History of Rocketry and Astronautics

Proceedings of the Fifty-Third History Symposium of the International Academy of Astronautics

Washington DC, USA, 2019

Otfrid G. Liepack, Volume Editor

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AAS History Series, Volume 52

A Supplement to Advances in the Astronautical Sciences

IAA History Symposia, Volume 39

AAS Publications Office
P.O. Box 28130
San Diego, California 92198

Affiliated with the American Association for the Advancement of Science
Member of the International Astronautical Federation

First Printing 2022

ISSN 0730-3564

ISBN 978-0-87703-681-4 (Hard Cover Plus CD ROM)
ISBN 978-0-87703-682-1 (Digital Version)

Published for the American Astronautical Society
by Univelt, Incorporated, P.O. Box 28130, San Diego, California 92198
Web Site: http://www.univelt.com

Printed and Bound in the U.S.A.

Chapter 2

Geoffrey E. Perry MBE and the Kettering Grammar School Satellite Tracking Unit, circa 1960–1984*

Doug Millard†

Abstract

Geoffrey Perry (1927–2002) was an English physics teacher. He taught at the Kettering Grammar School in Northamptonshire, some seventy miles north of London, and is remembered particularly for his award-winning contributions to the art of satellite tracking. With colleague Derek Slater, Head of Chemistry and an amateur radio operator, he set up the school's Satellite Tracking Unit, which in 1966 drew intense media attention with its announcing, having tracked Cosmos 112—the existence of a previously unknown Soviet launch site at Plesetsk in northern Russia. Perry and Slater's satellite studies were notable for their being incorporated into the former's physics lessons, the students helping operate the equipment and gather the empirical data. Perry had started on this teacher/pupil collaboration when thinking about new ways of explaining the Doppler Effect to his classes. Rather than play recordings of passing train whistles or police car sirens he chose instead those of satellite transmissions following his listening to a play back of Sputnik at an education conference in 1957. Perry's work was in

* Presented at the Fifty-Third Symposium of the International Academy of Astronautics, October 21–25, 2019, Washington, DC, United States. Paper IAC-19-E4.1.02.

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part enabled by a meticulous attention to detail which is manifest in the personal papers, recordings, log-books, diaries, bespoke equipment and numerous other materials acquired by the Science Museum from his family in 2018. This chapter draws from that archive to shed new light on Perry's work, seeking also to situate it within histories of scientific endeavor beyond the academy.

I. Geoffrey E. Perry and the Kettering Satellite Tracking Group

I.1. Formative Years

Geoffrey E. Perry was born August 4, 1927, in Braintree, a small town in the county of Essex, England. In 1944, the seventeen-year-old Perry learned of a V-2 rocket that had come down near the hamlet of Beazley End, just a few miles from Braintree. According to his daughter, Perry realised that "space travel was no longer a wild dream" [1]. He graduated in physics and mathematics from the University of Reading and in 1957 joined Kettering Grammar School as a physics teacher.

I.2. International Geophysical Year

Perry's awareness of the putative space age, no doubt fueled also by the gift at Christmas 1951 from his cousin of Arthur C. Clarke's *The Exploration of Space* [2], was particularly attuned to the launching of the International Geophysical year in 1957. Feeling questions on the IGY might appear in the Universities of Oxford and Cambridge scholarship papers for his pupils he read up on the subject and the likelihood of either or both of the United States or the Soviet Union launching space rockets and artificial satellites during the eighteen month global series of geophysical activities. He was therefore duly primed on the topic when the Soviet Union launched the first Sputnik October 4, 1957.

I.3. The Doppler Effect

Perry's colleague (Russell Gladdon, Senior Science Master) visually tracked and photographed the Sputnik rocket's upper stage as it pursued the spacecraft in its orbit and Perry did likewise when Sputnik 2 was orbiting one month later. Over that Christmas Perry attended a science teaching conference and heard a recording of the first Sputnik's radio signals played by John Osborne, a teacher from Stowe School in nearby Buckinghamshire. Always keen to make lessons relevant and topical to his pupils Perry realized that the variation in satellite signals' pitch could be used to demonstrate the Doppler Effect (rather than

the traditional references to passing train whistles or the ambulance bells of the day … sirens only replacing the bell in Britain in 1963)!

I.4. The Tracking Begins

Fellow Kettering teacher Derek Slater (Head of Chemistry) was an amateur radio operator and so well able to track satellite short-wave transmissions. He and Perry, working with information provided by Britain's Satellite Prediction Service,[*] were able to anticipate satellites' passing overhead and, tuned to the requisite frequency, track their progress. Their first significant target was Korabl-Sputnik 1, otherwise known in the West as Sputnik 4, launched May 15, 1960, as the first orbital test of what would become known as the human-rated Vostok spacecraft. The satellite's signals suggested to Perry and Slater a higher orbit than the predictions had indicated and this was indeed the case. It later transpired that—the spacecraft's orientation misaligned—its braking rocket had fired in the wrong direction serving to boost it into a higher orbit rather than decelerate it towards a lower one to prepare for re-entry. Fifty years on Slater recalled this inaugural tracking carried out by the "founding" members of what would become known as the Kettering Grammar School Satellite Tracking Group,

> Yes, I remember it well. It didn't seem such a big deal at the time, I had spent a year of my life as a wireless operator in the RAF, a lot of it on night shifts. Geoff was quite excited at the unusual thing of getting up at some ungodly hour to hear radio signals, whereas it was pretty routine to me. It was a boost for both of us to hear … [Korabl-Sputnik 1] and it impressed me that Geoff had got the time and frequency right. I knew that if the signal was there at all, we'd hear it. I don't think Geoff had such confidence in my equipment though [5].

Perry's daughter, Isabel Carmichael, later provided some additional technical detail of this pioneering tracking operation, describing how her father and Slater used,

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[*] The UK's Satellite Prediction Service had been started in 1957 by the National Almanac Office based at the Royal Greenwich Observatory at Herstmonceux, Sussex. The predictions were distributed by mail to anyone interested with instructions of how to observe and record the sightings of Sputnik (and its rocket). The observer was encouraged to watch (with binoculars, if possible) the satellite until it passed between two identifiable stars at which point the observer would start a stopwatch. The respective distance between the two stars would be estimated in tenths so that, for example, the satellite could be observed as being three tenths from Star A (and therefore seven tenths from Star B). While watching the satellite the observer should also be listening to the General Post Office's Speaking Clock on the telephone and would stop the stopwatch when the next specific time was read out. This simple method allowed an accurate fix of the satellite's trajectory to be obtained and the information would then be sent back to the Prediction Service by mail or by telephone. The Royal Aircraft Establishment (RAE) took charge of the prediction service in 1958 [3].

> Derek's Marconi CR100 and an [sic] US Army BC221 signal generator borrowed from Cyril Dobson (G31CK),* they heard signals (Rev 18) at 0415–1430 GMT on Monday 16th May and made a tape recording (Chemistry B at KGS Science Laboratory Block) and throughout the week (19.995MHz) [6].

I.5. The Group Begins

By 1964 Perry and Slater, struggling to reconcile full-time employment as teachers with their tracking "hobby," drafted in help from the school's pupils but initially from those of the neighboring Kettering High School for Girls. Richard Jahn joined Kettering Grammar as an eleven year old in 1960. He recalls an early visual tracking project of the Echo 2 satellite† run by Perry with his pupils,

> He got pupils to note the exact time when the satellite crossed their east-west on every occasion that it was visible. There was some sort of "League Table" of pupils who had made the most observations and I remember being usually within the top 3 places [7].

Jahn goes on to describe how his lunchtimes, breaks, and after-school hours were often taken up by radio tracking operations as well as, "the late-night plus early morning sessions during term-time, holidays and weekends when some of us would be asked to come in (and entrusted with the keys to the main Physics Lab) to log and record any signals" [8].

I.6. Cosmos and Plesetsk

In March 1963 the Kettering Group started tracking the Soviet Cosmos satellites and Carmichael recalls how, on her tenth birthday (March 17, 1966) the launch of Cosmos 112 and its orbital trajectory puzzled her father. He concluded that it had been launched not from Baikonur but from a more northerly and previously unknown location and he accordingly announced this in a letter to Flight International [Appendix A]. The flight of Cosmos 129 (October 14, 1966) provided confirmation that the launch site was some 200 miles south of Archangelsk and this Perry reported at a meeting of the British Interplanetary Society in London and a second letter to Flight International. Only when The Times ran a story on its front page in the run up to Christmas, 1966 did the discovery attract widespread attention. Michael Sinnett recalls,

> With a nudge from Dr Charles Sheldon of the Library of Congress in the USA, the world's press finally took notice and descended upon Kettering at the start of the school's Christmas holiday in December 1966. On Wednesday 21st December we gathered once more in the Science Lab—Mr Perry,

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* A fellow amateur radio operator's call sign.

† Echo 2 was a 41-meter inflatable passive communication test satellite, launched January 24, 1964, and visible with the naked eye.

> Mr Slater and a number of pupils—in front of the representatives from the national newspapers as well as the television news channels. We became stars overnight [9].

Sheldon was in charge of the Science Policy Research Division of the Congressional Research Service which, from the 1960s through to the 1980s, produced "Soviet Space Programs," a series of reports on Soviet space activity for the US Congress. Sheldon was fully cleared to access classified information but was only able to cite public sources in his reports. US intelligence was aware of the Soviet's northerly launch site and so, with the Kettering announcement now made, Sheldon too was able to refer to it in "Soviet Space Programs." In subsequent issues the Perry and Kettering analyses were referenced regularly in the reports.

II. A Wider Network

The Kettering studies formed part of a global network investigating the Soviet space programme. Isabel Carmichael refers to her father being "akin to a spider at the centre of its web [with local and international contributors] the spokes" [10]. This organization of amateur satellite tracking with Perry at the head drew on contributions from Sweden, West Berlin, Bahrain, Florida, and Texas.[*] Further, it nestled within a broader company of individuals and groups seeking to learn more of the Soviet Union's space activities by way of listening to Radio Moscow bulletins, reading Soviet Weekly, attending air shows and so on.[†] A focus for much of this investigation coalesced under the British Interplanetary Society's Soviet Space Forum, its inaugural meeting held in January 1980.

III. The Kettering Archive

Former Kettering Group member Bob Christy approached the author when visiting the Science Museum's *Cosmonauts: Birth of the Space Age* exhibition (2015) [11]. With some of Derek Slater's tracking equipment already displayed at the National Space Centre, Leicester, he broached the subject of Geoffrey Per-

[*] This chapter has drawn on Bob Christy's Zarya website (http://www.zarya.info/index.php), which includes a comprehensive set of articles about the Kettering Group, its history, activities, and achievements, several written by former members, including Christy.

[†] See D. Phelan (ed.), *Cold War Space Sleuths: The Untold Secrets of the Soviet Space Program,* Springer, London, 2013.

ry's papers. The Museum made it clear how significant this archival material was and how vital it was to preserve it for scholarly and public access in the future. Discussions were initiated with Isabel Carmichael and in July 2017 the first of three collections of the material made. The holding extends to over ninety boxes and is a comprehensive portrayal of the work of the Kettering Group and contains observation log books, Perry's diaries, papers relating to satellite launches, satellite signals on paper tape, audiovisual recordings and their transcripts (some containing the conversations of Soviet astronauts, including Valentina Tereshkova), photographs, transparencies, Perry's speaking engagements including illustration graphics, correspondence and original cartoons as they appeared in national newspapers (see Figures 2–1 to 2–4) [12].

The collection includes also a number of technical artefacts including tape recording equipment, a pen recorder and paper tape, a calculator presented to Perry by the United States ambassador and orreries of the Earth, planets and satellites (see Figures 2–5 and 2–6 and Appendix B). Other items include construction kit models used by Perry to glean more information on the external features of launch vehicles and spacecraft, postage stamps, lapel badges and pins, awards, trophies, and commemorative plaques.

IV. Discussion

We may recall Fred Whipple's unpublished prediction for the Moonwatch programme, but replacing "small telescope" with "small radio" when considering the work of Geoffrey Perry and the Kettering Satellite Tracking Group.[*] Both employed relatively unsophisticated equipment and harnessed the efforts and enthusiasm of the "amateur" scientist—very often the school pupil or student—to conduct original research that was in turn incorporated within the related work of the 'professional." McCray goes on to cite how such formative work could help the young practitioner catalyze a distinguished career in science.[†] Nevertheless, this presupposes a distinction between the amateur and the professional which he rightly points out presents, "issues to consider with regard to the historiography of amateur-professional relations."[‡] The Science Museum's acquisition of the large, comprehensive, detailed and highly informative Perry papers and associated artifacts provides a rich resource with which to investigate further the bounda-

[*] "history being made at a small telescope," cited in McCray, p. 653 [13].

[†] McCray, p. 655 [13].

[‡] McCray, p. 656 [13].

ry, if indeed such a term is an appropriate one, between two communities of scientific activity.

Acknowledgments

The author wishes to thank Bob Christy, David Baker, and Isabel Carmichael, in particular for her diligence in listing so immaculately her father's papers prior to collection by the Science Museum.

Appendix A

Flight International Plesetsk letter, April 21, 1966

New Cosmos Launch Site?

SIR,—Radio signals from Cosmos 112 were received in Kettering at the end of the second and third revolutions on March 17 and again on the following two days. Apart from the usual 19.995Mc/s signals, characteristic of the recoverable eight-day Cosmos, it soon became apparent that there were departures from the normal. One marked difference was the orbital inclination of 72.1°. The launch was unusually late, at 1035 GMT. Signals were not received on the usual five or six passes each day, and those which were received were weak and of short duration, suggesting that they were commanded-on when the satellite was much farther north than usual. Finally, the period was 92.07 min, the same as that of Cosmos 98.

Opinions have been expressed that this is an arbitrary period, possibly due to an unintentional variation of the launching technique. I take the view that it is a carefully calculated period, designed to reconcile a higher orbit with the usual recovery area, after eight days. Calculations show that the optimum period for recovery after 124 revolutions in the usual area is 92.08min.

The RAE Table of Artificial Earth Satellites gives the lifetime of Cosmos 112 as 7.79 days. Division by the orbital period shows that recovery occurred towards the end of the 122nd revolution. This implies that either the launch or the recovery, or both, occurred in different areas for the two satellites.

Multiplication of the track separation of 23.24° by 31 gives a product of 719.44°; nearly two complete Earth rotations. This suggests that the sub-satellite tracks will repeat themselves every 31 revolutions — a suggestion borne out by the prediction sheet published by the Radio and Space Research Station. Further examination of this sheet confirms that the launch could not have originated from the Aral Sea complex.

It appears that the initial orbit of Cosmos 112 had a northern apex at 1038 GMT at a longitude of 90°E. It has been suggested to me by a fellow-observer, Sven Grahn of Stockholm, that a launch from the southern tip of Novaya Zemlya (71°N, 52°E), would satisfy all the foregoing observations, and I am inclined to agree. Signals received from Cosmos 114, launched on April 6, show certain similarities to those from Cosmos 112. Although I do not have full information at the time of writing, I assume that, as the orbital inclination is 73°, it originated from the same "new" launch site. The fact that only the last part of the transits are received suggests that this satellite is being commanded from the northern site as well.

The Grammar School G. E. PERRY
Kettering, Northants

Appendix B

Perry 3D Objects

RACAL RA 217 Short-wave communications receiver and associated manuals; presented by Racal and the Daily Express in Nov 1967.

Pen-Recorder Great Northern Telegraph Co. Ltd. Undulator Mk2 and 1cm paper-tape, acquired Jan 1969.

Discriminator.

Grundig Reel-to-reel tape recorder TK5 with microphone and manual.

Aerials.

Eddystone EC10: receiver used by Geoffrey E Perry at home and in caravan.

Casio AL-2000 Gift to GEP from American Ambassador Mr. Walter Annenberg and manual.

Radio Scanning equipment: used by GEP at home in Kettering and later in Bude.

Appendix C

Figures

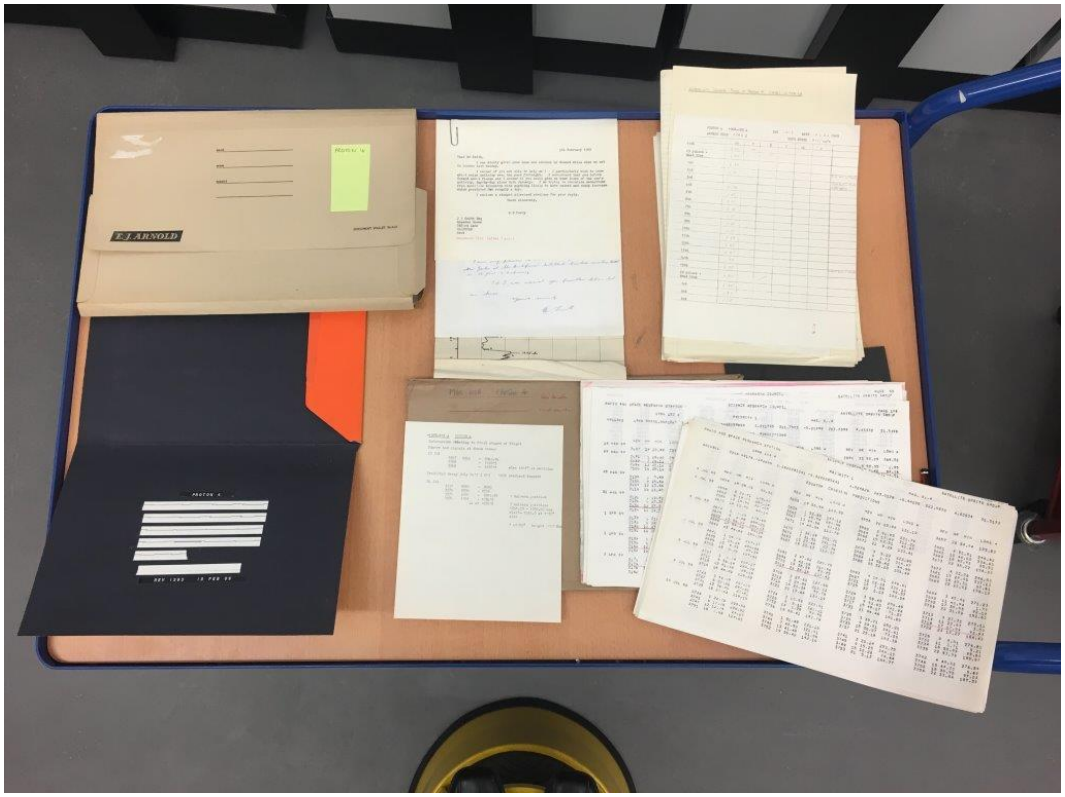
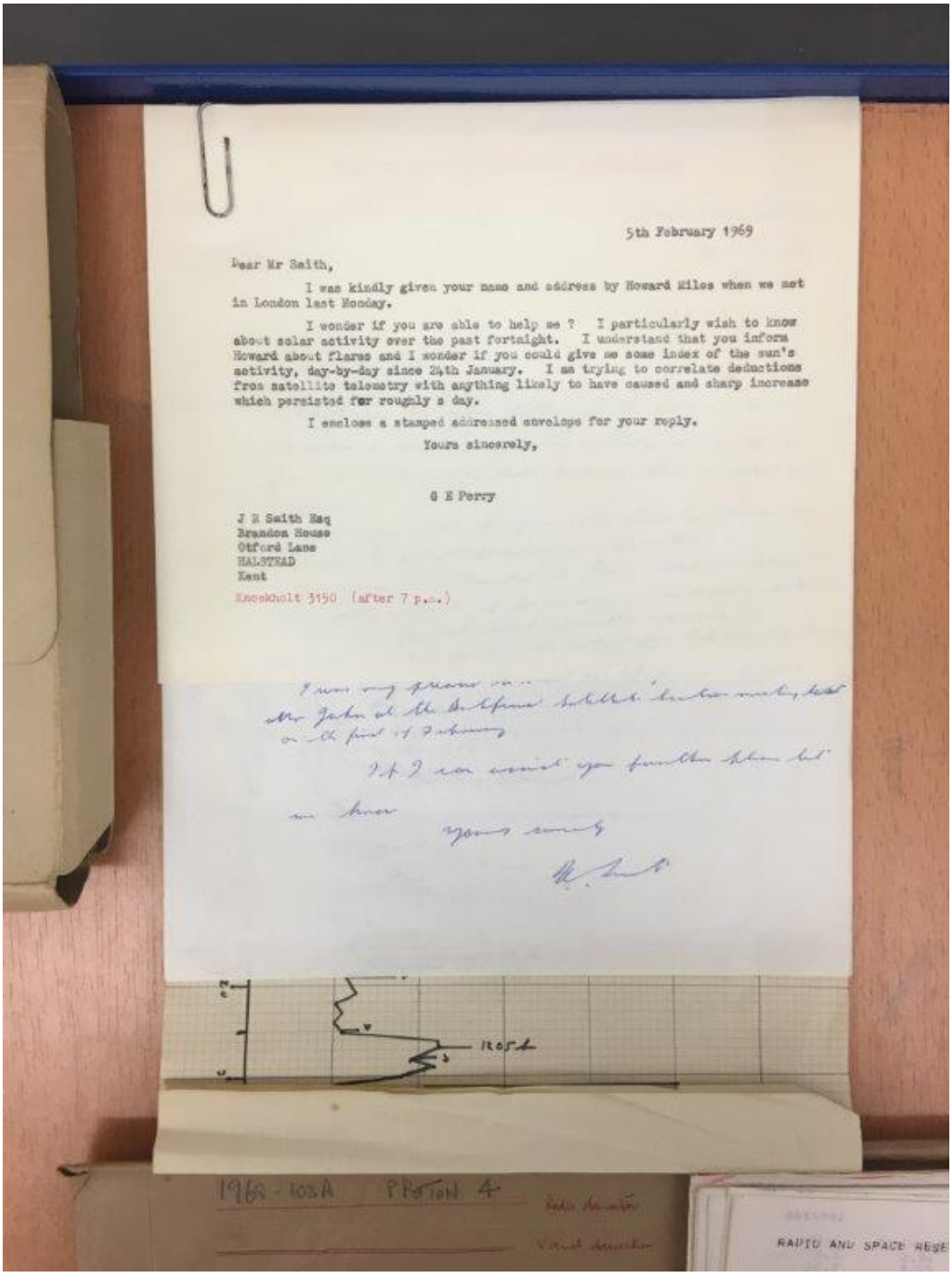


Figure 2–1: Papers relating to the Proton 4 mission (launch date November 16, 1968) including correspondence between Perry and solar expert J. R. Smith.



5th February 1969

Dear Mr Smith,

I was kindly given your name and address by Howard Miles when we met in London last Monday.

I wonder if you are able to help me ? I particularly wish to know about solar activity over the past fortnight. I understand that you inform Howard about flares and I wonder if you could give me some index of the sun's activity, day-by-day since 24th January. I am trying to correlate deductions from satellite telemetry with anything likely to have caused and sharp increase which persisted for roughly a day.

I enclose a stamped addressed envelope for your reply.

Yours sincerely,

G E Perry

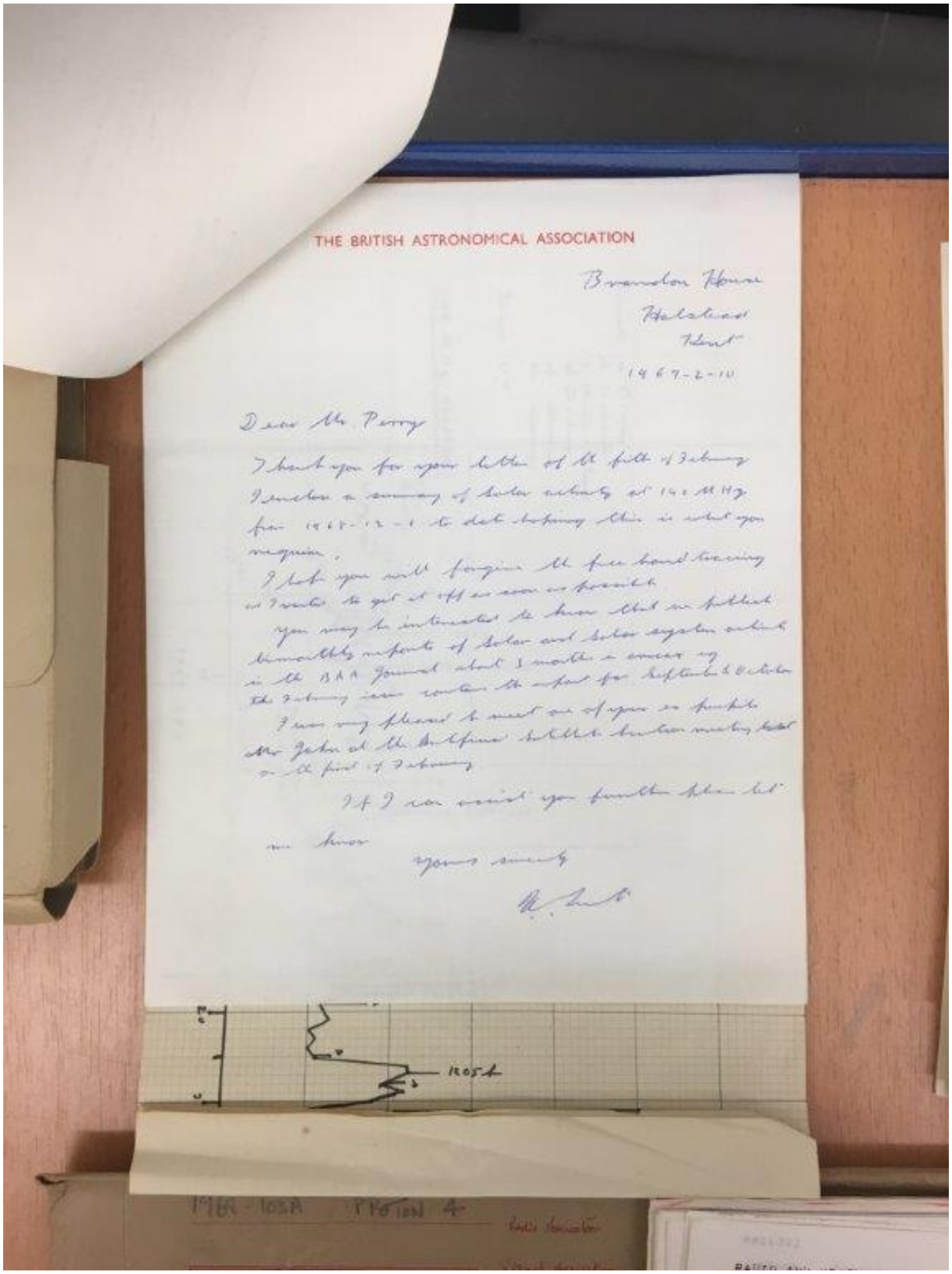
J R Smith Esq
Brandon House
Otford Lane
HALSTEAD
Kent

KnockHolt 3150 (after 7 p...)

1965-103A PROTON 4

RAPID AND SPACE RESE

Figure 2–2: Letter (February 5, 1969) from Perry to J. R. Smith inquiring about solar activity during early 1969.


THE BRITISH ASTRONOMICAL ASSOCIATION

Brandon House
Halstead
Kent
1969-2-10

Dear Mr Perry

I thank you for your letter of the fifth of February
I enclose a summary of Solar activity at 140 MHz
from 1968-12-1 to date hoping this is what you
require.

I hope you will forgive the free hand tracing
as I wanted to get it off as soon as possible.

You may be interested to know that we publish
bimonthly reports of Solar and Solar system activity
in the BAA Journal about 3 months in arrears [illegible]
the February issue contains the report for September & October

I was very pleased to meet one of your [illegible]
[illegible] at the [illegible] meeting held
on the first of February

If I can assist you further please let
me know

Yours sincerely

[illegible]

Figure 2–3: Reply of J. R. Smith (February 10, 1969) to Perry letter enquiring about solar activity.

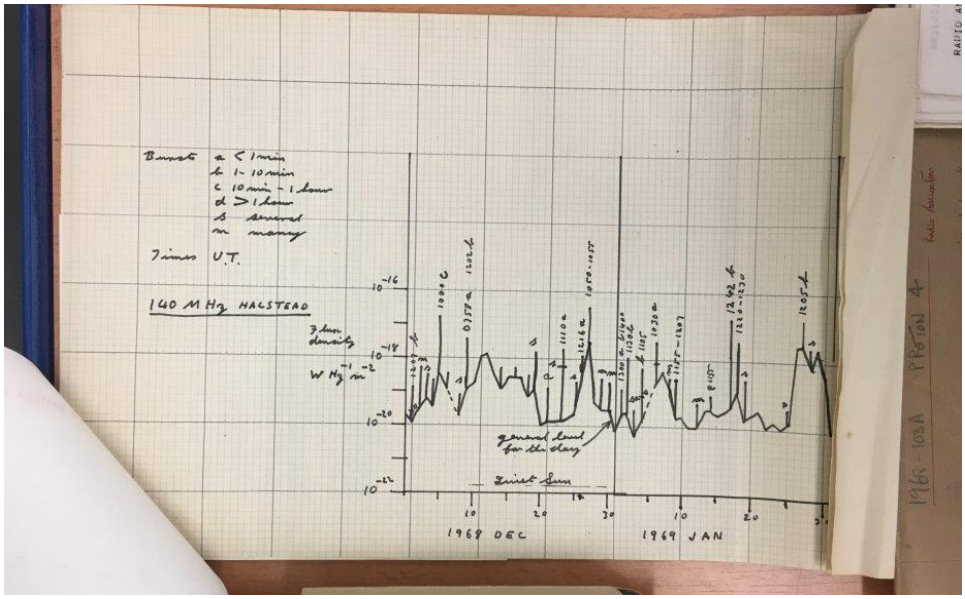


Figure 2–4: J. R. Smith's hand-drawn plot of solar activity for late 1968/early 1969.

Figure 2–5: Earth globe and satellite orrery, made by Frank Lewin 1969.

Figure 2–6: Mars, Venus, Earth orrery, made by Frank Lewin 1969.

Figure 2–7: Isabel Carmichael's (neé Perry) children's globe requisitioned by her father to provide instant visual fix of 65 degree inclination orbit.

References and Notes

[1] I. Carmichael, “Satellite Tracking in Kettering and Beyond,” talk given at Kettering Civic Society, October 14, 2016.

[2] Carmichael, “Satellite Tracking in Kettering and Beyond.”

[3] D. Millard, *Satellite: Innovation in Orbit, Reaktion,* London, 2017, p 81.

[4] D. Phelan (ed.), *Cold War Space Sleuths: The Untold Secrets of the Soviet Space Program,* Springer, London, 2013, p. 63.

[5] D. Slater, *Members Tales, Zarya Commemorates The Kettering Group*, http://www.zarya.info/Kettering/DerekS.php.

[6] Carmichael, “Satellite Tracking in Kettering and Beyond.”

[7] R. Jahn, *Members Tales, Zarya Commemorates The Kettering Group*, http://www.zarya.info/Kettering/RichardJ.php.

[8] Jahn, *Members Tales.*

[9] M. Sinnett, *Members Tales, Zarya Commemorates The Kettering Group,* http://www.zarya.info/Kettering/MikeS.php.

[10] Carmichael, “Satellite Tracking in Kettering and Beyond.”

[11] *Cosmonauts: Birth of the Space Age,* https://www.sciencemuseum.org.uk/what-was-on/cosmonauts-birth-space-age.

[12] Geoffrey Perry archive relating to operation of the Kettering Group, http://archives.sciencemuseumgroup.ac.uk/Details/archivescience/110093443.

[13] W. Patrick McCray, *Amateur Scientists, the International Geophysical Year, and the Ambitions of Fred Whipple,* Isis, 97 (2006), pp. 634–658.