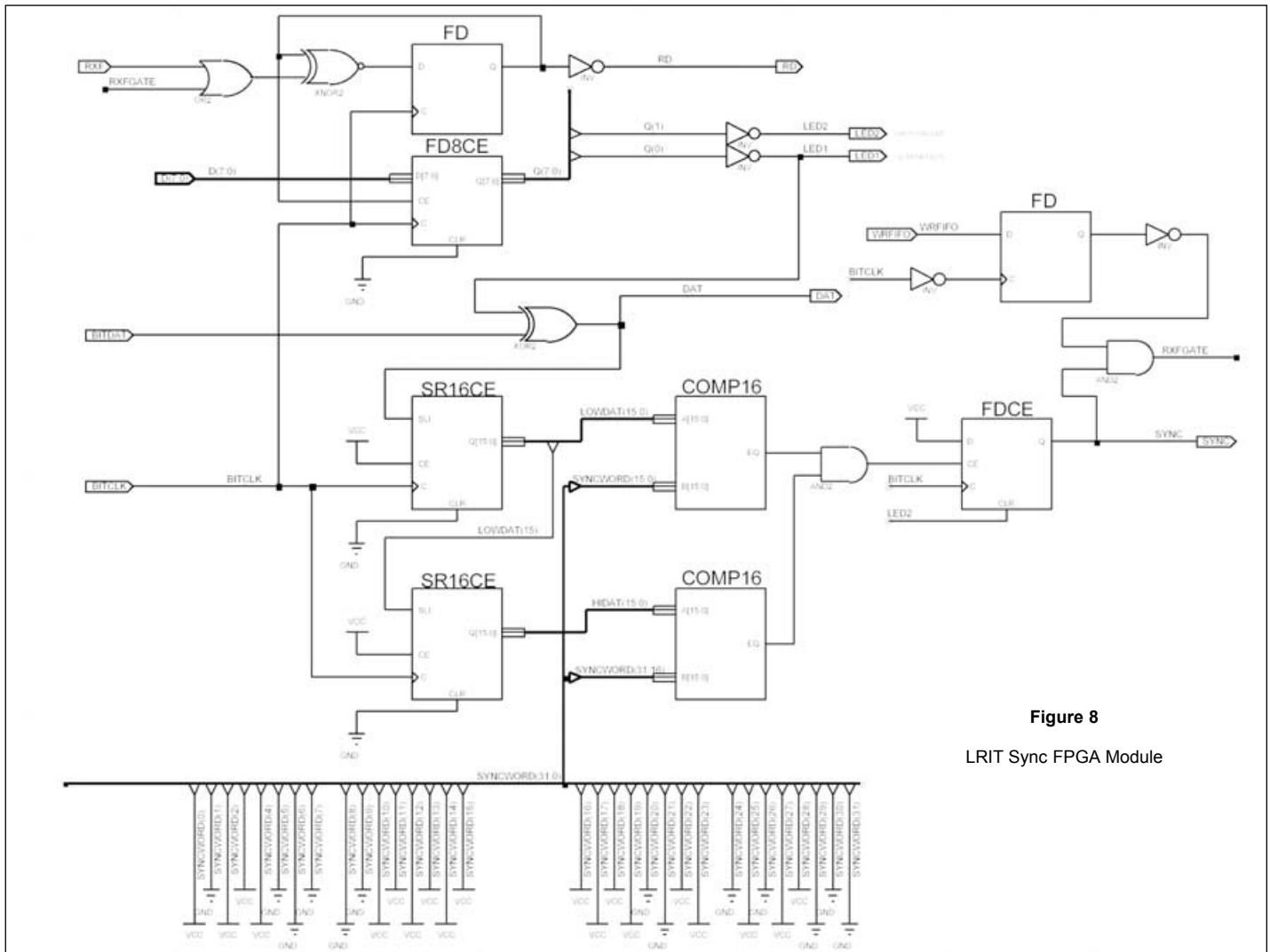**Figure 7** - Top Level FPGA Code

Figure 8

LRIT Sync FPGA Module

FPGA Coding Details

The top level schematic, *LRITsch* (figure 7), contains IOBUF8 and *LRITSync* schematics and *bitctr*, *caductr* and *syncctr* counter macros. IOBUF8 (figure 9) is a tristate buffer that controls the flow of data into and out of the FIFO USB chip.

LRITSync (figure 8) contains a two-bit I/O latch with bit0 used to invert the input data to remove NRZ-L ambiguity. Bit1 is used to clear the sync circuit. Both bits are controlled by the PC software through the USB chip. The data can be inverted by an exclusive OR gate before entering two 16-bit cascaded shift registers. The output of the shift registers is compared to the 1ACFFC1D sync code using two 16-bit comparators. When there is a match, the comparator output is latched.

Data is shifted into an 8-bit shift register (SR8CE) on the *LRITsch* page. When sync has been detected, *bitctr* and *caductr* counters are enabled. *Bitctr* counts off the data bits, and on count 7, writes the SR8CE data to the FIFO through the IOBUF8. *Caductr* counts off the 8160 bits of CADU data and then enables the *syncctr* counter. *Syncctr* counts off the 32 bits of sync and then rests both itself and the *caductr* counter. The SR8CLE shift register and output exclusive ORs form the pseudo number circuit. Its data exclusive-ORs the incoming data after initial sync has been detected but not during following sync sequences, when the *caductr* output is high and *syncctr* is enabled.

Closing Comments

I receive all of the images transmitted (which include only GOES-11 images with an occasional GOES-12 infrared image), the Data Collection System data (which is moving and fixed environmental platform data) and the same text message over and over. The text message mentions the LRIT email address and, for emergencies, to telephone 301-817-3880. The EMWIN (Emergency Manager's Weather Information Network) is buried in the data but, because it does not come out as normal data files, and I am only interested in the pictures, I am ignoring it for now. The images are spectacular, about half as good as GVAR and twice as good as WEFAX.

So now I ask you which is better, WEFAX or LRIT: or better yet, why can't we have both? I know the satellites are launched for the scientists, not the amateurs, and that the quality of the data is better. Technically LRIT is as complex if not more so than GVAR, so why have only two transmissions that are similar in technology instead of the system we used to have? WEFAX and GVAR which are completely different, could be received with simple or complex equipment depending on the data you needed.

What's next on the Hardware Front?

There are three directions I plan on exploring. The first will be to reprogram the FPGA and write the code to decode GVAR. The second is to experiment with a CDM-IP300L *Comtech* receiver I just bought on *eBay*. The *Comtech* receiver is similar to the CM701 with the L-Band card installed but has an ethernet interface. That will eliminate the *Xilinix* interface board but put more demand on the PC and software. The third direction is to explore SDR technology using the *Xilinx* interface board and *Comblock* modules. *Comblock* modules are *Xilinx* hardware and firmware modules that can be chained together to form SDRs. See

www.comblock.com

for more information.

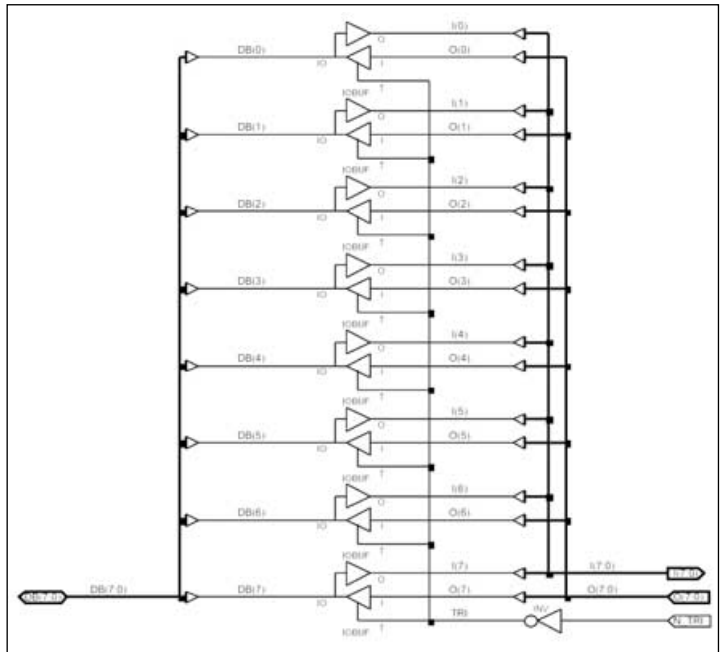In the next article I will describe the software and the decoding process.
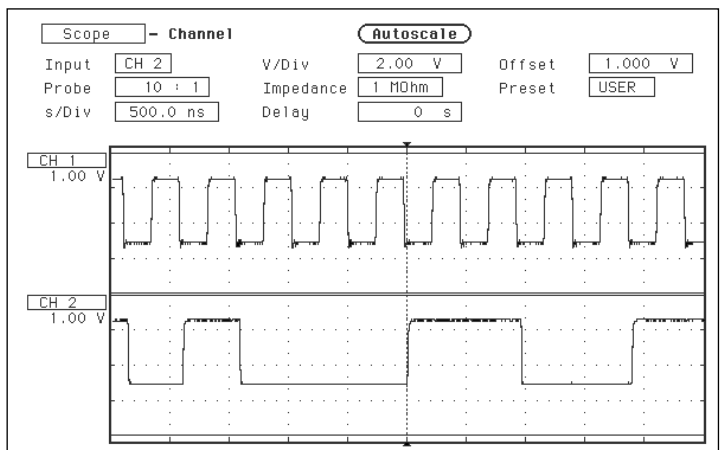
Figure 9 - IOBUF8 FPGA Module

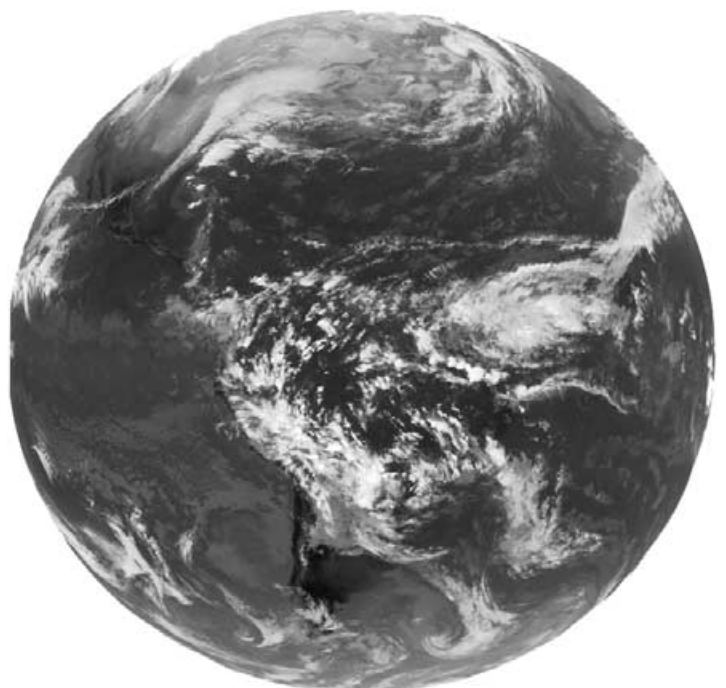Figure 10 - Waveform from the *Maxim* RS422 clock and data outputs

Figure 11 - GOES 10 IR Full Disc LRIT image

NOAA Satellite Predictions

(Based on Latitude 52°N, Longitude 2°W, UT/GMT)

Date	NOAA 15 137.50 MHz	NOAA 17 137.62 MHz	NOAA 18 137.10 MHz
Mar 01	05:21 07:01 15:09 16:48	10:11 11:51 20:00 21:39	02:05 03:46 11:59 13:39
Mar 02	04:57 06:37 14:46 16:24	09:48 11:28 19:37 21:16	01:55 03:36 11:48 13:29
Mar 03	04:33 06:13 16:01 17:42	09:25 11:05 20:52 22:34	01:44 03:25 11:38 13:18
Mar 04	05:49 07:29 15:37 17:17	10:41 12:22 20:30 22:10	01:34 03:15 11:28 13:08
Mar 05	05:25 07:05 15:14 16:53	10:18 11:58 20:07 21:46	01:23 03:04 11:18 12:57
Mar 06	05:01 06:41 14:50 16:29	09:55 11:35 19:44 21:23	01:13 02:54 11:08 12:47
Mar 07	04:38 06:17 16:05 17:46	09:32 11:12 21:00 22:41	01:03 02:43 12:36 14:19
Mar 08	05:54 07:34 15:41 17:22	10:49 12:29 20:37 22:17	02:33 04:14 12:26 14:08
Mar 09	05:30 07:10 15:18 16:57	10:26 12:06 20:14 21:54	02:22 04:04 12:16 13:57
Mar 10	05:06 06:46 14:55 16:33	10:02 11:43 19:51 21:30	02:12 03:53 12:05 13:46
Mar 11	04:42 06:22 16:10 17:51	09:39 11:19 19:29 21:07	02:02 03:43 11:55 13:36
Mar 12	05:58 07:38 15:46 17:26	09:16 10:56 20:44 22:25	01:51 03:32 11:45 13:25
Mar 13	05:34 07:14 15:22 17:02	10:33 12:13 20:21 22:01	01:41 03:22 11:35 13:15
Mar 14	05:10 06:50 14:59 16:38	10:10 11:50 19:59 21:38	01:30 03:11 11:25 13:04
Mar 15	04:47 06:27 16:14 17:56	09:47 11:27 19:36 21:14	01:20 03:01 11:14 12:54
Mar 16	04:23 06:03 15:50 17:31	09:24 11:03 20:51 22:32	01:10 02:50 12:43 14:26
Mar 17	05:39 07:19 15:27 17:07	10:40 12:21 20:29 22:09	00:59 02:40 12:33 14:15
Mar 18	05:15 06:55 15:03 16:42	10:17 11:57 20:06 21:45	02:29 04:11 12:23 14:04
Mar 19	04:51 06:31 14:40 16:18	09:54 11:34 19:43 21:22	02:19 04:00 12:12 13:53
Mar 20	04:27 06:07 15:55 17:36	09:31 11:11 20:59 22:40	02:08 03:50 12:02 13:43
Mar 21	05:43 07:23 15:31 17:11	10:48 12:28 20:36 22:16	01:58 03:39 11:52 13:32
Mar 22	05:19 06:59 15:08 16:47	10:24 12:05 20:13 21:53	01:48 03:29 11:41 13:22
Mar 23	04:56 06:36 14:45 16:23	10:01 11:41 19:50 21:29	01:37 03:18 11:31 13:11
Mar 24	04:32 06:12 15:59 17:40	09:38 11:18 21:06 22:48	01:27 03:08 11:21 13:01
Mar 25	05:48 07:28 15:36 17:16	09:15 10:55 20:43 22:24	01:16 02:57 11:11 12:50
Mar 26	05:24 07:04 15:12 16:51	10:32 12:12 20:20 22:00	01:06 02:47 12:40 14:22
Mar 27	05:00 06:40 14:49 16:27	10:09 11:49 19:57 21:37	00:56 02:36 12:29 14:11
Mar 28	04:36 06:16 16:04 17:45	09:46 11:26 19:35 21:13	02:26 04:07 12:19 14:00
Mar 29	05:52 07:33 15:40 17:20	09:23 11:02 20:50 22:31	02:15 03:56 12:09 13:50
Mar 30	05:28 07:09 15:17 16:56	10:39 12:19 20:27 22:07	02:05 03:46 11:58 13:39
Mar 31	05:05 06:45 14:53 16:32	10:16 11:56 20:05 21:44	01:54 03:35 11:48 13:29
Apr 01	04:41 06:21 16:08 17:49	09:53 11:33 19:42 21:21	01:44 03:25 11:38 13:18
Apr 02	05:57 07:37 15:44 17:25	09:30 11:10 20:58 22:39	01:34 03:14 11:28 13:07
Apr 03	05:33 07:13 15:21 17:01	10:46 12:27 20:35 22:15	01:23 03:04 11:18 12:57
Apr 04	05:09 06:49 14:58 16:37	10:23 12:04 20:12 21:51	01:13 02:54 11:07 12:47
Apr 05	04:45 06:25 16:13 17:54	10:00 11:40 19:49 21:28	01:02 02:43 12:36 14:18
Apr 06	04:22 06:01 15:49 17:30	09:37 11:17 21:05 22:46	02:33 04:14 12:26 14:07
Apr 07	05:37 07:18 15:25 17:05	09:14 10:54 20:42 22:22	02:22 04:03 12:15 13:57
Apr 08	05:14 06:54 15:02 16:41	10:31 12:11 20:19 21:59	02:12 03:53 12:05 13:46
Apr 09	04:50 06:30 14:39 16:17	10:07 11:48 19:56 21:35	02:01 03:42 11:55 13:35
Apr 10	04:26 06:06 15:53 17:34	09:44 11:24 19:34 21:12	01:51 03:32 11:45 13:25
Apr 11	05:42 07:22 15:30 17:10	09:21 11:01 20:49 22:30	01:40 03:21 11:34 13:14
Apr 12	05:18 06:58 15:06 16:46	10:38 12:18 20:26 22:06	01:30 03:11 11:24 13:04
Apr 13	04:54 06:34 14:43 16:22	10:15 11:55 20:03 21:43	01:20 03:00 11:14 12:53
Apr 14	04:31 06:10 15:58 17:39	09:52 11:32 19:41 21:19	01:09 02:50 12:43 14:25
Apr 15	05:46 07:27 15:34 17:14	09:29 11:08 20:56 22:37	00:59 02:39 12:33 14:15
Apr 16	05:23 07:03 15:11 16:50	10:45 12:26 20:33 22:14	02:29 04:10 12:22 14:04
Apr 17	04:59 06:39 14:48 16:26	10:22 12:02 20:10 21:50	02:18 04:00 12:12 13:53
Apr 18	04:35 06:15 16:02 17:43	09:59 11:39 19:48 21:27	02:08 03:49 12:02 13:42
Apr 19	05:51 07:31 15:39 17:19	09:36 11:16 21:04 22:45	01:58 03:39 11:51 13:32
Apr 20	05:27 07:07 15:15 16:55	09:13 10:53 20:41 22:21	01:47 03:28 11:41 13:21
Apr 21	05:03 06:43 14:52 16:31	10:29 12:10 20:18 21:57	01:37 03:18 11:31 13:11
Apr 22	04:39 06:19 16:07 17:48	10:06 11:46 19:55 21:34	01:26 03:07 11:21 13:00
Apr 23	05:55 07:36 15:43 17:24	09:43 11:23 19:32 21:11	01:16 02:57 11:10 12:50
Apr 24	05:32 07:12 15:20 16:59	09:20 11:00 20:48 22:29	01:05 02:46 12:39 14:22
Apr 25	05:08 06:48 14:56 16:35	10:37 12:17 20:25 22:05	00:55 02:36 12:27 14:11
Apr 26	04:44 06:24 16:11 17:53	10:14 11:54 20:02 21:41	02:25 04:06 12:19 14:00
Apr 27	04:20 06:00 15:48 17:28	09:50 11:30 19:39 21:18	02:15 03:56 12:08 13:49
Apr 28	05:36 07:16 15:24 17:04	09:27 11:07 20:55 22:36	02:04 03:45 11:58 13:39
Apr 29	05:12 06:52 15:01 16:40	10:44 12:24 20:32 22:12	01:54 03:35 11:48 13:28
Apr 30	04:48 06:28 14:38 16:16	10:21 12:01 20:09 21:49	01:43 03:24 11:37 13:17

Date	NOAA 15 137.50 MHz	NOAA 17 137.62 MHz	NOAA 18 137.10 MHz
May 01	04:25 06:04 15:52 17:33	09:58 11:38 19:47 21:25	01:33 03:14 11:27 13:07
May 02	05:41 07:21 15:28 17:08	09:35 11:14 21:02 22:44	01:23 03:03 11:17 12:56
May 03	05:17 06:57 15:05 16:44	09:12 10:51 20:39 22:20	01:12 02:53 11:07 12:46
May 04	04:53 06:33 14:42 16:20	10:28 12:08 20:16 21:56	01:02 02:42 12:36 14:18
May 05	04:29 06:09 15:56 17:37	10:05 11:45 19:54 21:33	02:32 04:13 12:25 14:07
May 06	05:45 07:25 15:33 17:13	09:42 11:22 19:31 21:09	02:22 04:03 12:15 13:56
May 07	05:21 07:01 15:09 16:49	09:19 10:59 20:46 22:27	02:11 03:52 12:05 13:46
May 08	04:57 06:37 14:46 16:25	10:35 12:16 20:23 22:04	02:01 03:42 11:54 13:35
May 09	04:34 06:13 16:01 17:42	10:12 11:52 20:01 21:40	01:50 03:31 11:44 13:24
May 10	05:50 07:30 15:37 17:18	09:49 11:29 19:38 21:17	01:40 03:21 11:34 13:14
May 11	05:26 07:06 15:14 16:53	09:26 11:06 20:54 22:35	01:29 03:10 11:24 13:03
May 12	05:02 06:42 14:51 16:29	10:43 12:23 20:31 22:11	01:19 03:00 11:13 12:53
May 13	04:38 06:18 16:05 17:47	10:19 12:00 20:08 21:47	01:08 02:49 12:42 14:25
May 14	05:54 07:34 15:42 17:22	09:56 11:36 19:45 21:24	00:58 02:39 12:32 14:14
May 15	05:30 07:10 15:18 16:58	09:33 11:13 21:01 22:42	02:28 04:09 12:22 14:03
May 16	05:06 06:46 14:55 16:34	10:50 12:30 20:38 22:18	02:18 03:59 12:11 13:52
May 17	04:43 06:22 16:10 17:51	10:27 12:07 20:15 21:55	02:07 03:48 12:01 13:42
May 18	04:19 05:59 15:46 17:27	10:03 11:44 19:52 21:31	01:57 03:38 11:51 13:31
May 19	05:35 07:15 15:23 17:02	09:40 11:20 19:30 21:08	01:46 03:27 11:40 13:20
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May 21	04:47 06:27 14:36 16:14	10:34 12:14 20:22 22:02	01:26 03:06 11:20 12:59
May 22	04:23 06:03 15:51 17:31	10:11 11:51 19:59 21:39	01:15 02:56 11:10 12:49
May 23	05:39 07:19 15:27 17:07	09:48 11:28 19:37 21:15	01:05 02:45 12:39 14:21
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May 25	04:52 06:31 14:41 16:19	10:41 12:21 20:29 22:09	02:24 04:06 12:18 13:59
May 26	04:28 06:08 15:55 17:36	10:18 11:58 20:06 21:46	02:14 03:55 12:07 13:49
May 27	05:44 07:24 15:32 17:12	09:55 11:35 19:44 21:23	02:03 03:45 11:57 13:38
May 28	05:20 07:00 15:08 16:47	09:32 11:12 20:59 22:41	01:53 03:34 11:47 13:27
May 29	04:56 06:36 14:45 16:23	10:48 12:29 20:36 22:17	01:43 03:24 11:37 13:17
May 30	04:32 06:12 16:00 17:41	10:25 12:05 20:13 21:53	01:32 03:13 11:26 13:06
May 31	05:48 07:28 15:36 17:16	10:02 11:42 19:51 21:30	01:22 03:03 11:16 12:56
Jun 01	05:24 07:04 15:13 16:52	09:39 11:19 19:28 21:07	01:11 02:52 11:06 12:45
Jun 02	05:00 06:40 14:49 16:28	09:16 10:56 20:43 22:24	01:01 02:42 12:35 14:17
Jun 03	04:37 06:17 16:04 17:45	10:32 12:13 20:21 22:01	02:31 04:12 12:24 14:06
Jun 04	05:53 07:33 15:40 17:21	10:09 11:49 19:58 21:37	02:21 04:02 12:14 13:55
Jun 05	05:29 07:09 15:17 16:57	09:46 11:26 19:35 21:14	02:10 03:51 12:04 13:45
Jun 06	05:05 06:45 14:54 16:32	09:23 11:03 20:51 22:32	02:00 03:41 11:53 13:34
Jun 07	04:41 06:21 16:09 17:50	10:40 12:20 20:28 22:08	01:49 03:30 11:43 13:23
Jun 08	05:57 07:37 15:45 17:25	10:16 11:57 20:05 21:44	01:39 03:20 11:33 13:13
Jun 09	05:33 07:13 15:21 17:01	09:53 11:33 19:42 21:21	01:28 03:09 11:23 13:02
Jun 10	05:09 06:49 14:58 16:37	09:30 11:10 20:58 22:39	01:18 02:59 11:13 12:52
Jun 11	04:46 06:26 14:35 16:13	10:47 12:27 20:35 22:15	01:08 02:48 12:41 14:24
Jun 12	04:22 06:02 15:49 17:30	10:24 12:04 20:12 21:52	00:57 02:38 12:31 14:13
Jun 13	05:38 07:18 15:26 17:06	10:00 11:40 19:49 21:28	02:27 04:08 12:21 14:02
Jun 14	05:14 06:54 15:02 16:41	09:37 11:17 19:27 21:05	02:17 03:58 12:10 13:51
Jun 15	04:50 06:30 14:39 16:18	09:14 10:54 20:42 22:23	02:06 03:47 12:00 13:41
Jun 16	04:26 06:06 15:54 17:35	10:31 12:11 20:19 21:59	01:56 03:37 11:50 13:30
Jun 17	05:42 07:22 15:30 17:10	10:08 11:48 19:56 21:35	01:45 03:26 11:39 13:20
Jun 18	05:18 06:58 15:07 16:46	09:44 11:24 19:34 21:12	01:35 03:16 11:29 13:09
Jun 19	04:55 06:35 14:43 16:22	09:21 11:01 20:49 22:30	01:25 03:05 11:19 12:58
Jun 20	04:31 06:11 15:58 17:39	10:38 12:18 20:26 22:06	01:14 02:55 11:09 12:48
Jun 21	05:47 07:27 15:35 17:15	10:15 11:55 20:03 21:43	01:04 02:44 12:38 14:20
Jun 22	05:23 07:03 15:11 16:51	09:52 11:32 19:41 21:19	02:34 04:15 12:27 14:09
Jun 23	04:59 06:39 14:48 16:27	09:28 11:08 20:56 22:37	02:23 04:05 12:17 13:58
Jun 24	04:35 06:15 16:03 17:44	10:45 12:25 20:33 22:14	02:13 03:54 12:06 13:47
Jun 25	05:51 07:31 15:39 17:19	10:22 12:02 20:10 21:50	02:03 03:44 11:56 13:37
Jun 26	05:27 07:07 15:16 16:55	09:59 11:39 19:48 21:26	01:52 03:33 11:46 13:26
Jun 27	05:03 06:44 14:52 16:31	09:36 11:15 19:25 21:03	01:42 03:23 11:36 13:16
Jun 28	04:40 06:20 16:07 17:49	09:12 10:52 20:40 22:21	01:31 03:12 11:25 13:05
Jun 29	05:56 07:36 15:43 17:24	10:29 12:09 20:17 21:57	01:21 03:02 11:15 12:55
Jun 30	05:32 07:12 15:20 17:00	10:06 11:46 19:55 21:34	01:10 02:51 11:05 12:44

SOFTWARE SHOWCASE

Douglas Deans - dsdeans@tiscali.co.uk

Following the request in my last column for help and suggestions from the membership, I have to report that the level of response was hugely disappointing. Despite that, there is another important issue on which I would welcome member's comments—so please read on.

However, I must firstly thank the four members who did contact me with their thoughts and suggestions. In addition, I had already discussed the matter with three Scottish GEO colleagues over a bite of lunch. Nevertheless a response from just seven out of a membership approaching 600 is quite depressing.

I find it difficult to conclude whether the column is just not being read or whether there is so much apathy about that people cannot be bothered to respond. Given the long struggle that Les Hamilton our Editor has had in finding his replacement, I suspect the latter. Another possible interpretation is that those who read my column have agreed with its contents, but somehow that seems unlikely.

Taking into account the views of those who were kind enough to respond, along with my own experiences of falling demand for library products, I have decided to terminate the Software Library after the publication of this issue of *GEO Quarterly*. If anyone wants any of the five CDs, may I suggest they order them now, as there will be no further updates or reference to them in future issues.

I am still considering how best to continue with the column, if at all, including the possibility of adding some basic computer tips as an integral part of the *Software Showcase*. As a helpline provider, I find that the majority of issues are often caused by lack of computer knowledge rather than anything else—the resolution of callers' problems are often further exacerbated by their inability to perform some quite simple computer tasks. Please do not interpret this as a criticism; it's merely an observation, and one that persuades me that perhaps a little more help can be provided in this area.

I would be interested in readers' thoughts about including a small computer Q and A section. It would not be possible or sensible in a quarterly journal to field actual questions so I propose simply to provide the questions and answers myself. These would be based on issues I have most commonly come across during my years on helplines with GEO and elsewhere. I would include issues for both *Windows* XP and Vista. I have no experience with other operating systems so apologies in advance to those using Linux or similar.

I still intend to report on updated software relevant to our hobby, but as I mentioned last issue, updates are becoming less frequent. The inclusion of computer tips would replace the space previously taken up by the shareware library and hopefully be found more useful.

Program Updates

There have been a number of updates to seven of David Taylor's programs, the latest versions of which are listed in the GS1 panel opposite.

How to Purchase Software Library CDs

Write to the address below requesting GS1, GS2, GS3, GS4 or GS5. Prices are £5 for any single CD, 2 for £8, 3 for £11, 4 for £14 or all 5 for £17. Please enclose cash or cheque (made payable to Douglas Deans - not GEO please) for the appropriate amount. Nothing else is required.

The cost includes CDs, packaging, posting and a small donation towards the cost of overheads. No fee is asked from overseas members although an exchange of software or interesting satellite images is always welcome.

Orders are normally dispatched on the day of receipt.

Order your CDs from:
Douglas Deans, 17 Montrose Way,
Dunblane, Perthshire FK15 9JL, Scotland.

GS1 — All David Taylor's weather satellite programs and libraries, including the current releases of WXtrack, Satsignal, HRPT Reader, GeoSatsignal, GroundMap, RX2 PassControl and many other program extras. This disc also contains a large quantity of sample files, many of high-resolution data, for use with these programs.

Program	Description	Version
AVHRR Manager	Processes and manages the files for HRPT via EUMETCast	v 1.4.0
GeoSatSignal	Manipulates Geostationary weather satellite images	v 6.1.2
GRIB Viewer	Viewer for GRIB format files	v 2.1.6
GroundMap	Rescales satellite images	v 2.0.6
HRPT Reader	Converts raw HRPT data files into images	v 2.7.2
Kepler Manager	Organises files of 2-line element data	v 1.2.8
Metop Manager	Processes and manages AVHRR files from Metop satellites	v 1.1.4
MSG Animator	Automatic animation of MSG images following reception	v 2.5.12
MSG Data Manager	Processes and manages MSG data files	v 2.5.12
RX2 PassControl	Computer control program for the RX2 receiver	v 3.1.0
SatSignal	Creates images from wave files	v 5.0.8
WXtrack	Satellite Tracking Program	v 3.6.6

GS2 — A wide range of software for all aspects of weather satellite reception, including tracking, receiving, monitoring and image manipulation. Content is detailed below but many other extras are provided. Titles correspond with folder names. * implies a DOS program.

Program	Description	Version
Collection D02	Recall (wave file recorder), Palette (modifies Wxsat colour palettes).	
Collection D03	Scanner recorder v 1.8 (wave file recorder), *NOAA95/*FENG99 (software for the NOAA 95 HRPT project)	
Collection D04	Wxsat (wave file recorder/decoder), Satmon (wave file recorder).	v 2.59
AGSatTrack	Satellite tracking program	v 1.33
APTDecoder	Program for capturing APT audio and processing images	v 2.0.4.76
Cirkit	Documents for the Cirkit Wxsat receiver and the UOSat receiver (PDF)	
Element Manager	2-line element manager	v 1.59
Footprint	Satellite tracking program	v 2.24
Irfan View	Image/slideshow viewer	v 3.80
JVcomm32	Evaluation version (APT/FAX/SSTV decoder)	v 1.40 pre
Macintosh kepler editor	Edits verbose AMSAT format elements. Mac OS X and OS9 only.	
NeoPaint	Image processing program (30 day evaluation)	v 4.60
Orbitron	Satellite Tracking Program	v 3.70
Paintshop Pro	Image processing program (30-day evaluation)	
PhotoFiltre	Image retouching program with many extras	v 6.2.7
Satscape	Satellite tracker and wave file recorder	v 2.02
Space-Track TLE Retriever	Generates TLE files in 'Celestrak' style from 'Space Track' data sets	
Xrit2Pic	Processes MSG and Metop data	v 2007.03
WXtoImg	WAV file recorder/decoder program with many options.	v 2.7.3

GS3 — **3DEM Package for 3D Terrain Visualisation**
This CD includes the full set of GLOBE Tiles to allow you to produce excellent images and flybys from HRPT images. Also included is a selection of Mars MOLA files, sample images and helpful guides by Ed Murashie.

GS4 — **Image CD**
A wide selection of high-resolution remote images from a range of satellites, including stunning imagery from the Space Shuttle missions. A full description and source if provided for each image.

GS5 — **Mars Rover Panoramics**
A chronological account, in panoramic images, of the NASA Mars Rovers' progress across the Martian Terrain

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Earth Imaging News

Peter Wakelin

Oil Leak off South Korea Imaged by Envisat

The 146,000-tonne oil tanker *Hebei Spirit*, collided with another vessel to the southwest of Seoul, South Korea, on December 7, releasing an estimated 10,000 tonnes of crude oil into the sea. Envisat's *Advanced Synthetic Aperture Radar* (ASAR) imaged the polluted area four days later. Oil on the sea surface damps down wind-generated waves making them reflect less of the radar signal back toward the source. Consequently, oil slicks appear as darker areas than the surrounding sea.
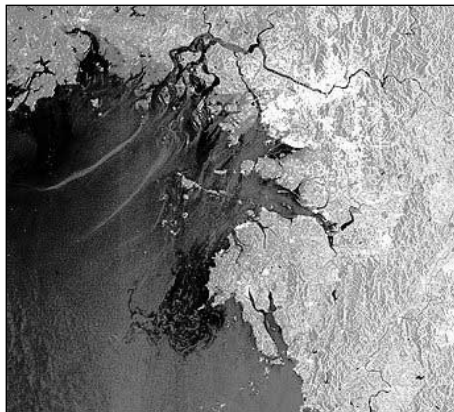
Oil pollution from the wrecked tanker Hebei Spirit near Seoul, South Korea
Credit: ESA

Canada's Radarsat 2 Launched

Radarsat 2 lifted off from the Baikonur Cosmodrome in Kazakhstan on December 14 aboard a *Soyuz-FG/Fregat* combination to a 798 km circular sun-synchronous orbit. The *Soyuz* upper stage re-entered the atmosphere within a few hours and the *Fregat* was deliberately de-orbited after releasing the payload.

Radarsat 2, although smaller and less massive than *Radarsat 1*, which was launched in 1995, has been designed with
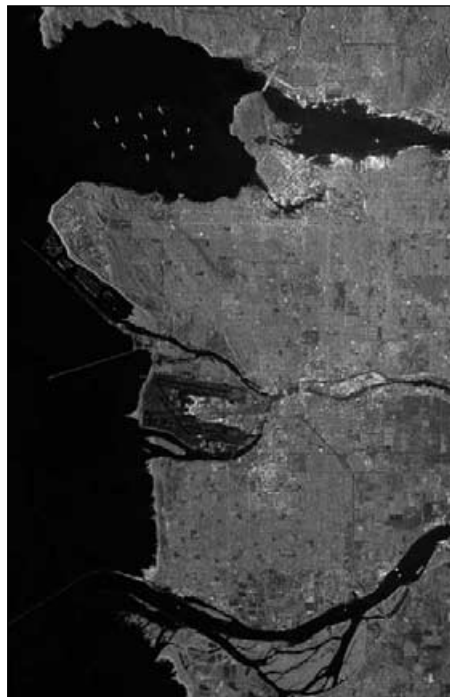

Vancouver airport at full resolution imaged by Radarsat-2
Credit: Canadian Space Agency

significant and powerful technical advances which include 3-metre high-resolution imaging, flexibility in selection of polarization, left and right-looking options, superior data storage and more precise measurements of spacecraft position and attitude. The radar operates in C-band (5.405 GHz) and the SAR antenna is 15 m × 1.5 m. More information and further images can be found at:

http://www.space.gc.ca/asc/eng/ satellites/radarsat2/default.asp

and

http://www.radarsat2.info/

The city of Vancouver is visible in the upper part of this image (reproduced at reduced resolution) acquired on January 6 from Radarsat-2
Credit: Canadian Space Agency

China Launches First Deep-Space Probe

China launched *Chang'e 1* into a highly eccentric Earth orbit on October 24. The apogee was initially at about 50,600 km then it was raised to about 120,000 km on October 29 and 380,000 km on October 31. It enterd a polar orbit around the moon on November 5. After further manoueuvres it reached its 200 km operating orbit two days later. Following on-orbit testing, imaging with its CCD stereo camera began on November 20. The composite image reproduced above is made up from multiple 60 km swaths and covers an area approximately 280 km wide and 460 km long.
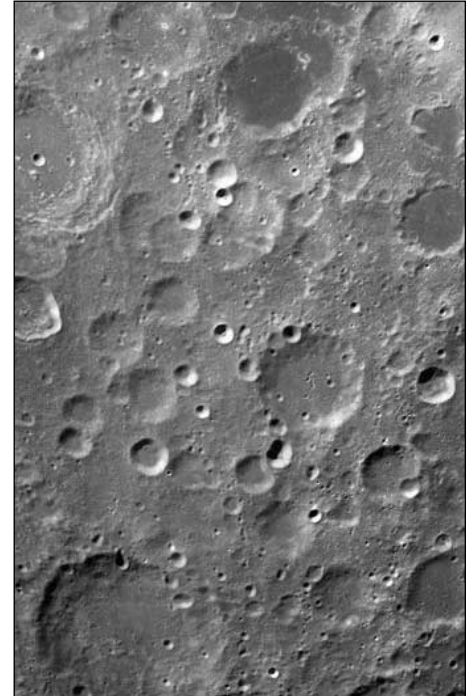
First lunar image from Chang'e-1
Credit: Xinhua News Agency

China Launches another Radar Satellite

China launched *Yaogan 3* on November 11 into a sun-synchronous 613 × 623km orbit and then, on November 20 and 21, small adjustments trimmed the orbit to 628 km circular, which is identical to that of *Yaogan 1*. *Yaogan 2* orbits a few kilometres higher.

Believed to have a resolution of 5 m in the highest of the two operating modes, the Chinese report that its uses include estimating crop yields and monitoring natural disasters. Of course, should they just happen to leave it switched on when passing over the Taiwan Strait, it may detect naval forces too.

More Space Debris Catalogued

In this column, in GEO Quarterly No 13, March, 2007, it was reported that several hundred fragments were created when the Chinese deliberately destroyed their old weather satellite *Feng Yun 1-C* in an anti-satellite weapon test. US sensors continue to detect more fragments from this break-up and the number of catalogued pieces has now reached 2,380, which represents nearly 20% of all known orbiting objects. The sensors are believed to be able to detect fragments no smaller than about 10 cm across, so there must be many thousands of smaller pieces each of which, when travelling at around 7 km/s, has

Crystals

for VHF Satellite Receivers

Francis Bell

I have a number of VHF satellite receivers. Some I have built myself from kits and others I have accumulated second-hand from radio/computer rallies. My recent project was prompted by the changes of frequency for the downlink APT signal from NOAA 18.

My understanding is that NOAA and EUMETSAT agreed that NOAA-18 should transmit on the frequency of 137.9125 MHz while Metop-A would use 137.10 MHz. Following the launch of NOAA-18 it became clear that reception in the UK was difficult because adjacent frequencies were being utilised by high-powered commercial pager systems. Representations by myself and others persuaded NOAA to switch frequency from 137.9125 MHz to 137.1 MHz, a frequency change that lasted until the launch of Metop-A. At this point, NOAA-18 was switched back to its original frequency of 137.9125 MHz, thus leaving UK receiving stations with the background problem of interference from pagers. Subsequent events, and the non-use of 137.1 MHz by Metop-A, appear to have released this frequency, which is once more being used by NOAA 18.

Some of the APT receivers I use contain EPROMs, which can be changed/replaced to accommodate new frequencies. My *Dartcom* receiver and the Ray Godden designed *RX2* which I built from a kit both fall into this category, and I have upgraded them with the new EPROMs available from the *GEO Shop*. However, this left me with two further receivers, of my own and another belonging to a friend, which have crystal controlled frequencies. Understandably my friend wished to receive NOAA-18, hence a requirement for new crystals or the purchase of a new receiver. We decided to go for the new crystals.

Custom Crystals

I don't know how many companies are willing to make custom specified crystals but the one I identified was *QuartsLab Marketing Ltd* [1]. This company used to be located in Erith, Kent, UK but has recently moved to Ireland. Their business still seems to include the supply of crystals suitable for VHF satellite receivers.

If you are planning to upgrade a receiver, be careful to order the correct crystal casing. The plug-in crystals illustrated above have substantial one millimetre diameter pins. The plug-in system is very easy—just replace an old crystal with a new one: polarity is not important.

Two of the receivers I modified contained plug-in crystals but, in the case of my RX1, these were soldered <u>directly</u> to the circuit board; these crystals have a base with wire terminals and are directly soldered on to the board with no socket.

Care must be taken when changing components directly soldered to a circuit board. When I changed my circuit board crystals I used a temperature-controlled soldering iron and, using a solder sucker to remove the molten solder from its pins, I was able to lift the crystal from the board. Provided no other adjustments are made to the circuits the new crystal will give the desired frequency.

The RX1 receiver can have additional crystals added to the existing circuit board but this requires a small circuit modification.

If anybody wants to do this please contact me and I will send you the new circuit diagram.

Determining Receiver Frequency

The crystal controlled receivers I have dealt with have all used the same system for determining the final receiver frequency. A crystal can be made to have a desired fundamental frequency but it will also generate harmonics of that fundamental.

In the case of my receivers, the third harmonic was exploited, to which the IF value of 10.7 MHz must be added. The crystal value for the 137.1 MHz frequency is calculated as

(137.1 – 10.7) / 3 = 42.13333

Similarly, for a frequency of 137.9125 MHz, the crystal value is calculated from

(137.9125 - 10.7) /3 = 42.40416

A supplier will need to know these two figures if you order new or replacement crystals.

- For 137.1 MHz order a crystal with a value of 42.13333 MHz
- For 137.9125 MHz order a crystal with a value of 42.40416 MHz

The cost of such crystals is about £8.00 each, but the company has a minimum order charge of £15.00. The logic here seems quite clear: order two crystals, one for each of the two new frequencies.

Reference

1   QuartSLab, Connogue House, River Lane, Shankill,
    Co. Dublin, IRELAND

    Telephone (from the UK): 0845 004 7603 or 0207 100 6357

    email: quartslab@connogue.com

    Website: www.quartslab.com

Why use the 3rd Harmonic?

Ray Godden

Crystals oscillators rely on the acoustic resonance of a piece of quartz sandwiched between two electrodes. The resonant frequency bears an inverse relationship to the thickness of the quartz: the higher the frequency, the thinner the quartz. As frequency increases it becomes increasingly difficult to manufacture resonators at reasonable cost with adequate performance. The limit is at about 30 MHz and the crystals are used at their parallel resonant frequency.

The range is extended by using crystals at harmonics of their fundamental resonance (3rd, 5th harmonics etc.), the so-called overtone operation. Note that only odd overtones are possible and their frequencies are near, but not exactly multiples of, the fundamental frequency.

Higher overtones make oscillator circuitry more critical, particularly if a number of crystals are to be switched, and crystals for high overtone use are more expensive. Therefore, above about 100 MHz, it's easier to use a multiplier to derive the required frequency.

A New *Vista* for EUMETCast Reception?

Trialling the Dexatek DK5702 I-Tek Sphere DVB-S USB Box

David Taylor - *davidtaylor@writeme.com*

Ever since EUMETSAT started transmitting MSG-1 SEVIRI data via the Hot Bird-6 *EUMETCast* link in April 2003, the *Technisat SkyStar-2* DVB-S satellite receiver card (and subsequently USB box) have been the favoured means of receiving the data. As the primary units recommended by EUMETSAT [1], these receivers have gained universal acceptance. Since those days, more and more data has been added to the *EUMETCast* stream. The *SkyStar-2* card copes comfortably with current maximum data rates for those enthusiasts who wish to download the full spectrum of MSG, NOAA and Metop data. The USB box, on the other hand, only operates at USB 1.1 data rates and requires users to be more selective as to which data they acquire. Moreover, it has been discontinued and unavailable for a year.

Owing to the compromise, the USB 1.1 box placed on full *EUMETCast* data reception, Arne van Belle and later David Simmons began researching alternative USB units, and spent many months testing the both *SkyStar Plus* and *TechnoTrend DVB-S* USB boxes. Owing to several operational problems, including driver software, both units proved very difficult to use. EUMETSAT engineers had also come up against these problems. At the start of last year, Microsoft released the latest version of Windows—Windows Vista—which imposes additional requirements on hardware and software. Some early adopters of Vista and the beta hardware drivers found that they suffered more data loss than with Windows XP.

Fortunately, David Simmons has recently come across a newer USB 2.0 hi-speed box - the Dexatek DK-5702 I-TEK Sphere - which he has found to be quick and easy to set up, and able to receive the both MSG and Metop EUMETCast data without problems. He demonstrated this on a laptop at the GEO Management Team meeting in November 2007 and the results were very encouraging. The excellent, loss-free performance he obtained has now been replicated by others using various PCs, running both Windows XP and both the 32-bit and 64-bit variants of Windows Vista.

The Dexatek I-TEK Sphere USB-S Receiver

The *I-TEK Sphere* comes with a universal PSU, remote control, USB cable and a CD which contains the installation software and manual. All you have to do is attach the lead from your dish antenna to the box, which connects to a USB port on your PC. Connect the PSU to the *I-TEK Sphere*, power it up, and you are ready to install the software. At this point you will almost certainly be presented with a 'Found New Hardware' warning dialogue. Ignore this and press the 'Cancel' button.

Figure 1
The Dexatek
I-TEK Sphere

From the outset, it is vital that you note to which USB port you connected the receiver (your PC will surely have several). If, for any reason, you disconnect the unit from the PC, you must reconnect it to the same USB port. If you don't, *Windows* will assume that you are connecting a *second* unit and therefore fail to associate it with the already installed software!

The Dexatek Software

The installation file, along with instructions, can be found on the included CD. It is well worth checking the *Dexatek* website for updates: if the CD does not provide the latest version, you should be able to obtain it as a 13 MB download from

http://www.dexatek.com/Download.asp

This file comes in the compressed 'RAR' format and you will require the freeware utility *UnRAR.exe* to unpack it. Download your copy of *UnRAR* from

http://www.rarlab.com/rar/unrarw32.exe

then double-click to extract and install the *UnRAR.exe* command line utility. The easiest way to proceed is to place the *Dexatek* driver software and *UnRAR.exe* in an empty folder along with a small command file '*go.cmd*'. This contains the single instruction 'unrar x *.rar' (you can create this using any text processor such as *Notepad*; then save it as 'go.cmd'). When you double-click on *go.cmd*, all the driver and application software for *Windows Vista* are unpacked into a folder named

Figure 2 -The Dexatek box + PSU

V2.0build02_20071102Dexatek·

At the time of writing, the latest drivers and application download file for Windows Vista was '*DK5702 - 20071107 update Vista Driver and updated application pack*', containing a number of files and subfolders, including the all-important *setup.exe*. Double-click on *setup.exe* to start the install process.

Note: It is not unknown for the *Dexatek* drivers site to go off-line. In this case, you can also use the *DVBWorld* drivers with the *Dexatek* hardware. Go to the *DVBWorld* download page at

http://www.worlddvb.com/html/softdown.htm

and in the '*DVBWorld Software and Drivers*' section, download the 'DVBWorld Software' (big remote control). The download, *DVBWorld-V2.0.rar*, can be unpacked as described above. The *setup.exe* file can be found in the '*DVB World*' subfolder. These files also work with the 64-bit version of *Vista*.

Note: The *Dexatek* and *DVBWorld* boxes contain almost identical hardware and the same software works with both. The screen-shots that follow are applicable to either, even though there are minor differences.

Driver Installation

Windows Vista may prompt you to authorise the program before continuing—unless, of course, you have disabled the User Authorisation Control (UAC). Select 'Allow' then proceed to work through the installation wizard.

In the 'Setup Type' screen (figure 3), make sure that both 'Drivers' and 'Software' are checked. At two points during the installation you will be presented with a warning that the drivers are unsigned: just click on the 'Install this driver
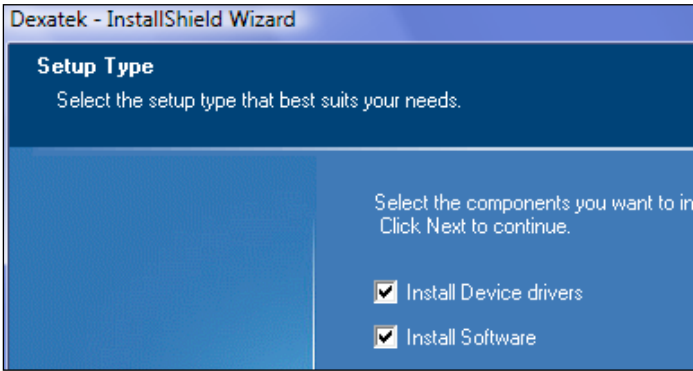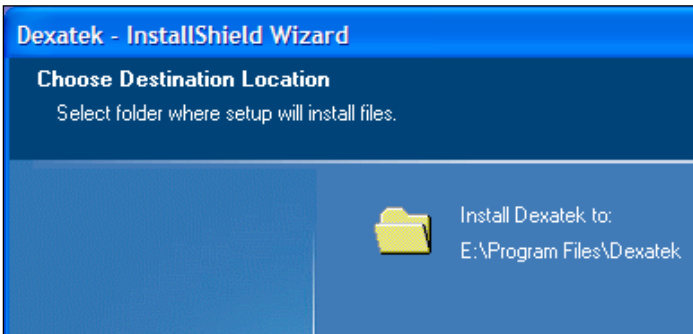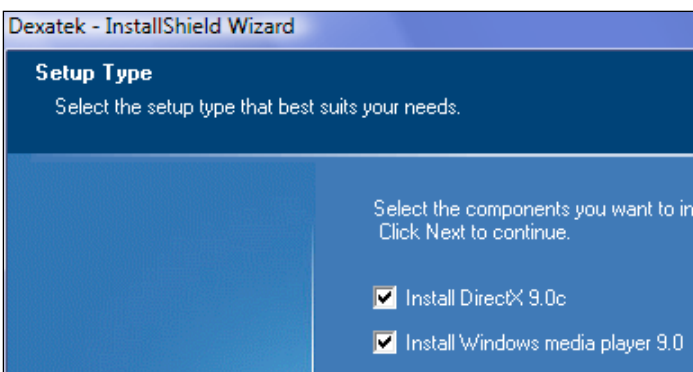
Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

software anyway' box. At another point you will have to chose a folder for the installation (figure 4).

You will be prompted to install older versions of *Windows* Media Player and Direct-X. Check both options (figure 5) and click 'Next'. If your PC already has up-to-date versions of these installed, this step will simply be skipped. When the 'Wizard Complete' screen appears, click 'Finish' and reboot your computer.

The manual notes:

'If you are using a USB2.0 adapter PCI card/PCMCIA etc. to support the USB2.0, please turn off the USB Box power before you restart the computer. Please restart your computer directly if USB2.0 supported by motherboard.'

If required, power-up the USB box after the computer has rebooted. You may see messages about finding new hardware, installing drivers and the device being ready for use.

Setting up the Dexatek Software

There are two stages to this process, firstly setting up the *I-TEK Sphere* for TV operation, followed by a second stage when you have to set it up for data reception.
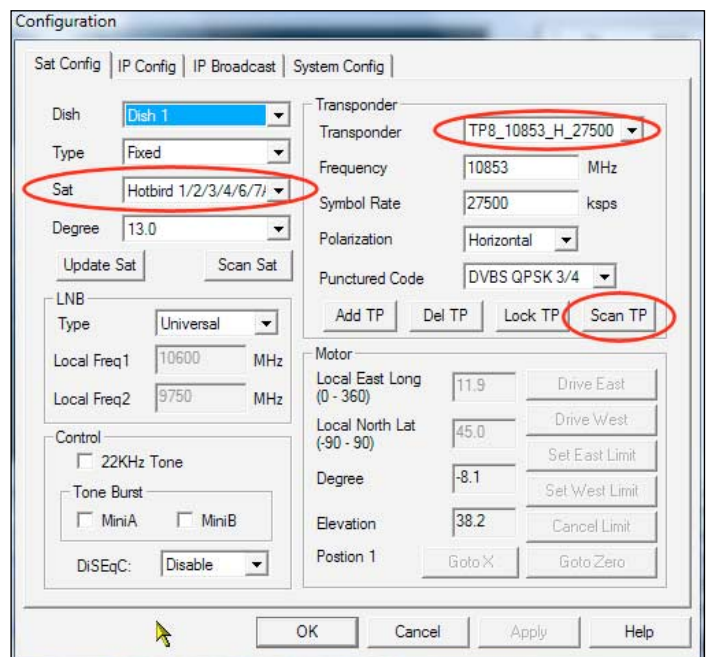
TV Setup

You must select the satellite and transponder you wish to connect with, and configure the data connection for EUMETCast use. Double-click the Dexatek icon on your Desktop to reveal the screen illustrated in figure 6 and click the spanner-shaped

Figure 8

configuration icon on the bottom row. Use the drop down lists to select the satellite as '*HotBird 1/2/3/4/5/6/7A*', and the transponder as '*TP8_10853_H_27500*' (figure 7). If you have a more complex LNB setup, you may also need to configure the 'DiSEqC' parameters at lower left but for most simple setups, 'Universal LNB' should be all that is required. There is no need to scan the whole satellite (Scan Sat); just click the 'Scan TP' button to scan the selected transponder for the active TV and radio channels. After scanning a transponder you are presented with a choice as to what to make available. Select 'All' and 'FTA' as illustrated in figure 8 then click 'OK'.
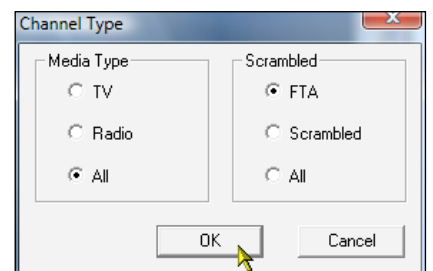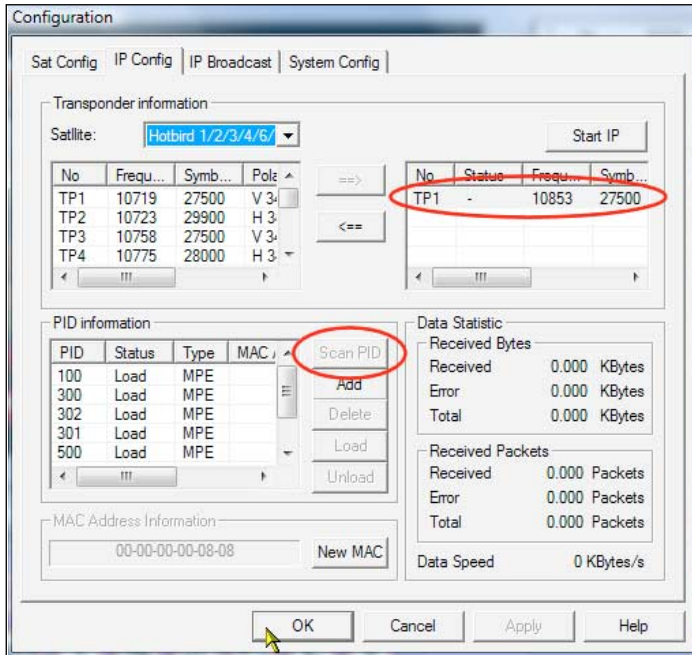
Figure 9

You should now be able to select and view TV channels via your *I-TEK Sphere USB receiver*.

Data Setup

Click on the spanner-shaped icon once more but this time select the 'IP Config' tab to display figure 9, where your first task is to select the 10853 (MHz) transponder from the left-hand browser in the 'Transponder information' panel; then click on the transfer button (right pointing double arrow) to transfer this information to the right-hand list (circled).

Next, click on the TP1 transponder in this list and, in the PID information box, click the 'Scan PID' button. You may have to add the PID manually in order to enable the ' Scan PID' button. Do this by clicking the 'Add' button, then click on 'Decimalization' (sic) and enter '100' in the top PID Data box (figure 10). Click 'OK' to confirm.

You can now click 'Scan PID', which is much more efficient than entering all the PIDs you need, individually, by hand. Any PIDs that you don't want can be selected with a mouse-click and removed by pressing the keyboard 'Delete' key. You can access a list of all the relevant *EUMETCast* PIDs on my website at
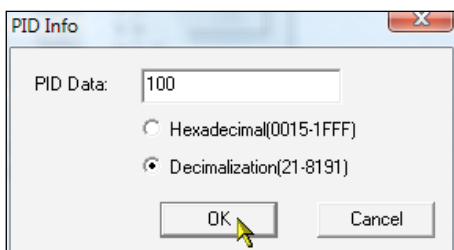
http://www.satsignal.eu/wxsat/atovs/

Figure 10

The website [2] also carries a highly comprehensive guide to the latest information on testing the *Dexatek* box and is regularly updated as new results become available.

Do please be aware that, if the data from a particular PID is not actually flowing while you click 'Scan PID', the PID for that data may not be recorded automatically. Be sure to check the PID list carefully—if you miss a PID associated with data you are allowed to receive, you may get an intermittent red 'T' icon. Check the list of PIDs carefully to avoid this (e.g. PID 302 for DWDSAT data). When all is done, click 'OK' to close the configuration dialogue. Your data should. now start flowing when you click the 'IP' button.

Recent Developments

Recently, Ian Deans invested in a new '*Vista*' computer and transferred his *SkyStar-2* card to it with the intention of using the higher PC specification to streamline his *EUMETCast* reception. Unexpectedly, Ian suffered severe problems. Although the *SkyStar* card and software certainly appeared to install correctly, he was beset by large numbers of missing segments, an issue he was unable to cure. So bad was the problem, that Ian had to restore the card to his old PC to resume his *EUMETCast* activities.

I suggested that the *Dexatek I-TEK Sphere* USB receiver might be worth trying and took round a spare unit for him to try out. After following the installation instructions, I found that the unit worked well, with one exception; although there was no data loss, he kept getting a red 'T'-icon. It didn't take long to source this problem: the PID for DWDSAT was missing, and as soon as it was included the red 'T'-icon went away.

It is not yet understood just why *Dexatek* USB box works so well with Ian's PC when it had suffered problems with the *SkyStar-2* PCI board. Other GEO readers have transferred to *Vista* without problems. Perhaps it is a question of the specific hardware in Ian's PC, or maybe a software or driver problem. Perhaps *Vista* is better optimised for USB operation; maybe the *SkyStar-2* drivers don't work as well under *Vista*; it could simply be that the *Dexatek* drivers are better than the *TechniSat* ones? I would love to get to the bottom of this

unexpected result! If you have any ideas, do get in touch and let me know.

Testing and the Future

At the present time, the *Dexatek I-TEK Sphere* USB receiver is giving highly promising results for a number of dedicated *EUMETCast* enthusiasts. There is little doubt that the volume of data available to amateurs via *EUMETCast* will continue to increase, and that a faster receiver, such as the *Dexatek* or *DVBWorld* boxes, will be required to cope with all the data.

Neither GEO nor EUMETSAT is yet in a position to state definitively that the *Dexatek* USB box is the way forward, but it is highly promising and no adverse issues with the unit have yet been identified.

The *Dexatek I-TEK Sphere* USB receiver is not currently available in the UK but can be purchased from vendors in the EU. Cost is generally in the range 65 - 70 euros.

GEO are investigating the logistics of making this, or a similar, unit available from the GEO Shop. By the time you read this it may be worthwhile visiting the Shop web page at

http://www.geo-web/shop.html

to see if there have been any developments. Meanwhile, any reader keen to experiment with the *Dexatek* box should be able to order one from the continent by searching the web for 'Dexatek I-TEK 5702'.

Note for Windows XP Users

If you have not upgraded to *Vista*, don't despair. The *Dexatek* USB box and its software also operate successfully under Windows XP.

Acknowledgements

I wish to acknowledge the work and effort of many others. Arne van Belle has been looking at different USB boxes ever since the need for the higher bandwidth to handle Metop data became apparent, and tried many combinations of hardware, operating system, and drivers with various degrees of success. David Simmons has contributed his technical expertise, John Tellick his knowledge of the satellite TV field and Klaus-Peter Renner (EUMETSAT) his in-depth knowledge of EUMETCast to an informal working group which has corresponded by e-mail over the last year or so.

References

1 EUMETSAT Technical Document No 15
   http://www.eumetsat.int/groups/ops/ documents/document/pdf_td15_eumetcast. pdf
2 David Taylor's Website
   http://www.satsignal.eu/
   ==> Eumetcast and Vista (under 'Weather Satellites')

Unseasonable Weather

2007 Brings Weather Extremes across Europe

John Tellick

Well, what a year? I started writing an article about winter and our record-breaking spring in the UK and parts of northern Europe. But thinking the summer might also be noteworthy, the article was left pending and I now find myself at the keyboard, between Christmas and New Year finalising it. I'm sure I'm not alone in asking: 'Where did 2007 go?'

Winter

It was another mild winter in southeast England, but fortunately the succession of dry winters leading to last years 11 month hose-pipe ban was broken. Good rainfall over the period allowed reservoirs to replenish and underground resources to begin to build up again.

Winter was late arriving in Scandinavia and the Alps with many resorts having to rely heavily on snow cannon to produce artificial snow until good falls of the 'real thing' arrived in January and February. This lack of real snow, coupled with warm temperatures and sometimes windy conditions, forced the curtailment or cancellation of several winter sports championship events. In figure 3, high pressure over central Europe gives a clear mid-April view of the Alps.

Spring

Northern Europe experienced prolonged large areas of high pressure throughout March and April. This situation produced extended spells of record-breaking, above-average temperatures and sunshine in southeast England and other European countries during both months, coupled with unusually little monthly rainfall.

Figure 1, dating from March 27, shows one of these high pressure areas, with early morning fog in central England stretching into Wales. Sea fog and low cloud—called haar—shrouds the coastlines of northeast England and eastern Scotland while heavy winter snowfall continues to highlight the mountains of Norway.

Figure 2 is part of a NOAA-18 AVHRR transmission on May 2 which shows the phenomenon particularly well. The high pressure conditions led to the formation of an impressive region of haar over the North Sea, which persisted for several days around the end of April and blanketed much of the east coast of Britain. Figure 4 shows sea ice breaking up off the east coast of Greenland on April 19, with less

dense ice showing as milky swirls while figure 5, dating from April 28, depicts a not very icy Iceland. By way of contrast, though, figure 6 illustrates a very icy Svalbard on May 1, with lots of sea ice to the N and E. Svalbard is, of course, the location of the EUMETSAT Metop ground station.

Summer

The record-breaking spring was, alas, a false promise. Having spent many days on the beach during March and April, what followed is best forgotten. Summer was, nevertheless, memorable, but for all the wrong reasons! May experienced well above average rainfall over most of the UK, lower than average sunshine and disappointing temperatures. A mere 7.9°C was recorded at London's Heathrow Airport on May 28! And things just got worse. The below average sunshine continued through June with rainfall well above average. Parts of NE England experienced severe flooding and in Yorkshire, rainfall was 300% up on normal.

Temperatures continued below average with sunshine well below average through July and rainfall was again well above average in most areas: England and Wales recorded more than double the norm while Worcestershire suffered four times its average precipitation, leading to severe flooding throughout Worcestershire, Gloucestershire and the Sheffield area. August also proved disappointing, the coldest in most of Britain for at least ten years. Unsettled weather lasted till the end of the month when high pressure finally began to build.

Throughout June, July and August the jet stream looped much further south than normal, allowing Atlantic depressions to cross the UK when they would normally have passed to the north, between Scotland and Greenland. Several times during these months, as many as three active low pressure systems would cross the UK within a week, bringing cool, wet and windy weather. The image on the inside back cover shows a typical successive scenario.

September started promisingly, with the jet stream back where it should be; the Atlantic lows were passing north of the UK as a very large area of high pressure close by started influencing the weather. However, it was 'in the wrong place': just too far to the west, and allowed a northerly airflow to stream across the UK, bringing cloudy yet settled conditions and mid range temperatures for a long period.

The high pressure stubbornly remained stationary off Ireland for nearly four weeks. Finally, on September 23/4, a depression passed over Scotland bringing an active cold front across the UK, with mini tornados reported in parts of southern and central England.

Whilst much of northern Europe suffered a cool, miserable summer, southern Europe experienced weeks of cloudless sunshine and record breaking high temperatures. Wild fires broke out in several countries with Greece experiencing the worst fires ever. These were fanned by days of blustery NE winds which devastated vast areas of forest, countryside and homes and caused loss of life. The neighbouring countries of Bulgaria, Albania, parts of the former Jugoslavia and southern Italy were also affected. These fires could be clearly seen in both NOAA and Meteosat imagery (lower image on inside back cover).

Autumn

As if to make up for the poor summer, autumn throughout much of the UK was wonderful. SE England enjoyed fine settled weather from mid October into November as periods of high pressure brought calm sunny conditions. The cool wet summer had provided a considerable spurt of growth to trees and bushes and the autumn colour was just breathtaking; in the calm conditions the leaves remained and seemed to last for a month.

However, 'the weather' had one more sting to its tail: on November 9, a combination of very low pressure, a very high tide and strong winds in the North Sea brought a fear of severe flooding from an enormous tidal surge along the North Sea coasts of England and The Netherlands. It had been predicted for several days but passed off with only minor flooding, since sea defences all along vulnerable coasts had been strengthened and upgraded after the catastrophic flooding and loss of 307 lives in the UK during a similar surge in 1953. Predictions are for this type of event, with climate change and rising sea levels, to become far more frequent!

December had many days of fine, cold sunny weather, though with a chilling north to easterly wind at times. And, the winter sports season in Europe got off to a brilliant start with 'early' heavy snowfalls in parts of the Alps during early November—a once in 30 year occurrence. Scandinavia also enjoyed good falls of snow in November, with cold, clear sunny conditions for all the opening Nordic events, including cross country skiing, biathlon and ski jumping.

It was reported on BBC News in early January that, despite the cool, wet dismal summer, with the heaviest rains in living memory and a record-breaking warm spring, 2007 was a pretty average year for the UK in terms of overall rainfall, sunshine and temperature.

Now what will 2008 bring?

Figure 1 - High pressure over Europe - NOAA-17 on March 27, 2007
Image © EUMETSAT 2007

Figure 2 - Haar fills the North Sea - NOAA-18 on May 2, 2007
Image © EUMETSAT 2007

Figure 3 - Cloud-free Alps - NOAA-17 on April 17, 2007
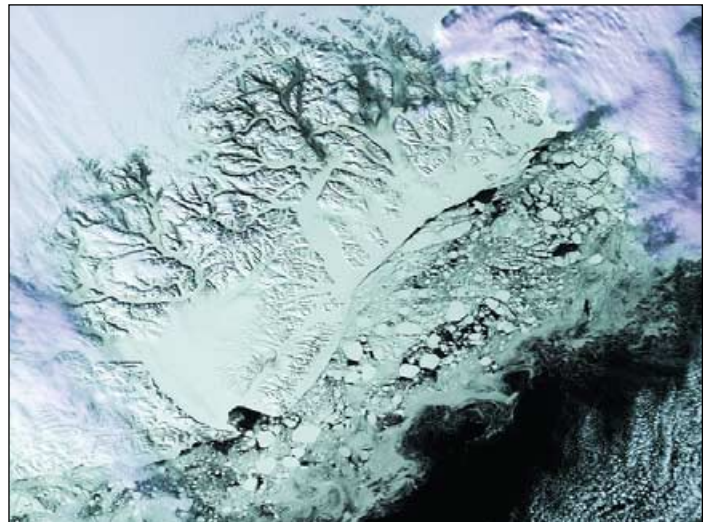*Image © EUMETSAT 2007*

Figure 4 - Ice breaking off the Greenland Coast - NOAA-18 on April 19, 2007
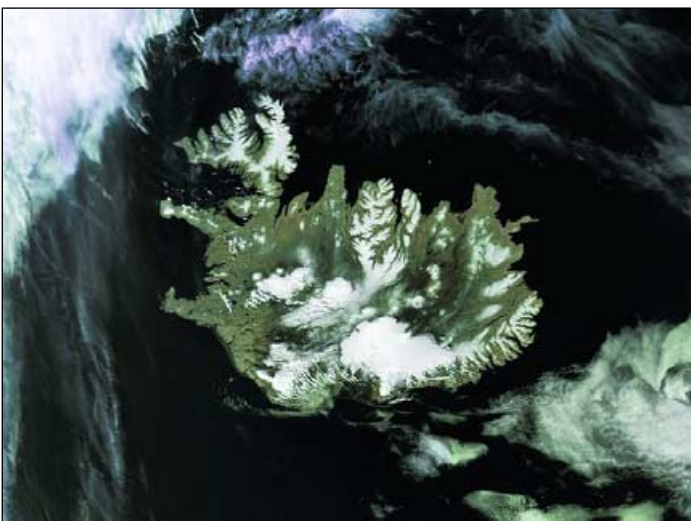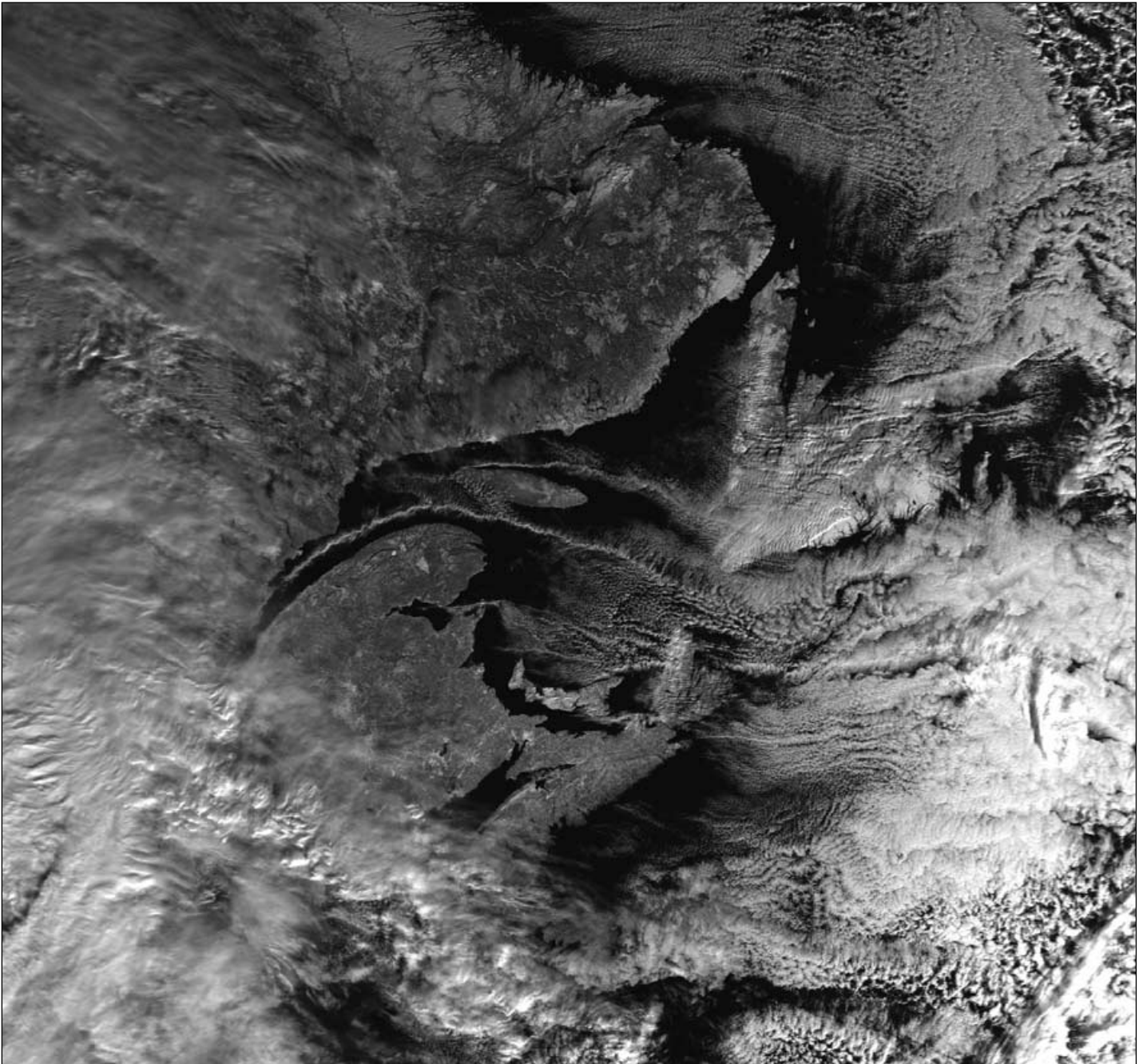*Image © EUMETSAT 2007*

Figure 5 - Iceland without the 'ice' - NOAA-18 on April 28, 2007
Image © EUMETSAT 2007

Figure 6 - Svalbard - NOAA-17 on May 1, 2007
Image © EUMETSAT 2007

BERNOULLI EFFECT

Observed in Cloud over the Gulf of St Lawrence

GEO reader **Keith Fraser**, who lives in Amherst, just outside Buffalo, New York, spotted an unusual cloud formation streaming down the Gulf of St Lawrence, on one of his NOAA-17 APT images. Keith, now retired, formerly worked as a pilot, and immediately recognised the pattern as being identical to the smoke streamlines observed in a wind tunnel Venturi as it flows over an airplane wing.

The airflow over the top curve of the wing is faster than that flowing beneath the wing, thereby causing a lower pressure on top; it is the higher pressure from below the wing that provides the lift that keeps the 'plane aloft.

Daniel Bernoulli (1700-1782) was working with liquids rather than air when he discovered this eponymous effect but it is equally applicable when the fluid is a gas.

In the satellite image above, cloud streamers sweeping past Anticosti Island, one closely following the full length of the Gaspe Peninsula then stretching far out to sea, are clearly an aerodynamic effect.

The image above is a channel-2 NOAA-17 obtained at 14:45 UT on December 12, 2007.

Image: NOAA CLASS Archive - http://www.class.noaa.gov

DIY Lightning Radar

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Having a general interest in the weather, I have always been fascinated by storms, and particularly the lightning associated with them. There are professional lightning detectors, the most well known being the *Boltek* system, which provides a radar-like display of the surrounding location and the position of lightning strikes. However, this system can cost around £300 and I wondered if there was a 'simple' DIY solution? A quick search on the Internet led me to Daniel Verschueren's *Lightning Radar Project* site at

http://users.edpnet.be/DanielV37/Detecteur3/

featuring a Lightning Radar (LR) based on a design and concept by Frank Kooiman

http://members.home.nl/fkooiman/lightning/

I have to say that these guys have developed the hardware and software for this project and I owe them much thanks for helping me to set up my own LR station. The purpose of this article is to describe the principal behind LR, the hardware required (including a surface mount design I have developed) and the setting up and use of the software.

The Concept

The LR system antenna consists of two loops with a resonant frequency of approximately 10 kHz; these are mounted 90° apart so that one can point north/south and the other east/west. Lightning strikes produce a distinct 'signature' that can be recognised by a software algorithm which eliminate spurious sources like car ignitions and central heating switches. The low frequency RF lightning signal arrives at the antenna and, depending on the direction, will generated a voltage in each loop.

Each antenna loop is connected to a simple circuit containing an op-amp, with the gain set close to 100, which is in turn connected to the line input of a PC soundcard. The specially written software can sample the signal arriving at the soundcard, decide whether it is a lighting strike, and if so, the direction from which it arrived. Also, depending on the signal amplitude, it can calculate how distant the strike was.

Unfortunately, using just two antennas gives rise to a 180° phase ambiguity in the received lightning signal. To overcome this problem, Frank's software is able to link up with another station (via the Internet) and, using a clock synchronisation routine, employing underline triangulation to pinpoint the direction of the lightning strike. This triangulation method has an accuracy of one degree. Figure 2 shows how two 'linked' stations can use triangulation to pinpoint the location of a lightning strike. It will only work if the two PC's have their clocks synchronised so that they detect the strike at the same time.

My system has been up and running for a few months now and when it is properly set up can give very accurate results. The latest software additions allow connection to the *Blitzortung* network [1]. Figures 3 and 4 show a comparison between my LR and the corresponding Blitzortung map. As you can see there is a very good correlation between the lightning strike maps which show a storm over Belgium.

The Copper-Pipe Loop Antenna

For a more robust and waterproof design, Daniel designed the copper-pipe loop antenna and figure 5 shows my more sturdy version. You can find all the constructional details for this

antenna on his website when you click the '*Hardware*' button.

I have built this antenna myself, specifically for an outdoor location. The antenna is made from four lengths of 15 mm copper tube bent into semicircles and mounted at each end in PTFE blocks. Connecting wire is then fed through the openings in the top and bottom blocks into the copper pipes to form each of the two loops. A diagram showing one of the twin loops is shown in figure 6. Note that the ends of each winding are twisted together (twisted pair) but, if fairly short, less than 15 cm, then the wires can be left free.

The diameter of the loop is 900 mm and each semicircular element is 1382 mm in length. A 1 µF capacitor connected across the winding of each loop should resonate the antenna to the correct frequency (around 10 - 11 kHz).

The PTFE blocks are fitted in the 32 mm wide gaps. Details on manufacturing the PTFE blocks and more information on this antenna can be found on Daniel's '*Hardware*' page.

Hardware Electronics

The electronics for the LR are very simple and consist of two identical low noise op-amp circuits each with a gain of 100. The op-amps require a dual voltage supply of ±15 V from a PSU sited indoors and fed to the op-amp circuit at the antenna.

The PSU Design

If the whole system is to be sited indoors, in a loft for example, then the circuitry could be easily built on *Veroboard* using leaded components. The surface mount (SM) design described below is based on Daniel's circuit. To simplify the build of the system, I designed a surface mount version of Daniel's LR design (figure 12 and 13). The top view, with component identities, is shown in figure 18. Figure 14 shows the system connections to the PC via a stereo 3.5 mm plug. Connection between the PC/PSU and the antenna-mounted LR PCB was made via four individually screened audio leads.

Note that the SM circuit is built on double-sided standard FR4 PCB board with the underside ground-plane remaining intact to allow earth connections. The earth connections of the component side are completed by drilling a 0.8 mm hole through the board and linking the two layers with a piece of copper tape or wire. The PCB layout is shown in Figure 16 and the completed PCB assembly in figure 1.

Figure 1 - The completed SM LR PCB

Most of the parts are easily sourced through component suppliers like *Maplin* and *Farnell*. Table-1 (page 36) lists the parts for the amplifier-regulator section. The values of R4 and R9 are set to 100k which gives each amplifier a gain of 100,
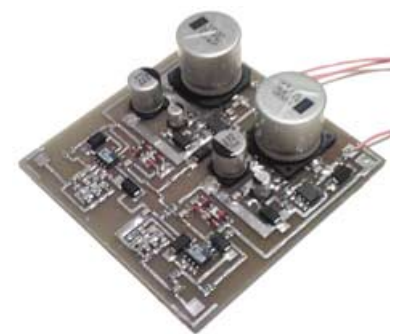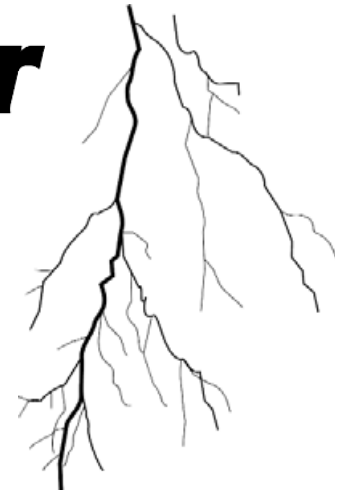
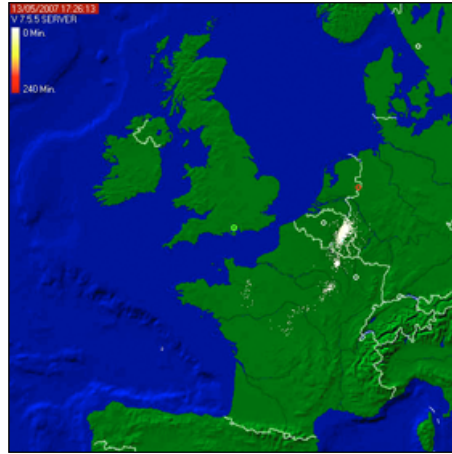Figure 2 - Lightning Location by Triangulation

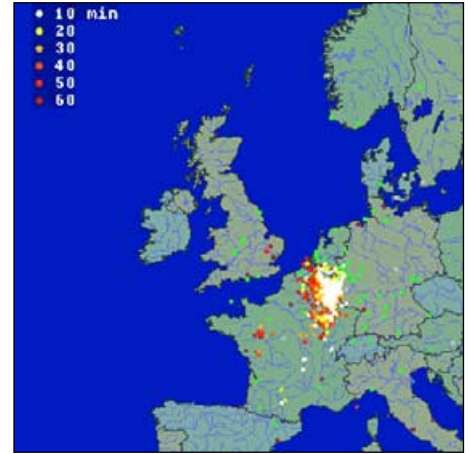Figure 3 - The author's Lightning Map

Figure 4 - The *Blitzortung* Lightning Map

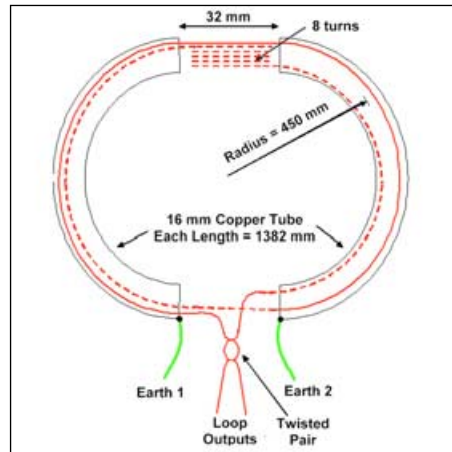Figure 5 - The Copper-Pipe Loop Antenna
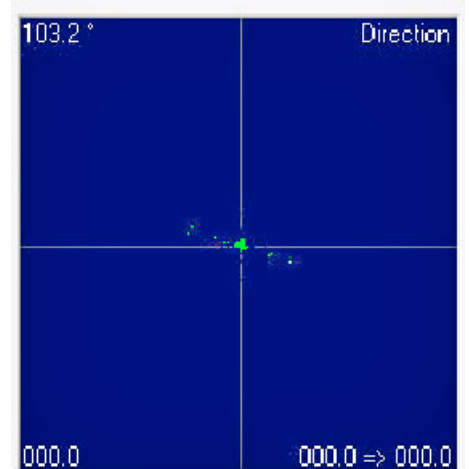

Figure 6 - Schematic: Copper-Pipe Loop Antenna

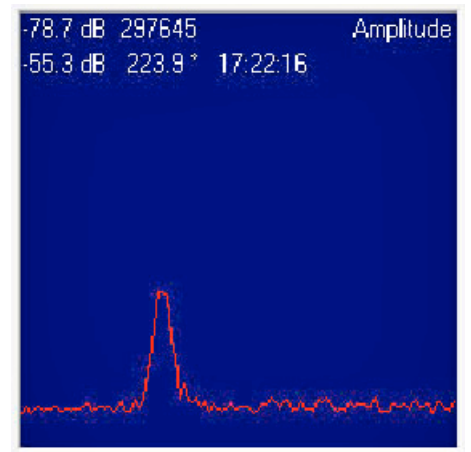Figure 8 - A strike detected

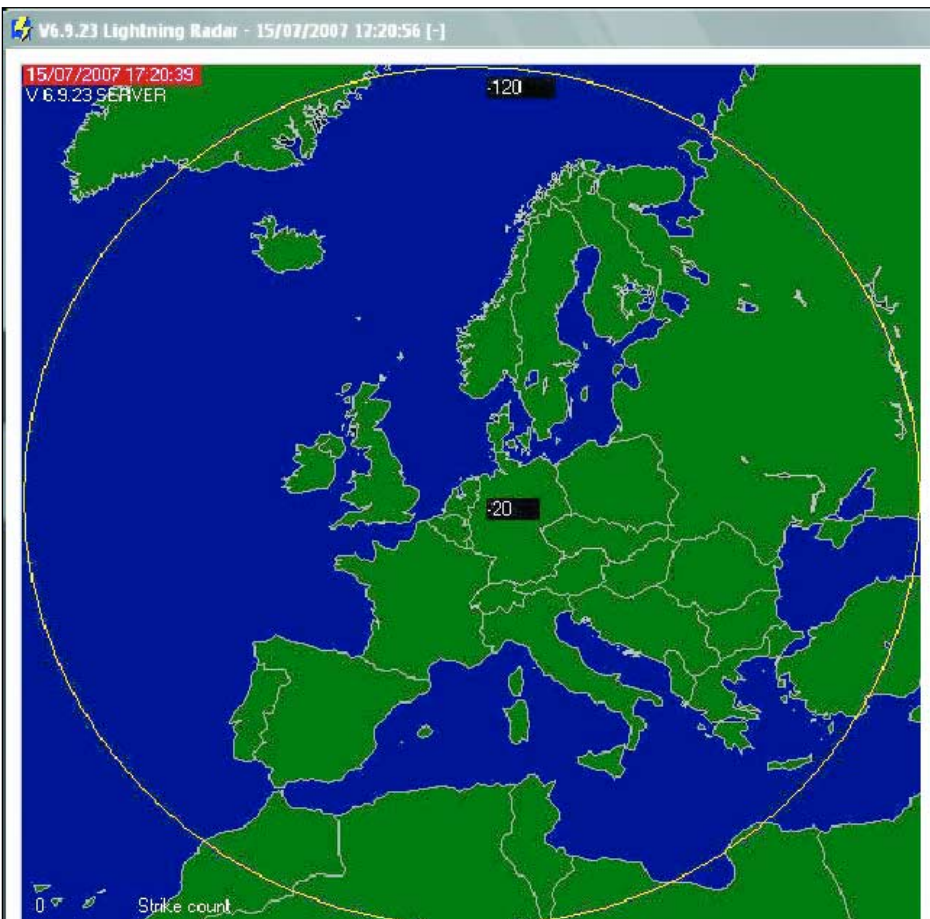

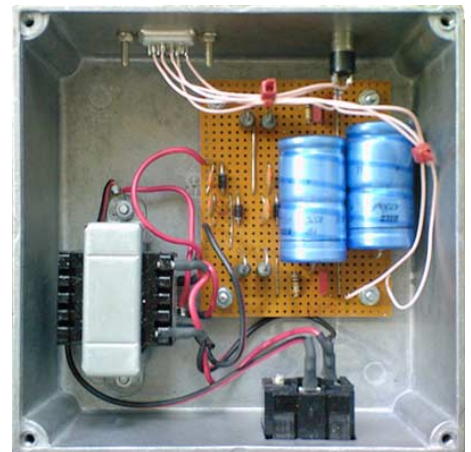Figure 7 - The initial radar screen shown when first running LR

Figure 9 - The prototype PSU

which seems to be a pretty optimum value. No alignment is required with this design. However, it is <u>very important</u> that the PCB is thoroughly sprayed with a conformal coat of lacquer to ensure it is absolutely waterproof. I am hopeful that a populated and tested LR Antenna amplifier PCB assembly will be available from the *GEO Shop*.

The PSU Circuit

The PSU provides an unregulated ± 20V to the LR circuit board sited at the antenna. The circuit diagram is shown in figure 15 and the parts lists in table-2 (page 36). The transformer has two 12-0V windings that are wired to give ± 20 V a.c. The rectifier components are mounted on a small PCB. My prototype, which used a simple *Veroboard* layout, is shown in figure 9 (a PCB has been designed for future builds). The voltage outputs are connected to a 9-way *Cannon* plug (top left) and this connector is used to receive the right and left channels from the antenna PCB. In addition, a 3.5 mm stereo socket connected to the *Cannon* socket is located at upper right so that the strike pulses from the LR circuit can be fed into the PC soundcard. The audio cable to the PC is connected to this socket. The IEC mains connector, with fuse, is at the bottom right. As a precaution, two additional fuses have been added to the +20 V and –20 V outputs in case of cable shorts.

It's a good idea to fit fuses all round, especially as our new dog decided to chew through the LR cable causing one of the rectified voltages to short—and resulting in a very hot PSU unit.

There is no requirement to use the PSU design given here. Some LR operators have simply used two mains unregulated power supplies. Such a power supply suitable for this application is *Maplin's* 24 V, 500 mA unit (order code *N88AT*).

There will still be a need for a small box, the purpose being to provide a socket for the LR data/PSU cable, sockets to connect the two PSUs and a 3.5 mm jack socket to permit an audio connection to the PC. The wiring inside this box connects the PSU and jack sockets to the LR data/PSU cable socket (the aforementioned 9-way *Cannon* socket).

The PSU PCB

As described above, the original PSU section was built on *Veroboard*. My latest design uses a single-sided PCB measuring 85 ^{x} 75 mm; the component side is shown in figure 16 and the foil side in figure 17. (The 4 fixing hole positions are 65 ^{x} 65 mm). The PCB is mounted in a die-cast box with the mains fed through a fused IEC connector. The a.c. mains is wired to the primary of the transformer. You must ensure that any exposed connections are insulated with heat-shrink sleeving. Make sure that the secondary transformer connections are made correctly, so that the rectified voltage outputs of the PCB are approximately +20V and –20V. The completed PCB assembly is shown in Figure 10.

Figure 10
The completed PSU PCB

The circuit diagram (figure 15) shows the suggested *Cannon* pin connection numbers to be used. Two pins on the connector supply the audio from the LR amplifiers and connect to the stereo 3.5mm audio connector. You also require a lead to link the PC to the LR amplifier. I used 4-core screened cable (*Farnell* 389-4745) although you could in fact use twin screened audio cable as the current taken by the LR is very small.

The 'Lightning Radar' Software

The software written by Frank determines whether a strike has occurred and uses triangulation with another station to plot the strike on a map. The audio output cable connects to the soundcard 'Line' input (usually denoted by a green connector). Ensure that the line is activated and <u>set it to maximum</u> using Windows sound recording options. Also, if you have a firewall running (software and/or router), you must make sure that port 4711 is free. This will enable the LR software to communicate with another station; otherwise, there will be no triangulation process and the plotted strike direction will be meaningless.

Once you have constructed the hardware, it is time to install and set up the *Lightning Radar* software, which can be downloaded from.

http://members.home.nl/fkooiman/lightning/index.htm#5

Click menu item No 6 at the top of this page ('Software Downloads'), which takes you to the 'Download Lightning Radar Software' section near the foot of the page. Click the link to download the current full version, *V.6.7.25Setup.zip* and install it. The program is constantly being updated and you may also also download and install the latest update patch, currently *V 7,12,5.zip*, which should be saved into the existing application folder. Note that these version numbers may well have been updated by the time you read this.

If you experience difficulties obtaining the software, feel free to email me and (***john@jps.myzen.co.uk***) and I can forward copies to you

Initial Startup

This section assumes that you have the latest version of the software installed. The screenshots below refer to version 7.12.5. When first running LR it will open with a default radar screen (figure 7). Set the centre value to –20 and the outer value to –120.

An instruction manual on how to generate your own radar map can be found at

http://users.edpnet.be/danielv37/Detecteur3/Forum

Download the file '*Step 6 - How to build a map.pdf*'.

Setup Gain

You need to ensure that a signal is being received by the soundcard and that the level is set correctly in LR. To start with, connect the LR audio lead to the 'Line' input of the soundcard, <u>not</u> the 'MIC' input and use Windows *sndvol32.exe* utility to ensure that the recording level of the 'Line' input is set to maximum.

Next, select the LR gain window and insert the details shown in figure 11 (these values are a good starting point).

If lightning strikes are being received you should be seeing the sort of patterns shown in figure 8; if not, and you get a flat line all the time or nothing at all, then either the lightning radar is faulty, there is a broken wire, or there is a problem with the soundcard setup.

Figure 11 - The LR gain settings dialogue

Note: A small utility called *Sound Input* should be running, showing a blue bar for 'bu' at about 10% and green bars for 'vl' and 'vr' at about 1%.

General Settings

Figures 22 to 23 show screen dialogues from the LR program which illustrate good starting settings.
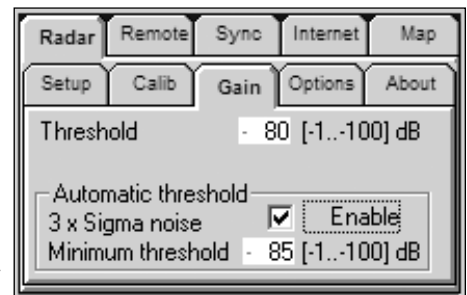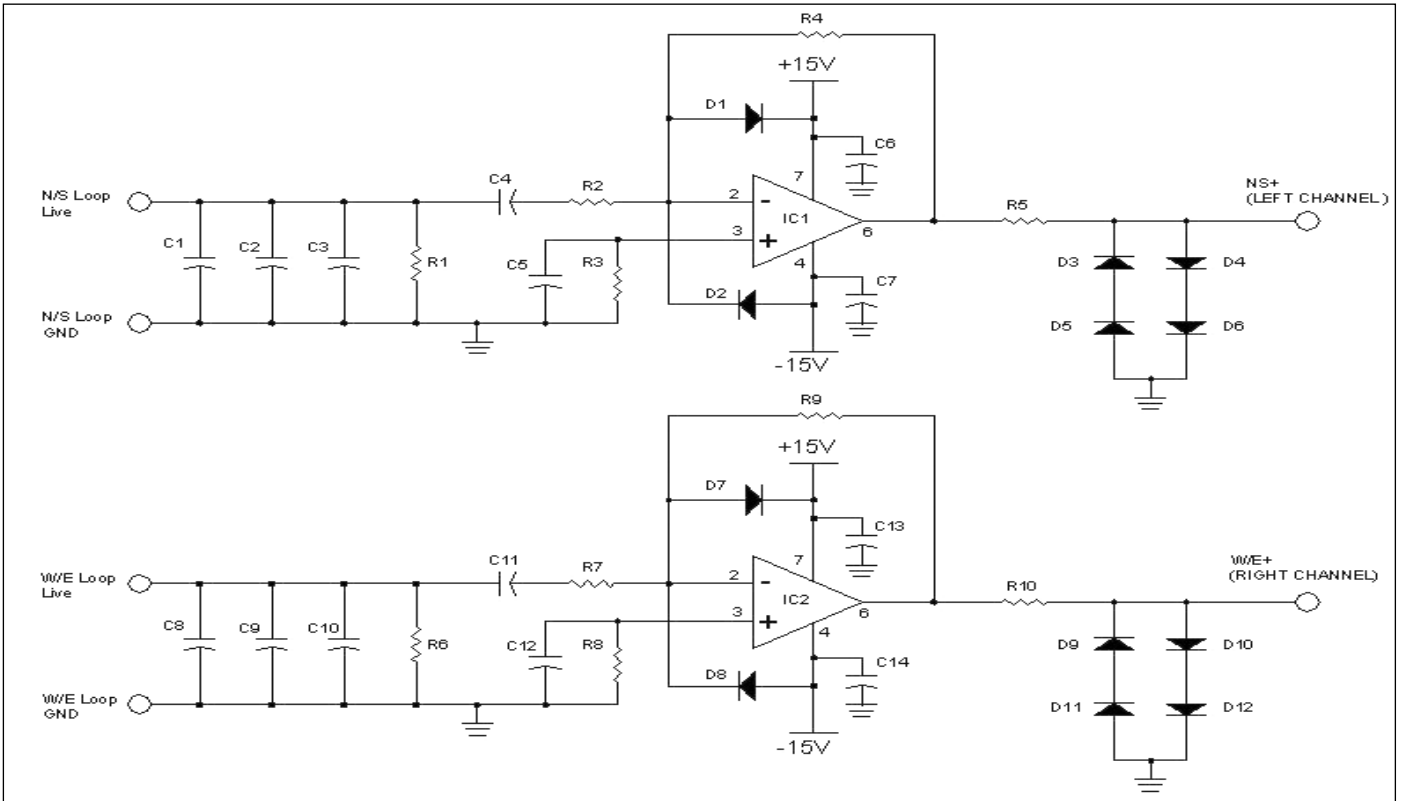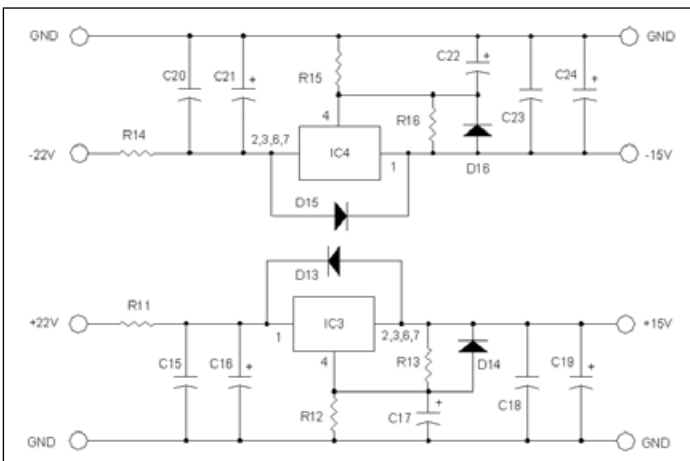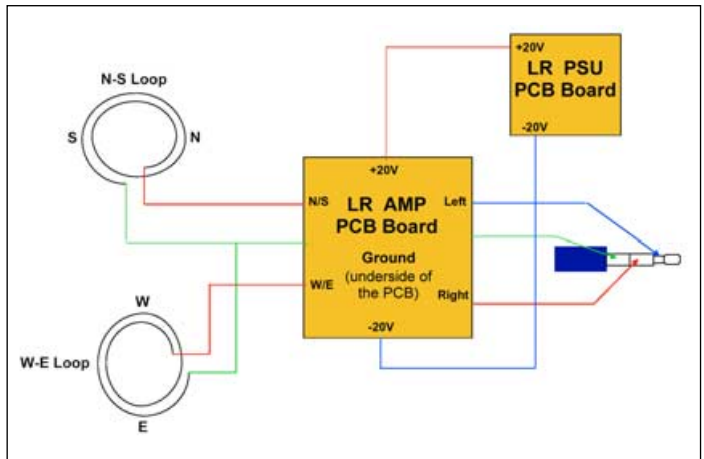
Figure 12

Figure 13

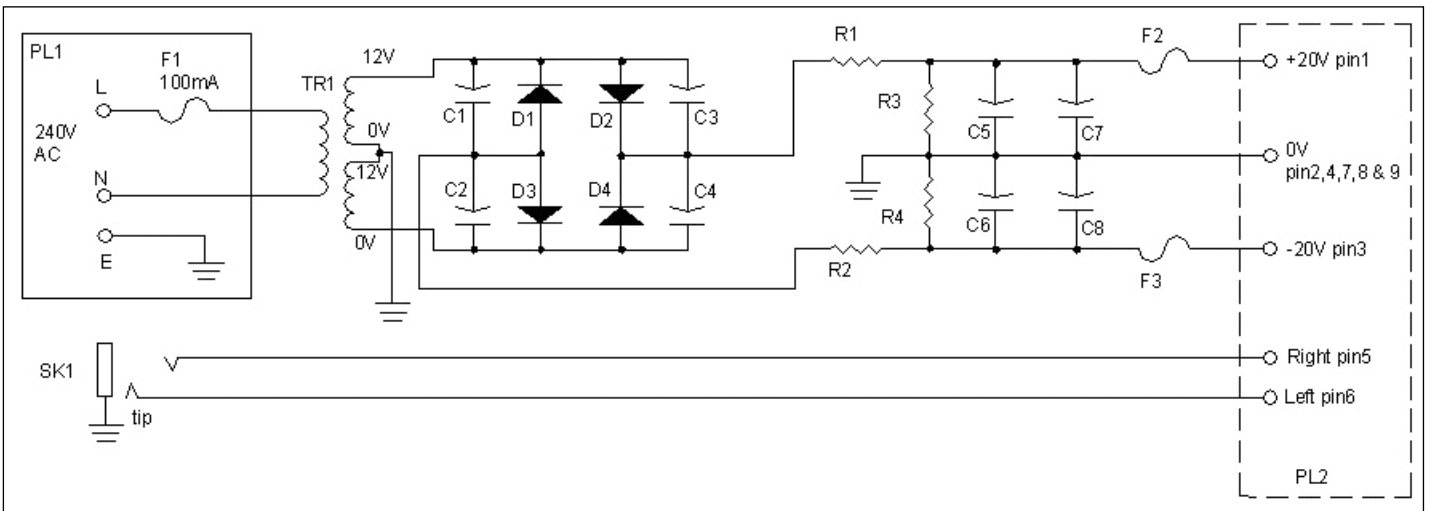Figure 14 - The wiring of the LR and PSU modules to the PC and antenna.

Figure 15 - The PSU section circuit diagram. The components are mounted on a small PCB in a diecast box.
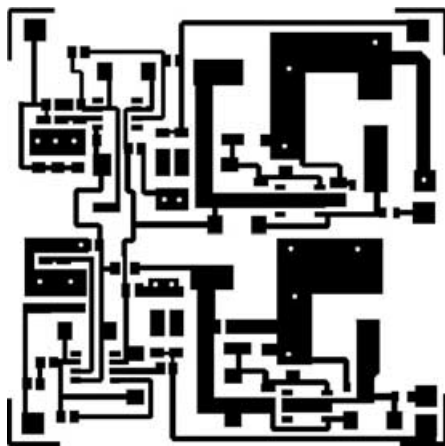The 100 mA Fuse (F1) is part of the IEC mains input plug, SK1.

Figure 16 (Actual size)
The PCB foil track side of the LR SM PCB (the reverse of the PCB is continuous copper ground-plane). There are 17 via thru holes, which are made by drilling a 0.8 mm diameter hole and linking the top track to the rear ground-plane using thin strips of copper tape (or tinned copper wire). PCB size is 58mm by 58mm.
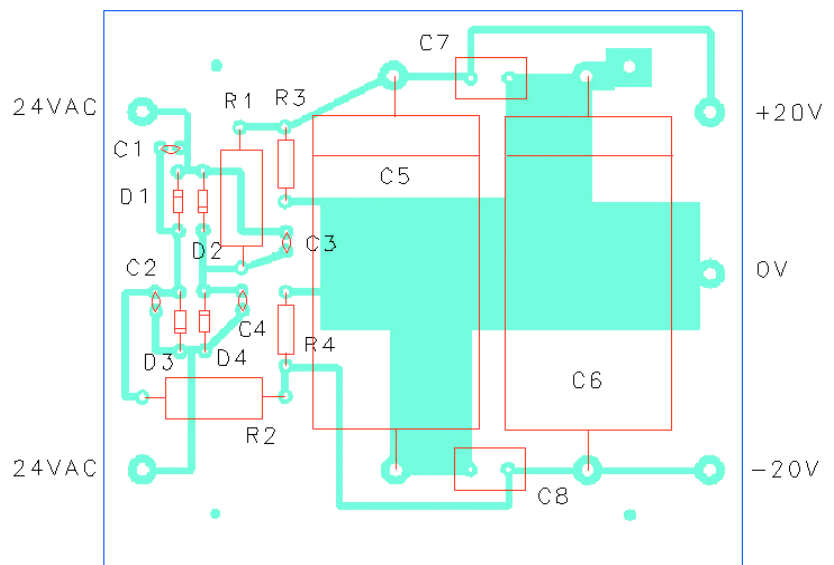

Figure 17
The component positions for the PSU PCB section (actual size).
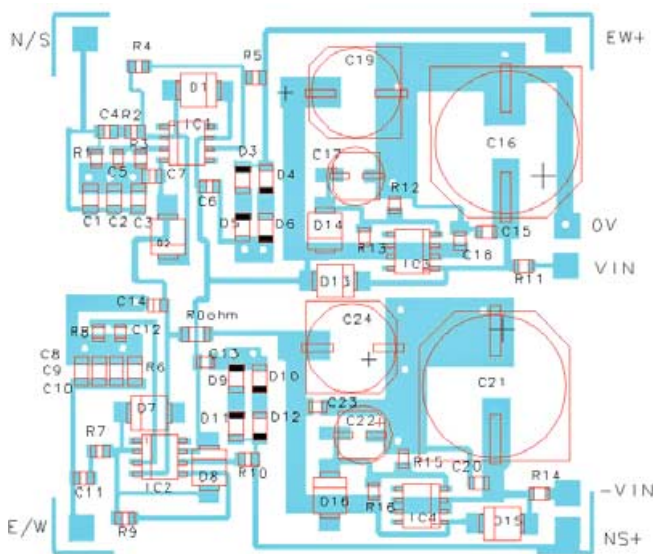Note the line on C5 and C6 signifies the positive end of the capacitor.

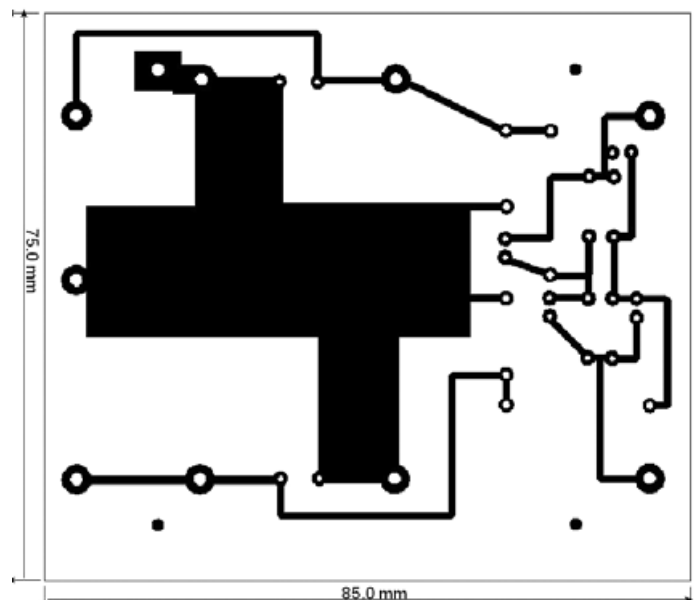**Figure 18**
The PCB component schematic (actual size)

Figure 19
The PCB foil pattern (actual size) of the PSU section. This is what you need to <u>see</u> on the copper clad side of the PCB.

Internet Settings

This dialogue (figure 24) allows data to be uploaded from the user's own FTP site to Daniel 's website. First, enter your FTP site address in the '*FTP to*' field, then edit the file '*Publish.cmd*', found in the LR folder.Initially, it looks like this:

```
<username>
<password>
send "picture5.png"
send "picture4.png"
send "picture1.png"
bye
```

Enter your FTP username between the angle-brackets in the topmost field and the corresponding password between the second set of angle-brackets.

Next, add the instruction '*cd Lightning_radar/*', the address of the folder **on <u>your</u> FTP site** to which you intend to upload the pictures. This must be followed by the instruction 'binary' to establish the mode of transmission. Finally, just prior to the 'bye' command, add a line such as

send "C:\Program files\ LightningRadar\Data\picture8.png"

```
<ftp.username.isp.co.uk>
<mypassword>
cd Lightning_radar/
binary
send "picture5.png"
send "picture4.png"
send "picture1.png"
send "C:\Program Files\
    LightningRadar\Data\picture8.png"
bye
```

Your edited '*Publish.cmd*' file should now look something like the above. This script will upload your plots on to Daniel's website.

Forum

Although the software does not possess a full help file, there is a forum to assist would-be LR builders at

http://foudre.chasseurs-orages.com/ viewforum.php?f=45

Conclusions

This article describes the construction of a simple lightning radar capable of results similar to commercial systems like *Boltek*. Although SM components can be somewhat fiddly to use, they do result
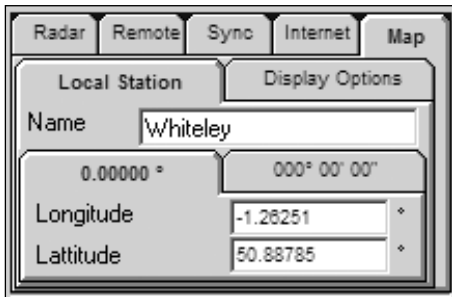
Figure 20 - Enter the coordinates
of your Station Location

Figure 21 - Selecting a high-pass filter, which
helps to eliminate spurious sources
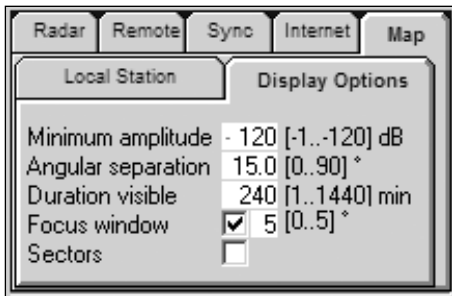

Figure 22 - Calibration Settings

Figure 23 - Display Options

The *Minimum amplitude* matches that entered on the radar diagram; *Duration visible* is the number of minutes to show the strike before erasing it; *Focus window* uses software to pinpoint clumps of strikes; *Angular separation* is a parameter that can be varied to remove spurious strikes.

Figure 24 - Internet Settings

in a very compact design that can be housed within a box at the antenna. In addition, I found that using an SM design made it at lot easier to waterproof the active antenna circuit (by spraying the completed PCB with *Conformal Coat*), So far, my unit has survived the very wet weather experienced during the 2007 summer.

The author of the software is continuing to develop it, removing bugs and adding extra functionality (most recently, a link to the *Blitzortung* storm site [1]. The latest version now has a drop and drag feature under the calibration menu. The user can locate a local storm (either from the *Blitzortung* site or a local *Boltek* site) and drop and drag the corresponding storm on to the correct position on their own LR map.

Reference

1   Blitzortung - *http://www.blitzortung.org*

Component	Quantity	Part type	Part Package	Part Source
R1, 2, 5, 6, 7, 10	6	1k Resistor	0805 SMT	
R3, 8	2	10k Resistor	0805 SMT	
R4, R9	2	100k Resistor	0805 SMT	
R12, 15	2	1k1 Resistor	0805 SMT	
R13, 16	2	100R Resistor	0805 SMT	
R11, 14	2	10R Resistor	0805 SMT	
R 0 ohm (figure 11)	1	0 ohm link	1206 SMT/wire link	
C1, 2, 8, 9	4	470nF Capacitor	1210 SMT	
C3, 10	2	150nF Capacitor	1210 SMT	
C5, 12	2	1nF Capacitor	0805 SMT	
C4, 11	2	10nF Capacitor	0805 SMT	
C6, 7, 13, 14, 15, 18, 20, 23	8	100nF Capacitor	0805 SMT	
C16, 21	2	1000µF, 35V Capacitor	SMT Case J16 (Range FK Panasonic)	Farnell 9695982
C17, 22	2	10µF, 50V Capacitor	SMT Case D (Range FK Panasonic)	Farnell 1244410
C19, 24	2	330µF, 25V	SMT Case F (Range FK Panasonic)	Farnell 1244418
D1, 2, 7, 8, 13, 14, 15, 16	8	Schottky 60V, 1A	SMT Case SMB	Farnell 4213038
D3, 4, 5, 6, 9, 10, 11, 12	8	1N4148	SMT	RS
IC1, IC2	2	OP27GSZ	SMT SOIC-8	Farnell 942612
IC3	1	LM317LM	SMT SOIC-8	Farnell 9488537
IC4	2	LM337LM	SMT SOIC-8	Farnell 9485945

Table 1 Parts list for the antenna amplifier PCB

Component	Part type	Suggested Part Source
T1	12-0, 12-0 Transformer 6VA each winding	Maplin N01CF
F1	100mA, 20mm fitted into IEC chassis socket SK1	Maplin GJ72P
F1, 2	100mA, 20mm fuses and chassis sockets	Maplin GJ72P & GU73Q
PL1	IEC mains plug and fuse holder	Maplin FT37S
SK1	3.5mm Stereo Jack socket	Maplin FK03D
PL2	9-way D-sub plug + lock posts	Maplin RK60Q & FP31J
SK2	9-way D-sub socket & Hood	Maplin RK61R & KE94C
D1-D4	1N4007	Maplin QL79L
R1, 2	Resistor 6.8 ohms, 5 W	
R3, 4	Resistor 100k, 0.25 W	Maplin M100K
C1-C4	Capacitor Ceramic 100pF, 100V	Maplin WX56L
C5, 6	Capacitor Electrolytic 4700uF, 35V	Maplin AT24B
C7, 8	Capacitor Polyester 220nF, 100V	Maplin BX78K
	Diecast case, PCB, Nuts, Bolts etc	
	4-core screened cable	

Table 2 - Parts list for the PSU section

Falkland Reminiscences

Recollections of a Meteorologist's Visits to the South Atlantic

Peter Wakelin

The recent sinking of *MS Explorer* following a collision with an iceberg near King George Island reminded me of my several tours of duty to the Falkland Islands following the conflict with Argentina in 1982. During my three years at RAF Mount Pleasant I made several flights in Hercules C130 aircraft to the South Sandwich Islands and South Georgia. I also made a very memorable flight down the incredibly beautiful Antarctic peninsula.

Background

The remote Falkland Islands, east of the southern tip of the South American continent and its even more remote Dependencies of South Georgia and the South Sandwich Islands, made world news headlines after Argentinian scrap merchants landed at Leith, South Georgia, on March 18, 1982 and raised the Argentinian flag. On the 20th, HMS Endurance left Stanley, Falkland Islands, for South Georgia, carrying Royal Marines who observed other Argentinian shipping off the coast of South Georgia. At 0430 hours local time on April 2, Argentinian Forces started landing near Stanley, the capital and only community of any size in the islands, with a population of about 1,100 persons.

During April, the Task Force, ordered by British Prime Minister Margaret Thatcher, was prepared and despatched southwards and on May 1st the effort to retake the Islands began when Vulcan bombers from Ascension Island (8°S, 15°W) bombed Stanley airfield. During six weeks of intensive military activity numerous ships were destroyed and over 1,000 persons died before the surrender on June 14.

Local meteorological services for the support of British military activities during the conflict, and for nearly four years afterwards, were provided by the Met Office's Mobile Meteorological Unit (MMU), staffed by volunteers on Special Commissions and in uniform. In April 1986 the MMU team was replaced by civilian volunteer staff on five-month tours of duty. I was amongst the first group of forecasters to go and enjoyed it so much I went down seven times in four years. By 1986 a new airfield was nearing completion some 70 km from Stanley which enabled RAF Tristar aircraft to operate on the entire route between the UK and the Falklands.

The Antarctic Peninsula near Brabant Island

Anvers Island off the Antarctic Peninsula

Falklands Weather

At latitude 52°S the islands are about the same distance from the equator as southern Britain. But with no equivalent of the North Atlantic's Gulf Stream in the South Atlantic, and the proximity of ice-bound Antarctica, Falklands' weather is more akin to that of northern Scotland or the Faroe Islands. The treeless and extensively peat-covered terrain resembles the Scottish moors too. Prolonged settled weather is rare and snow cover rarely persists for more than a few days except on the peaks which reach about 700 m. In summer, dry, northwesterly winds from Patagonia occasionally bring pleasant, warm days to the islands with temperatures topping 20°C.
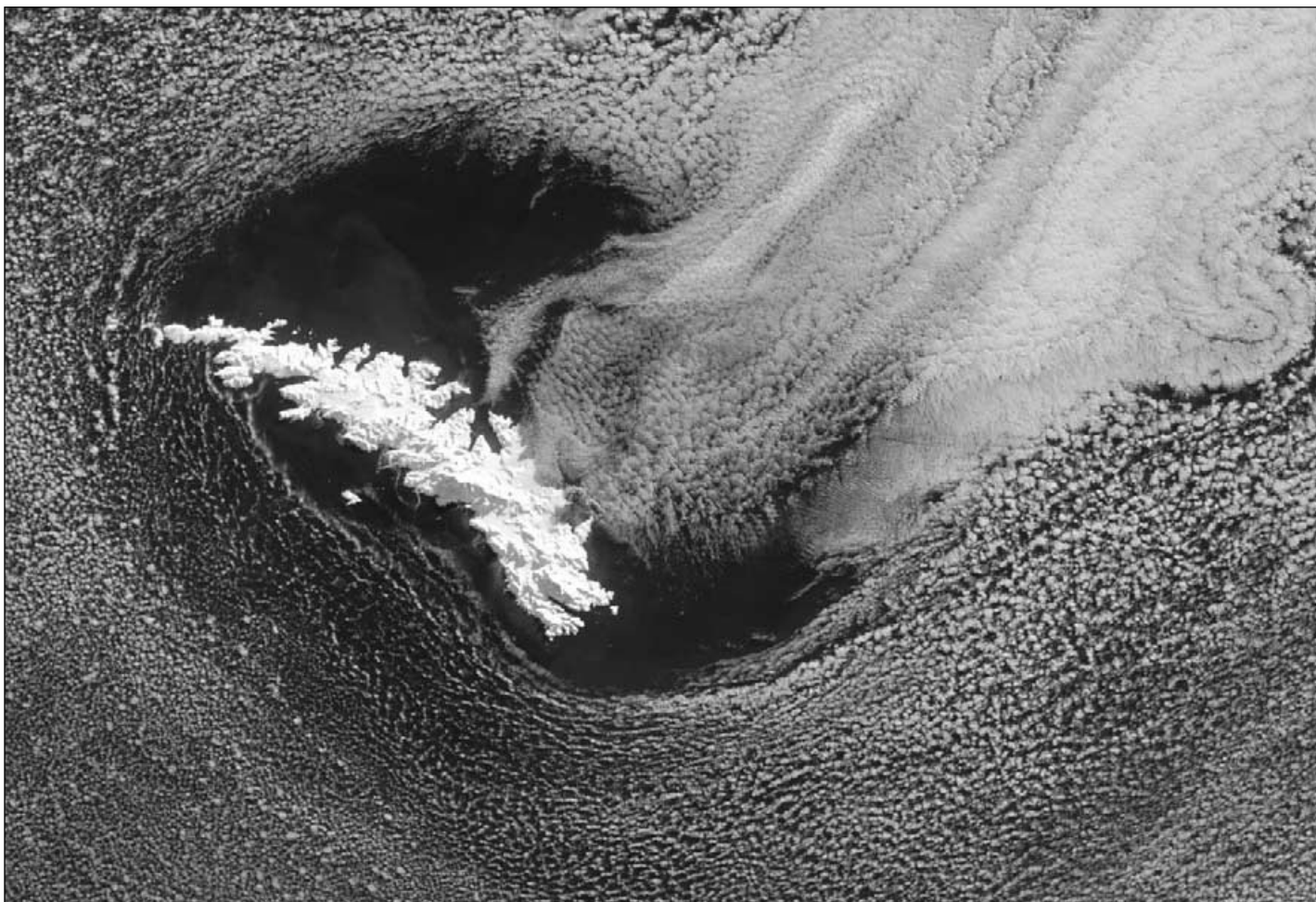
Wind circulation around South Georgia forms a cloud-free zone in which the whole island is visible   *Credit: NASA GSFC*

The influence of the Antarctic continent effectively confines the temperate-climate zone to a narrower latitude band than in the north. Also, the Andes mountain range is an effective barrier to the predominantly westerly flow. At the time, numerical weather prediction was advancing steadily and forecast accuracies in the northern hemisphere were very good but Bracknell's computer output for the South Atlantic region was of limited value. Consequently, forecasting was challenging to say the least, but it was a nice change from working at Heathrow where, with only rare exceptions, computer output had to be followed .

A few weather reports were available in the region but the biggest aid was satellite imagery. Fax machines of the Muirhead type using electro-sensitive paper were the standard in those days and resolution was poor. The Falkland Islands are very close to the edge of Meteosat's field-of-view and the images from GOES East rarely extended far enough south to be useful. Polar-orbiting satellites were the best for the area but radio interference on 137 MHz was a serious problem. However, by trying for every pass from all the transmitting satellites, including the Russian ones, we usually had some recent data to work on.

Flying Opportunities Within the Falklands

Met Office staff are always encouraged to fly as much as possible to observe the weather from a different aspect and opportunities arose often. Apart from the two main islands, East and West Falkland, 15 of the the smaller offshore islands are populated with a few sheep farmers. FIGAS, the *Falkland Islands Government Air Service,* operated small fixed-wing aircraft to link these outlying settlements to Stanley and, space permitting, would sometimes drop in at the RAF airfield to pick up Met staff. A small, high-winged Dornier aircraft was operated for the Falkland Island Government to monitor fishing activities and ensure licensing compliance. Based on the RAF airfield, it was easy to get flights on this plane and see some of the remote islands in the archipelago.

Helicopters were extensively used to supply the remote military outposts and it was easy to get a seat on them too. I'd sometimes get dropped off 30 or 40 km out and walk back to base, following sheep's tracks where possible as it's hard work walking through the tough grass and *diddle dee*, a woody sub-shrub from which the bulk of the peat deposits have formed. The Argentinians did lay extensive minefields during the conflict, mostly near Stanley, but were later able to provide maps of the affected areas which were subsequently fenced off. Caution still needed to be exercised though as there was still much unexploded ordnance lying around.

A reminder of past hostilities

Opportunities to fly aboard the Hercules C130 aircraft arose occasionally, and I made three flights down to South Georgia, the primary mission of which was to drop supplies and mail to the small British garrison at Grytviken (which has no landing strip). On another occasion, the weather was too poor to attempt a drop but the flight continued southeastwards to the South Sandwich Islands to check for signs of Argentinian activity.

South Georgia

The submerged Scotia Ridge extends eastwards from the southern tip of Argentina, just breaks surface at Shag Rocks then rises to end in a magnificent mountainous arc at South Georgia. Mount Paget, at 2934 m, is the highest point but most of the island is high enough to be permanently icebound; only on a narrow coastal strip around bays on the sunny northern side is there much in the way of vegetation.

This part of the South Atlantic is rarely free of cloud but, even if the island itself cannot be seen on a satellite image, its location

Map showing the principal islands discussed in this article

can often be ascertained by wave patterns in the cloud or, sometimes, a complete clearance of cloud on the lee side of the islands—created when air is forced up and over the island and then dries out as it descends causing cloud to evaporate. On rare occasions, as the accompanying image shows, the entire island can be seen through a hole in the cloud sheet created by air motion around the island. Local winds around an ice-capped island often lead to extremely turbulent conditions so the flight into Cumberland Bay, where Grytviken is situated, is made cautiously but with plenty of power on to get out of trouble if it arises. Strong down-draughts are especially hazardous to low-flying aircraft but crews are trained to look out for areas of unusually rough patches of sea which may be indicative of down-draughts.

South Sandwich Islands

Almost 800 km southeast of South Georgia lies an arc of small volcanic islands discovered by Captain Cook in 1775 and named Sandwich Land after the 4th Earl of Sandwich who, at the time, was the First Lord of the Admiralty. He discovered the eight most southerly islands but Fabian Gottlieb von Bellingshausen found three more in 1819.

These islands are geologically very young, about 5 million years old, and lie in some 2,600 m of water on the small Sandwich tectonic plate which is moving east and over-riding the South American plate. The ocean trench created at this subduction zone, which lies just east of the island chain, reaches depths in excess of 8,000 m.

Although the the most southerly island, Cook Island, is north of latitude 60°S, the climate is harsh due to wind and ocean currents coming from the Weddell Sea. Most islands are glaciated to a considerable depth but the smaller northern ones are almost ice-free during the short summer. Unsurprisingly, the islands are not permanently inhabited but they do attract scientists from several disciplines during the summer months. Only Zavodovski Island, in the north of the group was showing any signs of volcanic

activity during my visit but, more recently, the 1,370 m Mt Belinda on Montagu Island has been very active. Montagu was already the largest in the group when eruptions began in 2002 but, more than 5 years later, lava flows continue to increase its size.

On my flight the weather was overcast and dull, and only four islands were well seen. Fine weather is rare but, as in the case of South Georgia, the presence of the islands is often detectable in satellite images by their influence on the clouds and, on rare occasions, this influence is quite spectacular as the accompanying image shows. A stable airflow passing a mountainous island is disturbed in much the same way as a water surface is disturbed by a ship and these wake waves can persist in clouds for hundreds of kilometres before dissipating. This image, acquired by the MODIS instrument on NASA's Aqua satellite on January 27,

2004, is dominated by the waves created by Montagu Island but as only about 70 km separates the islands, interference patterns are formed where the waves diverge and meet one another. Although the wake patterns are moving almost due east in this image, there is evidence of another force at work resulting in a NW-SE alignment of cloud. A thermal image would almost certainly show a thin, higher cloud layer. Another image of South Sandwich Island waves, and an explanation of the mechanism involved, written by Les Hamilton, appeared in GEO Quarterly No 11, September 2006.

The Real Antarctica

Military aircraft are normally precluded from going south of latitude 60°S but when urgent medical supplies were needed on HMS Endurance, the UN did authorise a flight. Leaving the Falklands before dawn on a late summer's day, we reached cruising height just as the sun showed over the horizon: and what a bright sun it was too! Being so far from man-made pollution, the air is extremely clear and visibility is limited only by the curvature of the Earth. It was not long before the peaks of King George Island pierced the southern horizon but it took another hour to reach there. With no air traffic controllers to bother them, the crew had complete freedom of the skies and we flew at low, sometimes very low, level down the western side of the peninsula, just east of Brabant and Anvers Islands and on towards Adelaide Island (indicated by the arrow near the left edge of the accompanying Meteor image). HMS Endurance, with its bright red hull, was easily spotted sheltering close to the east side of the island not far from the UK's Rothera research station.
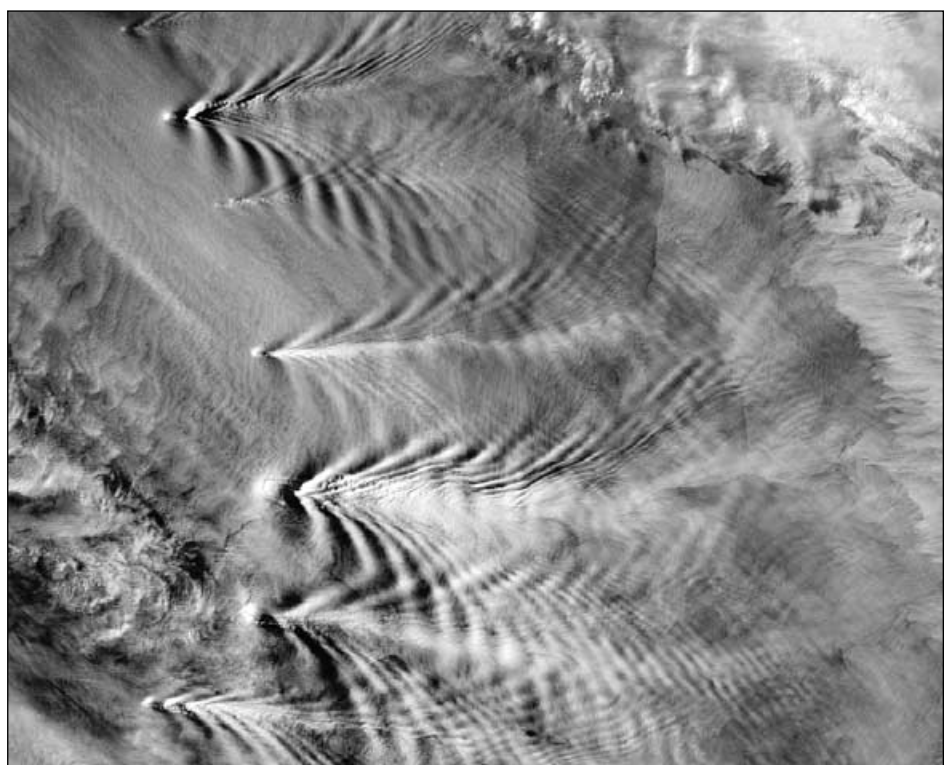
South Sandwich Island Wakes
Credit: Jacques Descloitres, MODIS Rapid Response Team at NASA GSFC

Part of Montagu Island, South Sandwich Islands.
Ice thickness estimated at 60 m

HMS Endurance sheltering off Adelaide Island

Candlemas Island, South Sandwich Islands

Banking steeply after a late-winter drop at Grytviken, South Georgia

Dropping supplies at Grytviken, South Georgia

Grytviken, South Georgia, in late summer

The author with an inquisitive striated caracara, one of the
World's rarest birds of prey

The supply drop, in perfect weather, was successful and the return flight began along a track slightly further east of the southbound one enabling distant views of the vast ice-shelves on the eastern side of the peninsula. Flying at low level, even at low temperatures, uses a lot of fuel and, even though we were enjoying superb weather with only small amounts of high cloud, landing conditions back in the Falklands were deteriorating rapidly. In order to have enough fuel to reach Montevideo, Uruguay, our primary diversion airfield, a tanker aircraft was despatched and we took on fuel near King George Island. After a superb day in bright sunlight, we landed in very marginal conditions at RAF Mount Pleasant.

In-flight refuelling near King George Island.

A mid-summer image of the Antarctic Peninsula and Weddell Sea received at RAF Mount Pleasant on December 28, 1988 and including Adelaide island (arrowed)

The summer *Meteor* image opposite, received in the Falklands during one of my visits, well shows the edges of the peninsula's ice-shelves as they were almost 20 years ago. The huge, tabular 'bergs at the bottom of the picture had broken from the Filchner shelf and grounded in shallower water. The clock-wise circulation, known as the Weddell Gyre, is evident in this image; ice is moving westwards in the south and then turns north. A comparison with more recent images will show significant changes to the ice edges in the last 20 years, especially to the Larsen shelf, across the peninsula from Adelaide Island, which has now largely disappeared.

Falklands Wildlife

Finally, no writing about this part of the world is complete without a mention of the diverse wildlife from the tiny tussock birds, which are so tame they may perch on your camera when trying to photograph them, to the mighty whales of the southern oceans. The penguins are always fascinating to watch but my favourites are the huge black-browed albatross which come ashore only in the breeding season. Fearless of humans, they raise no objection to your walking carefully through a nesting colony. A few of the smallest islands have never had sheep on them and retain the tall, native tussock grass which is ideal for seals and sea-lions as well as numerous bird species. As elsewhere, over-fishing is now a major concern and many species are suffering as a result but, hopefully, sanity will prevail and the balance of nature will be conserved for centuries to come.

Cover and Full-Page Images

Front Cover

Foxe Basin, southwest of Baffin Island, imaged free from sea ice at the height of the summer melt season on September 23, 2007.

Image: MODIS Rapid Response Team at NASA/GSFC

Inside Front Cover

On December 16, 2007, a fire just west of Dunkirk sent a huge column of smoke skyward, which fanned out in a streamer completely straddling the English Channel. This 250 metre resolution MODIS image was obtained by NASA's *Terra* satellite at 11:05 UT.

Image: MODIS Rapid Response Team at NASA/GSFC

Inside Back Cover

Twin depressions march across Europe (top) while a spectacular smoke plume rises from forest fires in Greece (bottom). See John Tellick's article on page 28 for further commentary.

Both images © EUMETSAT 2007

Back Cover

Just two days before Christmas, Robert Moore spotted an exceptional image of the Kamchatka peninsula amongst his Metop-A images and alerted *GEO-Subscribers*. It was so exceptional that we just had to reproduce it here. John Tellick provided this colour composite copy, where, totally devoid of cloud, this ice-encased region displays its backbone of volcanos to dramatic effect in the early light of dawn.

*Image © EUMETSAT 2007*

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Keith Fraser, who lives in Buffalo, NY, keeps a regular eye on the Arctic via his APT station. On December 1, he obtained a NOAA-17 image showing new ice building up in a rim around Hudson Bay which prompted him to seek out this strikingly detailed Terra MODIS image of the same scene.

Image: MODIS Rapid Response Team ad NASA/GSFC

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Metop-A imaged the British Isles enjoying a rare sunny day on January 23, 2008. England is seen emerging from deep shadow cast by the morning sunshine. But this respite from the rains and flooding was short-lived. The next Atlantic depression is already priming itself for action to the west.

Image © EUMETSAT 2007
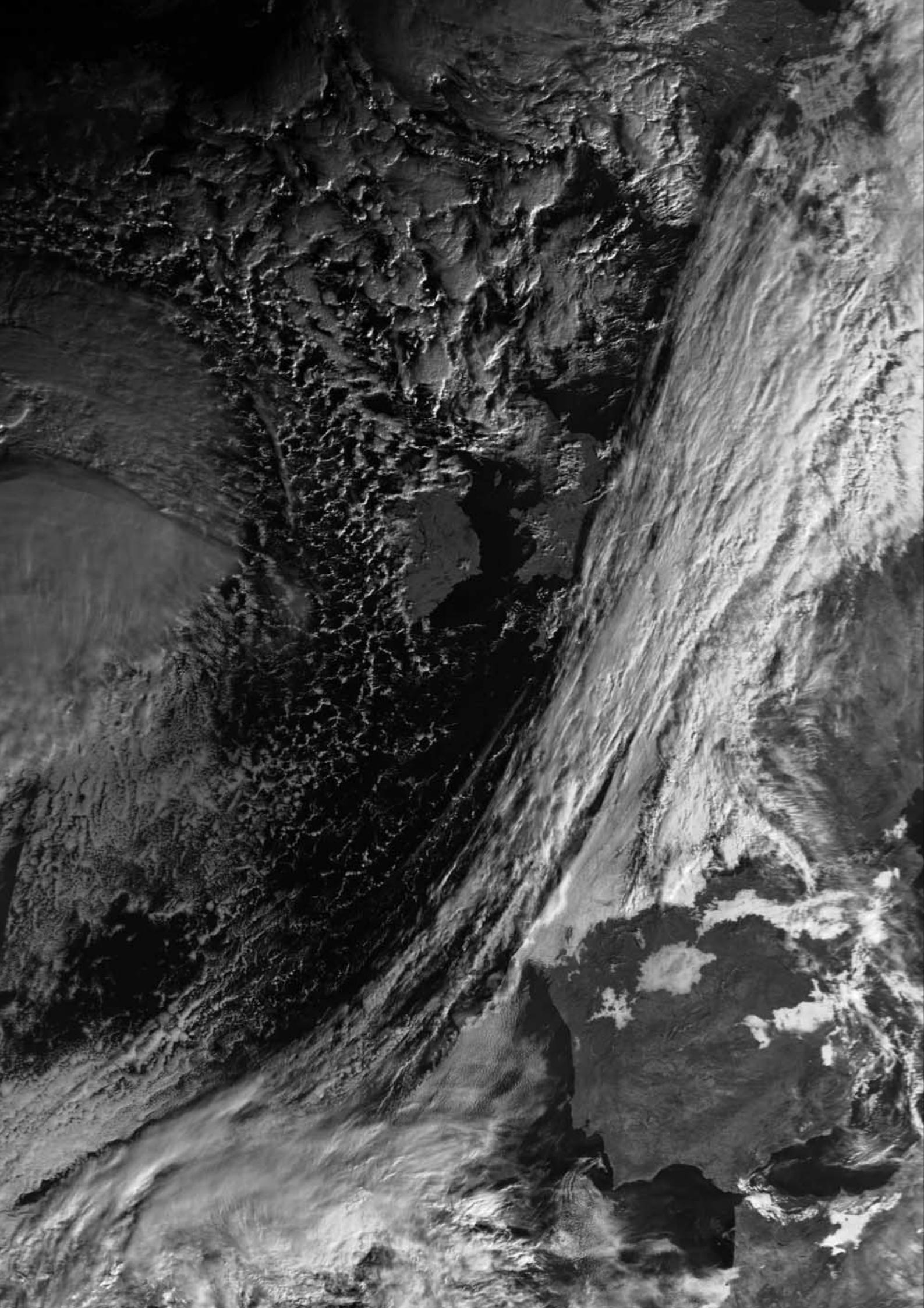
IN TRAY

The Column for Readers' Letters and Queries

email: geoeditor@geo-web.org.uk

Dear Les

I was very happy to see your article *It's a CLASS Act* in GEO Quarterly 16.

The reason is a bit strange. It is because we (my wife and I) have suffered major water damage in our house. Many floors, including the kitchen and bathrooms, are damaged so that the house is uninhabitable. We have now been living in our son's flat for a number of months. He happens to work in Melbourne, Australia for a year or so.
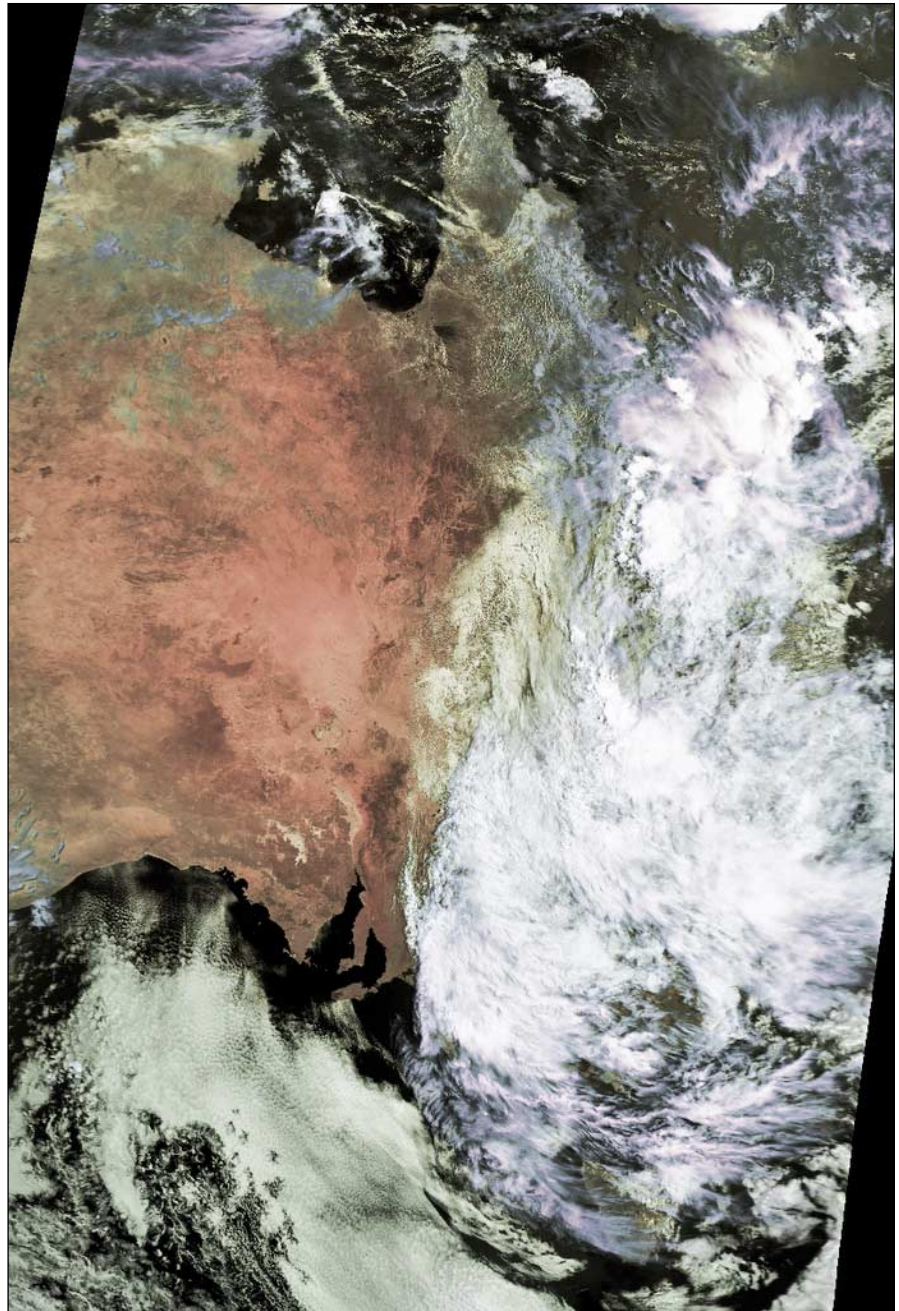
This means that I presently don't have access to my normal APT-equipment. That is why the possibility to load down data from the CLASS archive comes in so handy. It is also very good that our son has quite a fast broadband connection.

I have followed the procedures in your article and have; as I believe; been quite successful. It is a pleasure to get so much higher resolution images than with APT and it is also great to be able to get images from any part of the globe. So I attach an image from eastern Australia. It is from a Metop FRAC file dated 2008-01-17 at 23:14 UT, which should be 10:14 am Melbourne time. The area around Melbourne seems to be a little cloudy.

I am still very impressed by the high quality articles in this issue (and earlier issues) of *GEO Quarterly*. The article on the *Aral Sea* was very interesting, as I now and then was able to see it on my APT pictures and was terrified of how small it had become. I also appreciate the various technical articles on 'how to do' very much.

Best regards

Anders Hook (from Vallentuna, Sweden)

Earth Imaging News

continued from page 23 ...

sufficient kinetic energy to destroy an operational spacecraft.

India Launches Radar Satellite for Israel

An Indian Polar Satellite Launch Vehicle (PSLV) lifted off from the Satish Dhawan Space Centre at Sriharikota, on the east coast of India, at 0345 UTC on January 21, carrying *TecSAR* to a 403 × 581 km orbit inclined to the equator at 41 degrees.

Developed and built by Israel Aerospace Industries Ltd and its subsidiary companies, the 300 kg spacecraft carries an X-band dish antenna for SAR all-weather imaging. The first images are expected to be made available early in February.

TecSAR satellite
Credit: IAI

Eastern Australia, captured during Metop-A's morning pass, on January 17, 2008
Image: NOAA CLASS Archive (www.class.noaa.gov)   *Processed in HRPT Reader by Anders Höök*

GEO Members' Internet Survey

Readers who have been subscribers since our Launch Issue four years ago may recall we included a survey form with that Quarterly. Although we did publish a sample of the replies, it proved physically impossible to take everyone's views on board.

GEO would now like to offer its subscribers the opportunity to voice their opinions on the Group and to help shape its future. To this end, we have placed a new Survey Form on our website, which we would very much like you to complete.

www.geo-web.org.uk/survey08.html

A summary of the results will be published in the Quarterly later in the year.

How to Create Automatically Updated GeoSatSignal Animations with Meteorological Chart Overlays

... continued from page 15

noting that, once the first one has been prepared, such schedules can be copied, pasted (to a temporary holding directory), renamed and modified to suit.

Appendix A - Displaying Animations

Whichever means of display you use, take care that you do not attempt to open an animation file whilst it is being built in the background (as indicated by the presence on your taskbar of the command prompt and minimised GSS icons). I have found that this can cause unusual reactions, or an error message reporting the file as unreadable. Indeed, the file may not even show in its directory when browsing. In either case the displayed animation may stop when it is undergoing a rebuild or update.

Appendix B - Bracknell Charts from DWDSAT Data

Should your base of operations be 'out-in-the-sticks' and without Internet access, it is also possible to extract the Bracknell charts from the very EUMETCast data stream which provides the MSG imagery via the *DWDSAT* data. You will, of course, have to make a free registration request—via your local Internet café in this situation. It is a rather laborious manual task to crop and reduce these images to the 1065 x 718 resolution required by GSS but, if you are au fait with command line and/or batch conversion, then this could perhaps be automated. This could certainly be a means to an end from a remote location.

The *DWDSAT* service is provided by Deutscher Wetterdienst (DWD), the National Meteorological Service of Germany. *DWDSAT* consists of European forecast data and meteorological charts, which are disseminated via EUMETCast's European Ku-band service. David Taylor has produced a separate program '*DWDSAT viewer*' for showing the HRPT images transmitted but the chart images can be screened by most proprietary viewers, e.g. *Irfanview*.

Appendix C - Example Animations

I have uploaded a couple of images and their resultant overlaid animations on to a private web page at

www.rifleman.org.uk/mslp.htm

The first image shown there has been processed as explained above, but with a modified version of the 'LUTLandSea-zw' palette selected in the **Vis ch** field, while the **CLUT** field was set to 'none'. To lose the black arc that would otherwise show at the left-hand upper corner of the image, **Space is white** has been checked. **Crispen** is 'none'. You will see that the image masking, giving the customary green land and blue sea, forms the base to a cloud representation from white for lower warmer levels up to black for cold high level. This is quite a basic presentation, but a satisfactory grounding for the overlaid charts. As ever, the possibilities here are almost limitless if you are prepared to spend the time investigating palette preparation. Les Hamilton has produced the 'CLUT creator' software to assist such modification. You can download it from

http://myweb.tiscali.co.uk/wxsatellite/clutmaker.htm

Appendix D - Passwords

It is important to be aware that *Windows Scheduler* requires the input of your Windows username and password to run command files. If you are one of those who leave these fields blank when installing Windows, you will soon discover that using a 'blank' username and password in schedule files will result in them <u>failing to run</u>. A genuine username and password are **absolutely essential**.

In Conclusion

I apologise in advance for any errors or omissions but, should you discover any (or an opportunity for improvement), please contact me at

tohs@rifleman.org.uk.

Perfected this arrangement is not; but it may at least offer a worthwhile basis for further experimentation and will certainly help to while away the hours!

Footnote

1 Although the Met Office moved from Bracknell to new headquarters in Exeter during 2004, the term 'Bracknell' charts continues in use to this day—perhaps an acknowledged but happy misnomer—and most users still prefer to recognise that naming.

Book Review

The Complete Earth

A Satellite Portrait of Our Planet

Peter Green

I suppose this is what is called a 'coffee table' book. It's large enough—36 x 42 cm—and if you have one, you will want to keep it on your coffee table, and not just for yourself: you can bore your friends rigid with the fantastic images that it contains.

I am sure we all look at our satellite images of Earth daily and wonder at its beauty. The resolution we get as amateurs is spectacular, but we all want to see it in even more detail. Some of us use the satellites to watch the weather, some to look at the Earth. Well, The Complete Earth: A Satellite Portrait of Our Planet will certainly help you fulfil these wishes.

The images show the Earth cloud-free at 93 miles to the inch and the full-colour images are spectacular. I am sure you will be able to view these images on the NASA Blue Marble site, but there is nothing like sitting down with a photo of an area and really studying it. Social and political boundaries are invisible and irrelevant, what we see instead is the landscape of the whole Earth—the mountains, deserts, seas and oceans that have shaped human history.

The book is in several sections, starting with satellite images on rock and how it has transformed over time. The bigger picture combines some of NASA's 3D imaging with satellite and digital images to show how privileged we are to be able to look down on our planet.

Stunning pictures of cloud-free Arctic and Antarctica with ice flows and on to North America, Europe, South America, Africa and so on are all shown in both natural and false colour to highlight areas in different spectral bands. Each image has detail of how the area was formed, what affects it weather wise and how it has been shaped over millions of years. You get a great perspective of how huge, diverse and stunningly beautiful this globe is.

This cover price of this book is £50, which I would never have paid, although the quality of printing does perhaps justify the price. However some stores are selling it at a special price of £25, and I ordered mine from Amazon, two months ago, for £14, which is a steal.

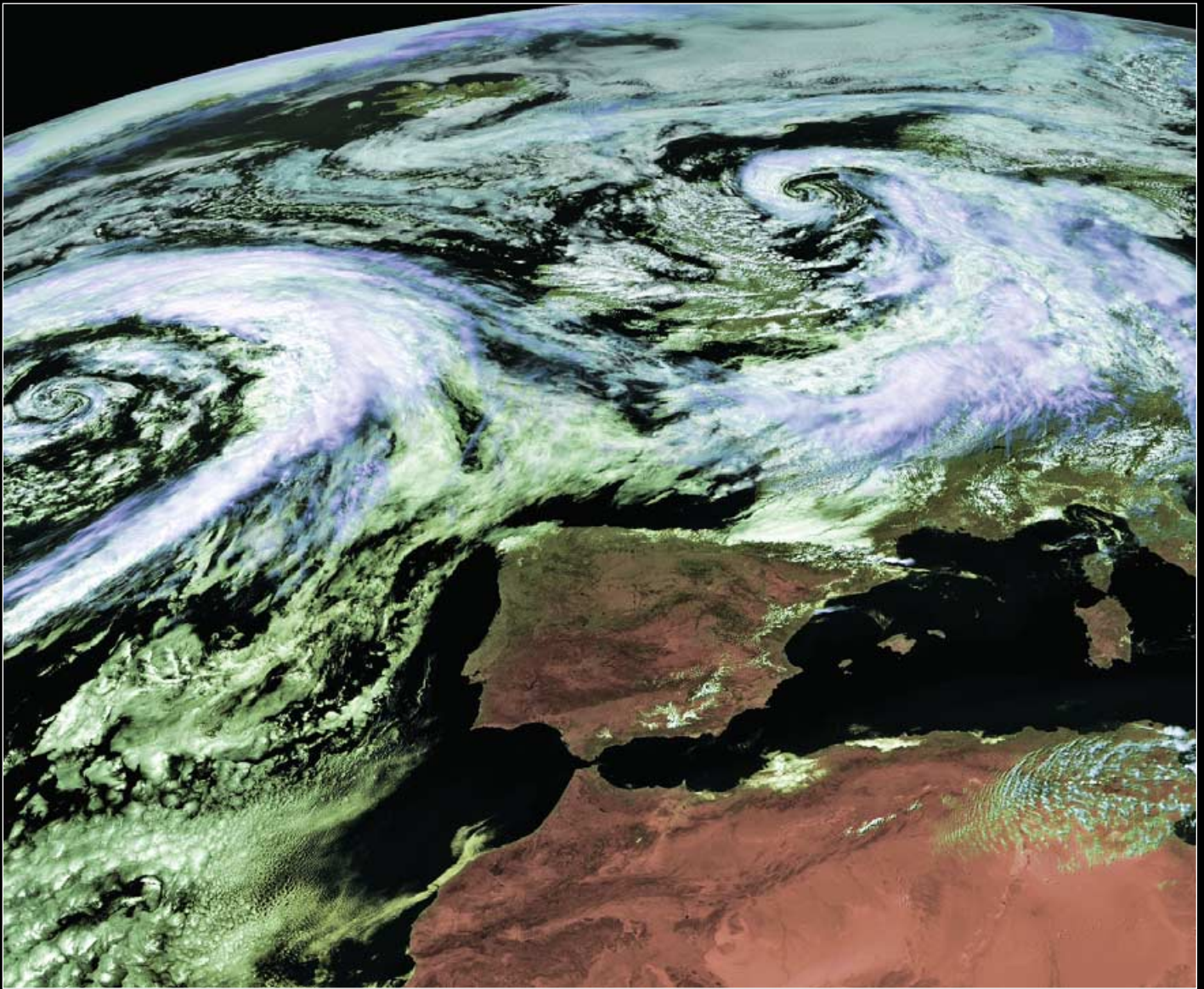This is definitely one for your shopping list.

Details

Hardcover: 224 pages
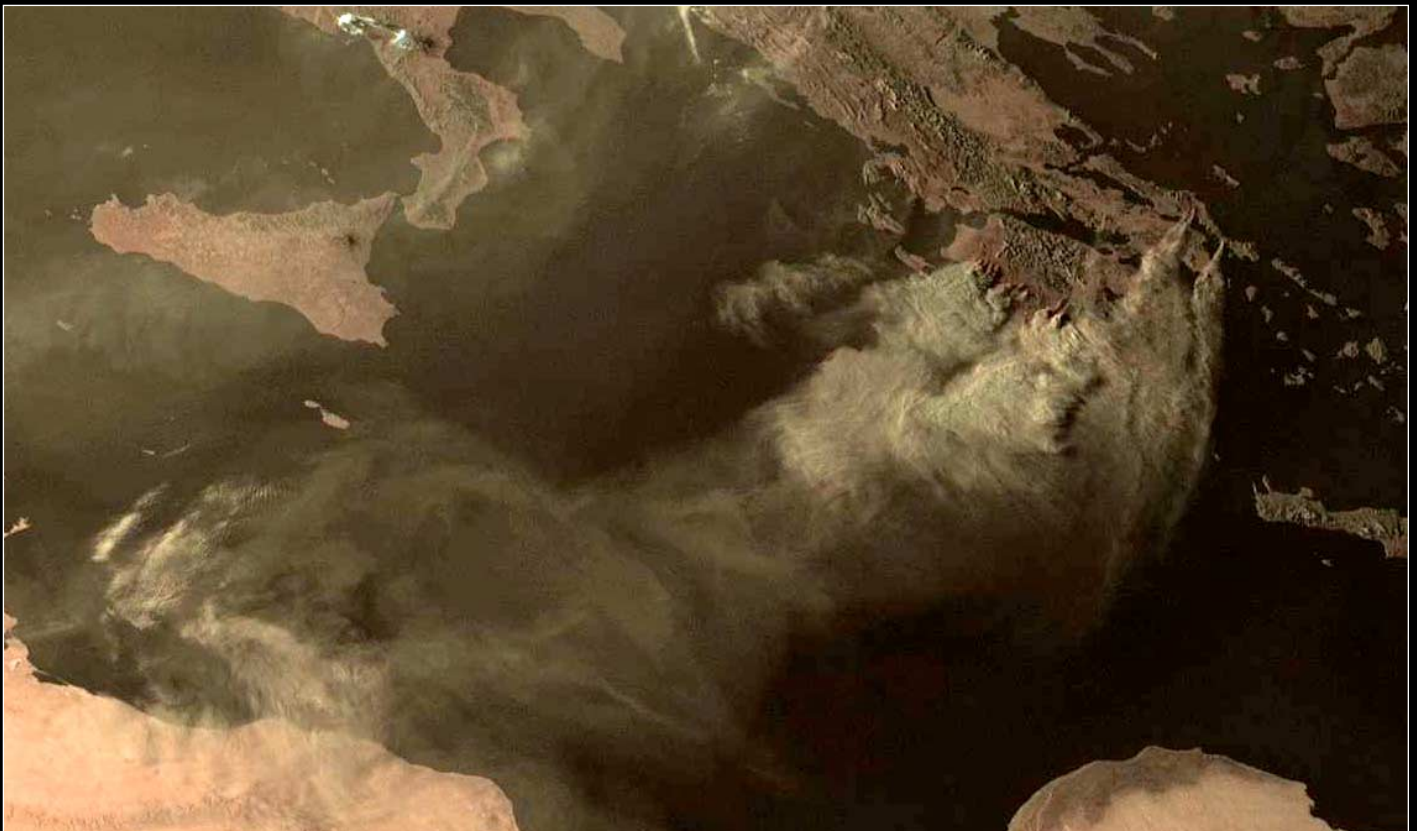Publisher: Quercus (October 2006)
Language English
ISBN-10: 1905204310
ISBN-13: 978-1905204311

Twin depressions over Europe on June 29, 2007 - see article on page 39
Image © EUMETSAT 2007

Wildfires in Greece show up starkly in the late evening sunshine in this August 25, 2007 image from Meteosat-9
Image © EUMETSAT 2007