

Optical Telegraphs

Steve Unger

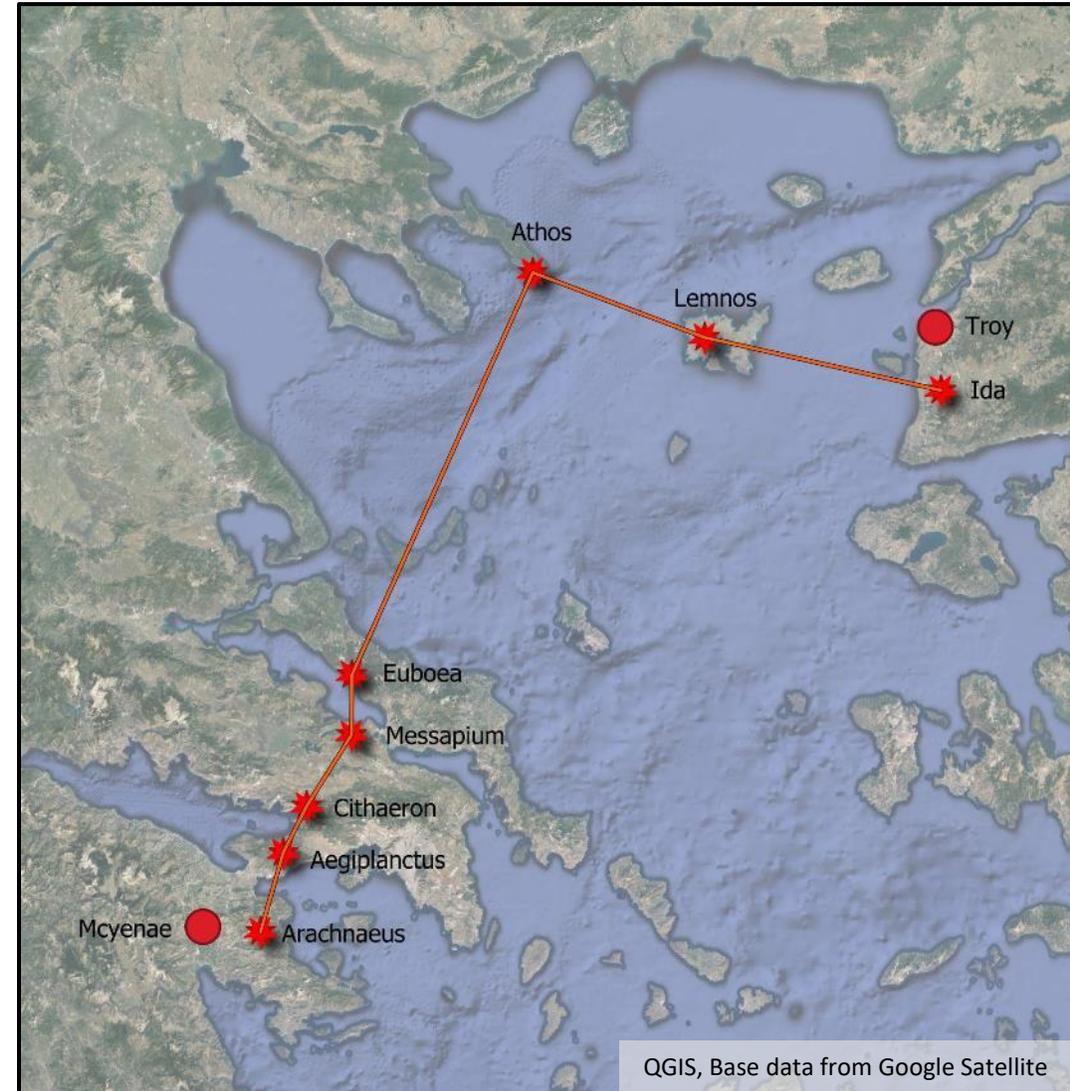
Fire beacons announce the fall of Troy

“Agamemnon” by Aeschylus, c.458 BC

Clytaemestra

Hephaestus, from Ida speeding forth his brilliant blaze. Beacon passed beacon on to us by courier flame: Ida, to the Hermaean scaur in Lemnos; to the mighty blaze upon the island succeeded, third, the summit of Athos sacred unto Zeus; and, soaring high aloft so as to arch the main, the flame, travelling joyously onward in its strength; the pinewood torch, its golden-beamed light, as another sun, passing the message on to the watchtowers of Macistus. He, delaying not nor heedlessly overcome by sleep, neglected not his part as messenger. Far over Euripus' stream came the beacon-light and gave the signal to the sentinels on Messapion. They, kindling a heap of withered heather, lit up their answering blaze and sped the message on. The flame, now gathering strength and in no wise dimmed, like unto a radiant moon o'erleaped the plain of Asopus to Cithaeron's scaur, and roused another relay of missive fire. Nor did the warders there disdain the far-flung light, but made a blaze higher than had been bidden them. Across Gorgopus' water shot the light, reached the mount of Aegiplanctus, and urged the ordinance of fire to make no dallying. Kindling high with unstinted force a mighty beard of flame, they sped it forward that, as it blazed, it o'erpassed even the headland that looks upon the Saronic gulf; until it swooped down when it reached the lookout, nigh unto our city, upon the peak of Arachnaeus; and next upon this roof of the Atreidae it leapt, yon fire not undescended from the Idaean flame. Such are the torch-bearers I have arranged - in succession one to the other completing the course; and victor is he who ran both first and last. This is the warrant and the token I give thee, the message of my lord from Troy to me

Translation by Herbert Weir Smyth



Polybius and Fire Signalling

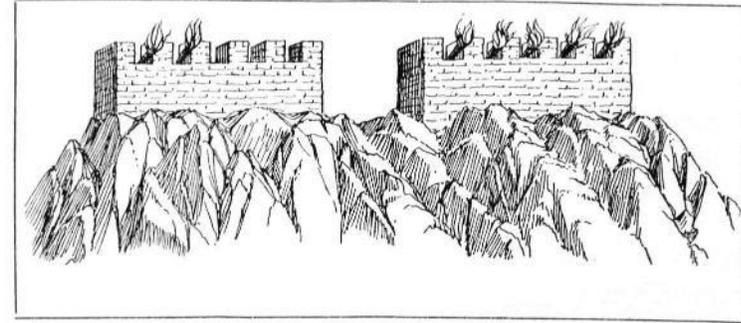
“Fire-signalling” by Polybius, c.200 BC

Now in former times, as fire-signals were simple beacons, they were for the most part of little use to those who used them. For the service had to be performed by signals previously determined upon, and as facts are indefinite, most of them defied communication by fire-signals.

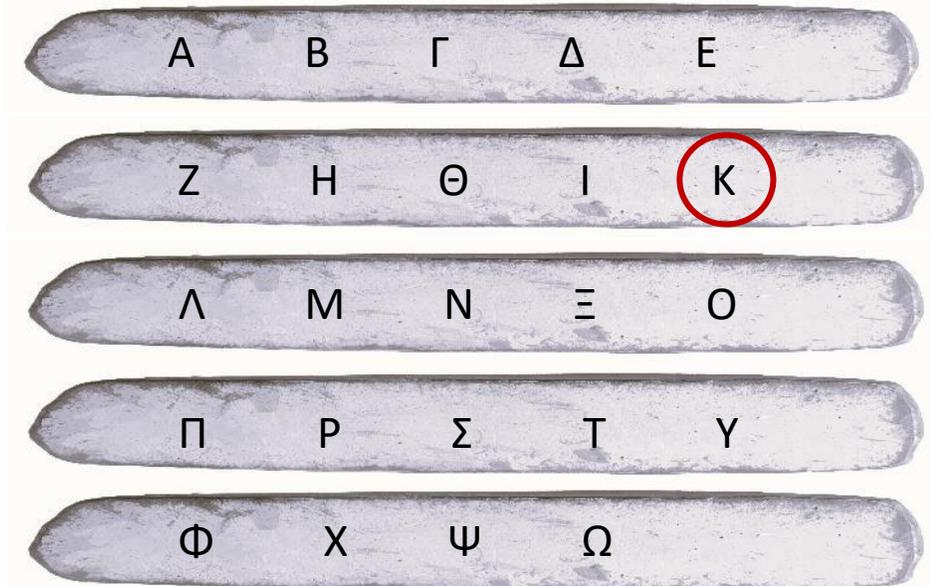
It was possible for those who had agreed on this to convey information that a fleet had arrived at Oreus, Peperethus, or Chalcis, but when it came to some of the citizens having changed sides or having been guilty of treachery or a massacre having taken place in the town, or anything of the kind, things that often happen, but cannot all be foreseen - and it is chiefly unexpected occurrences which require instant consideration and help - all such matters defied communication by fire-signal. For it was quite impossible to have a preconcerted code for things which there was no means of foretelling

The most recent method, devised by Cleoxenus and Democleitus and perfected by myself, is quite definite and capable of dispatching with accuracy every kind of urgent messages, but in practice it requires care and exact attention. It is as follows: We take the alphabet and divide it into five parts, each consisting of five letters. There is one letter less in the last division, but this makes no practical difference. Each of the two parties who are about to signal to each other must now get ready five tablets and write one division of the alphabet on each tablet, and then come to an agreement that the man who is going to signal is in the first place to raise two torches and wait until the other replies by doing the same. This is for the purpose of conveying to each other that they are both at attention. These torches having been lowered the dispatcher of the message will now raise the first set of torches on the left side indicating which tablet is to be consulted, i.e. one torch if it is the first, two if it is the second, and so on. Next he will raise the second set on the right on the same principle to indicate what letter of the tablet the receiver should write down.

From “Histories”, Book X, Translation by Paton et al.



2 torches visible on left → Select 2nd tablet
5 torches visible on right → Select 5th character



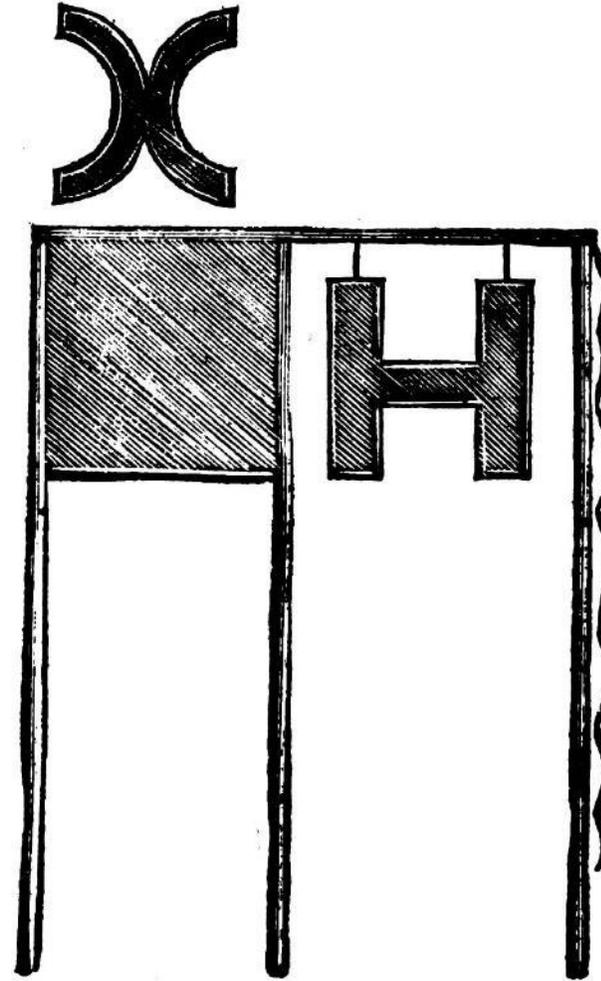
Hooke's Apparatus of Characters

“Discourse to the Royal Society, shewing a way how to communicate one's mind at great distances”

Robert Hooke, 1684

I say therefore 'tis possible to convey intelligence from any one high and eminent place, to any other that lies in sight of it, tho' 30 or 40 miles distant, in as short a time almost, as a man can write what he would have sent, and as suddenly to receive an answer, as he that receives it hath a mind to return it, or can write it down in paper. Nay, by the help of three, four, or more, of such eminent places, visible to each other, lying next it in a straight line, 'tis possible to convey intelligence, almost in a moment, to twice, thrice, or more times that distance, with as great a certainty as by writing

For the performance of this, we must be beholden to a late invention, which we do not find any of the ancients knew; that is, the eye must be affitted with telescopes, of lengths appropriate to the respective distances, that whatever characters are exposed at one station, may be made plain and distinguishable at the other that respect it



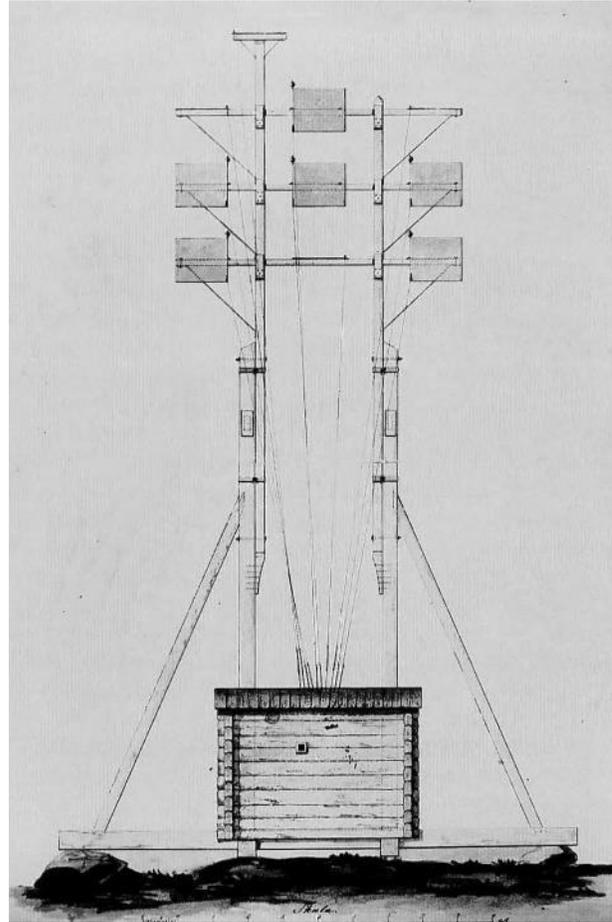
The first optical telegraphs



Claude Chappe's semaphore telegraph

Operational between Paris and Lille
from July 1794

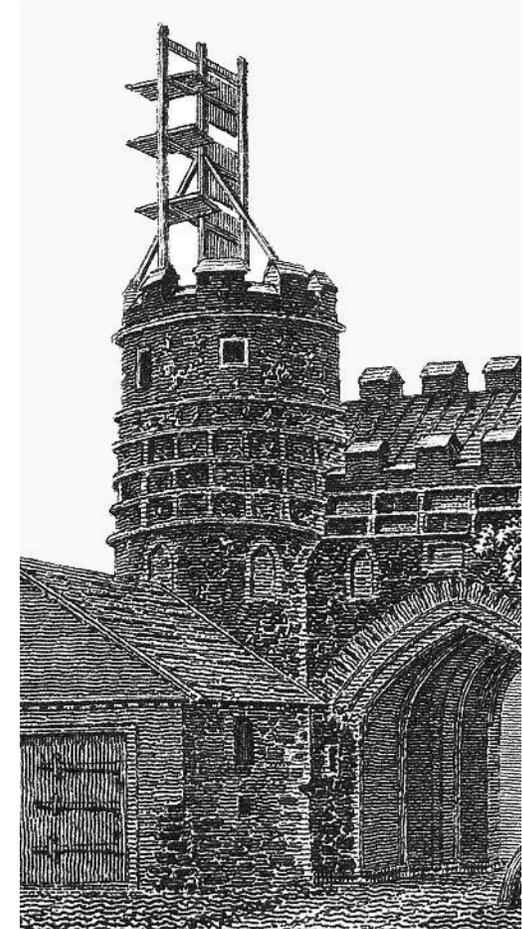
Telegraph post near Condé in November 1794.
Source: Detail of line drawing from Belloc 1888



Abraham Edelcrantz's shutter telegraph

Operational between Stockholm and Vaxholm
from July 1795

Source: Stockholm Telemuseum



The Admiralty shutter telegraph

Operational between London and Deal
from January 1796

The south gate, Great Yarmouth, Norfolk: leading to the
harbour. Detail of line engraving by J. Storer after W.
Brand. Source: Wellcome Collection

More optical telegraphs



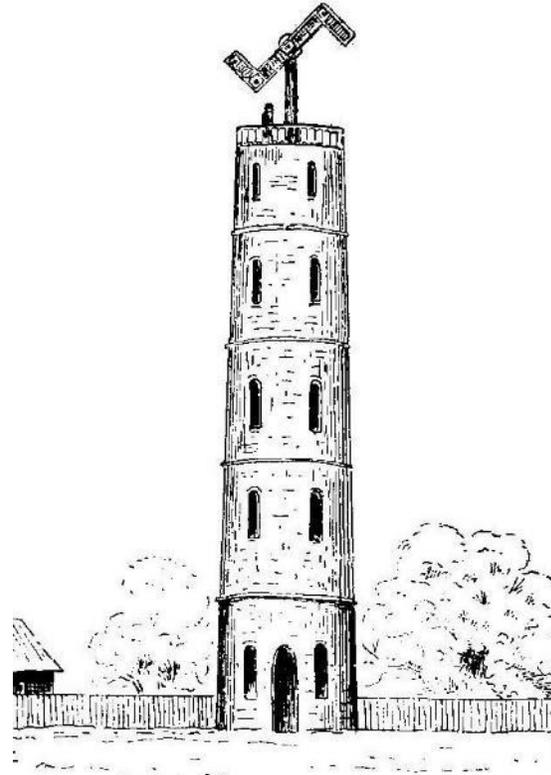
Admiralty semaphore,
London-Portsmouth

Restored tower at Chatley Heath. Source:
Photograph by Steve Unger



Prussian optical telegraph,
Berlin-Koblenz

Koblenz Castle. Source: Mittelrhein
Museum, Koblenz



Russian optical telegraph,
St. Petersburg - Warsaw

Source: Mead 1934

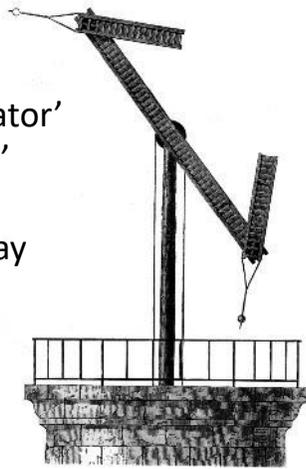


Fiskers shutter telegraph, Denmark

Kronborg Castle, Elsinore. Source Post & Tele
Museum, Copenhagen

How the Chappe telegraph worked

1) The mechanism comprised a 'regulator' and two 'indicators' which could be configured to display different symbols



3) 92 numeric codes were used to send messages

1	26	47	72
2	27	48	73
3	28	49	74
4	29	50	75
5	30	51	76
6	31	52	77
7	32	53	78
8	33	54	79
9	34	55	80
10	35	56	81
11	36	57	82
12	37	58	83
13	38	59	84
14	39	60	85
15	40	61	86
16	41	62	87
17	42	63	88
18	43	64	89
19	44	65	90
20	45	66	91
21	46	67	92
22		68	
23		69	
24		70	
25		71	

4) Words or phrases were transmitted by sending a sequence of codes. These indicated which code book to use, which page of the book to turn to, and which item on the page to read.

2) Some symbols were used to control traffic

Petite activité.	Grande activité. Cesce activité annule la petite.	Petite urgence. Cesce urgence annule la grande activité.	Grande urgence. Cesce urgence annule la petite.	Signal de réception.	Signal d'attente.
Signal de répétition de correspondance.	Signal final.	Congé de 1/4 d'heure.	Congé de 1/2 heure.	Congé d'une heure.	Congé de deux heures.
Erreur d'agent qui annule un faux signal porté au fini.	Suspension de brumaire.	Suspension d'absence.	Suspension de petit dérangement.	Suspension de grand dérangement qui exige la présence de l'inspecteur.	Suspension de retard.

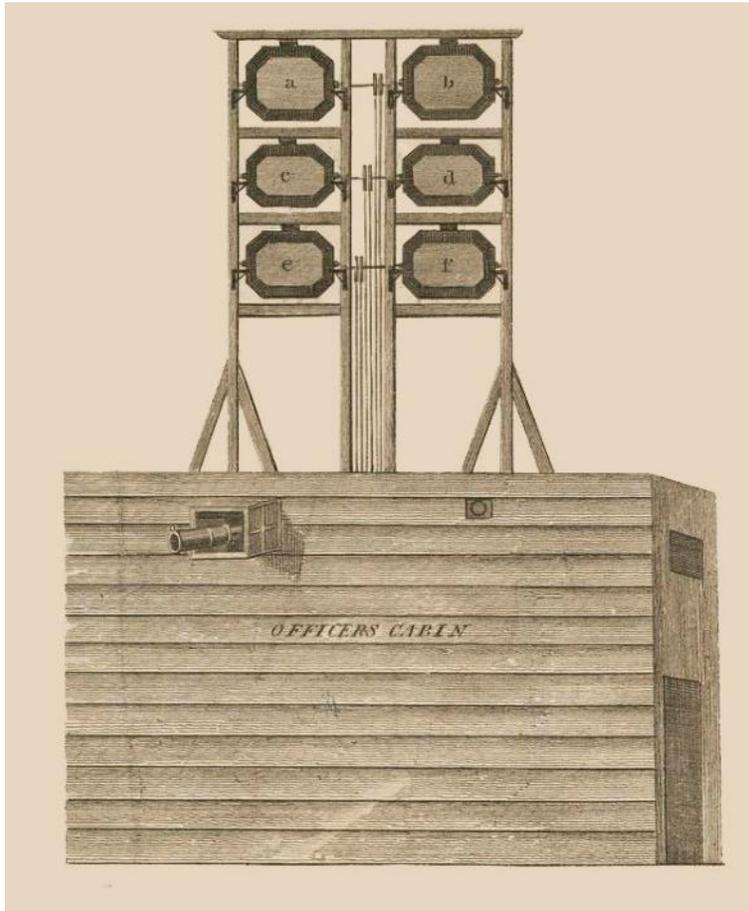
LE SECRETAIRE DES CONSEILS AUX AUTORITES CIVILES ET MILITAIRES SA MAJESTE (2ième voc.)		80 - 52
L'EMPEREUR		53 - 65
EST ENTRE A (2ième voc.)		32 - 29
PARIS		33 - 69
HIER SOIR		63 - 18
A LA		43 - 44
TETE		50 - 35
DES (1ère div.)		86 - 85
TROUPES		27
QUI AVAIENT ETE (1ère div.)		89 - 16
ENVOYES		63
HIER		34 - 2
CONTRE ELLE		43 - 40
ET (1ère div.)		52 - 43
AUX (1ère div.)		38
ACCLAMATIONS		6
D' (1ère div.)		1 - 79
UN		26
PEUPLE		1 - 58
IMMENSE		65 - 49
		44 - 34

How the Admiralty telegraph worked

1) The telegraph had 6 shutters, each of which could be open or closed. 64 different configurations were possible. One was used to indicate that the telegraph was 'at rest', leaving 63 available to send messages.

2) These were used to indicate the letters of the alphabet, the numbers 0-9, and a small number of commonly used words (e.g. 'fog', 'frigate', 'French', 'fleet')

3) Messages were compressed by leaving out unnecessary words and characters. For example:



Admiralty Six-shutter Telegraph.

No. of Signal, or of Shutters closed.	Signi- fication.	No. of Signal, or of Shutters closed.	Signi- fication.	No. of Signal, or of Shutters closed.	Signi- fication.
1	A	123	9	1235	
2	Z	124	6	1236	
3	X	125	5	1245	
4	W	126	4	1246	
5	B	134	0	1256	
6	F	135	1	1345	
12	L	136	2	1346	
13	O	145	6	1356	
14	V	146	3	1456	
15	U	156	8	2345	
16	H	234	G	2346	
23	Qu	235	C	2356	
24	R	236	D	2456	
25	T	245	E	3456	
26	S	246	Y	12345	
34	P	256		12346	
35	N	345		12356	
36	I	346		12456	
45	O	356		13456	
46	K	456		23456	
56	M	1234		123456	

“Order the Agamemnon out of harbour, and direct her to proceed to Spithead”

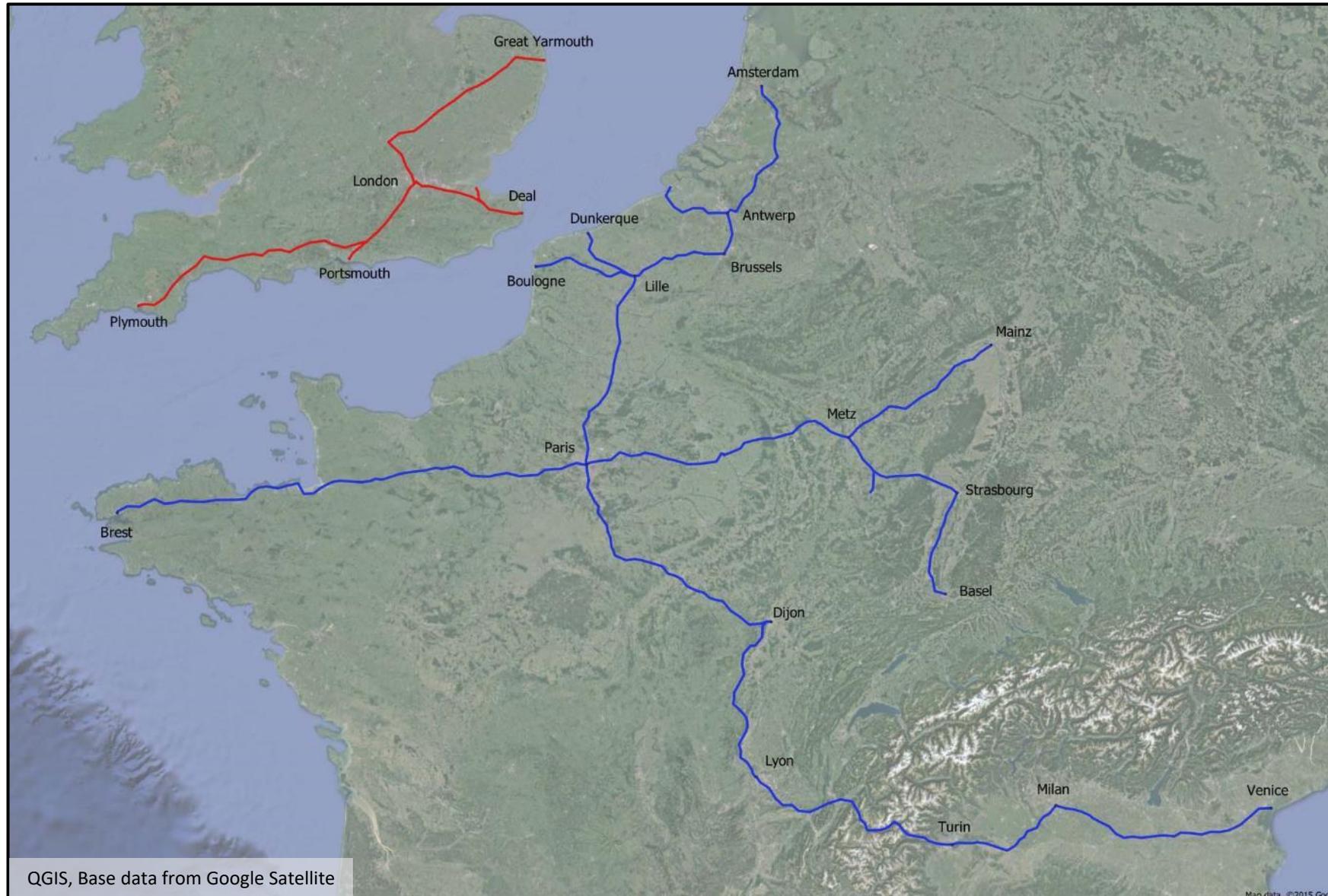


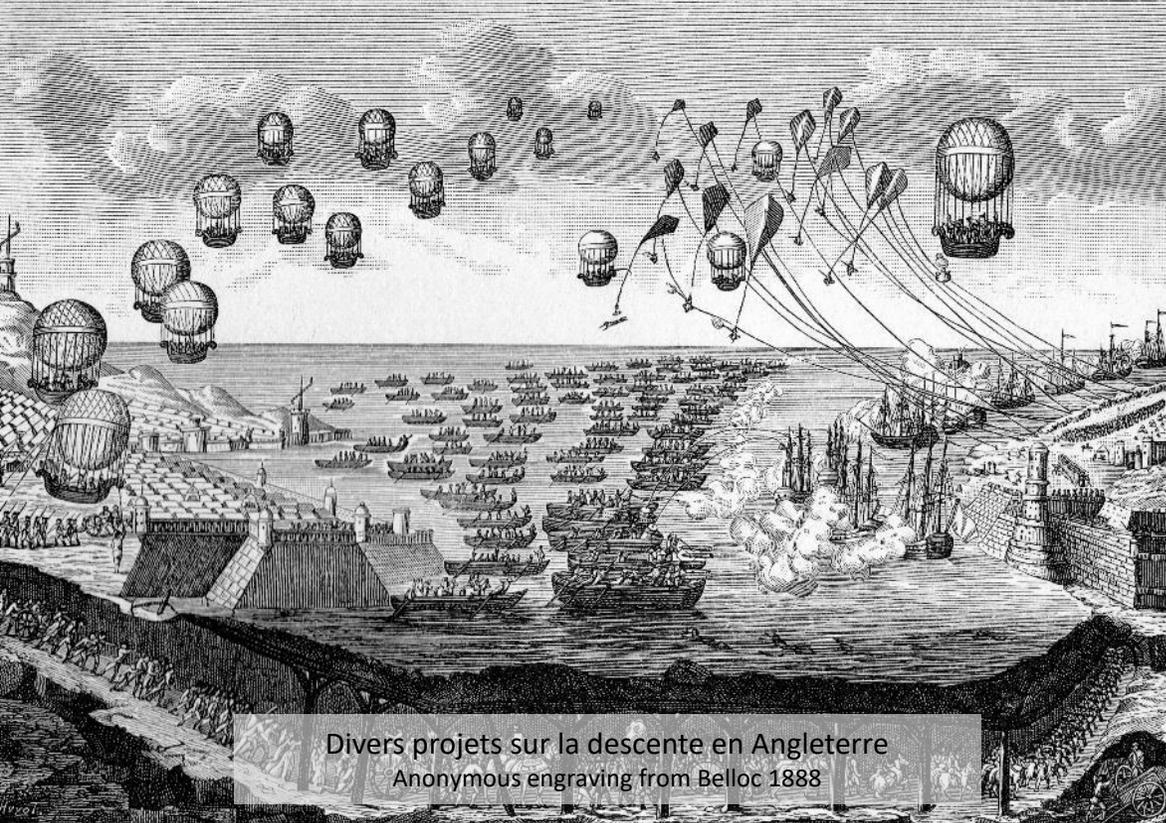
“Agmemn to Spthed”

According to John Barrow, the senior official in the Admiralty, this approach was faster and more reliable than the use of complex code books.

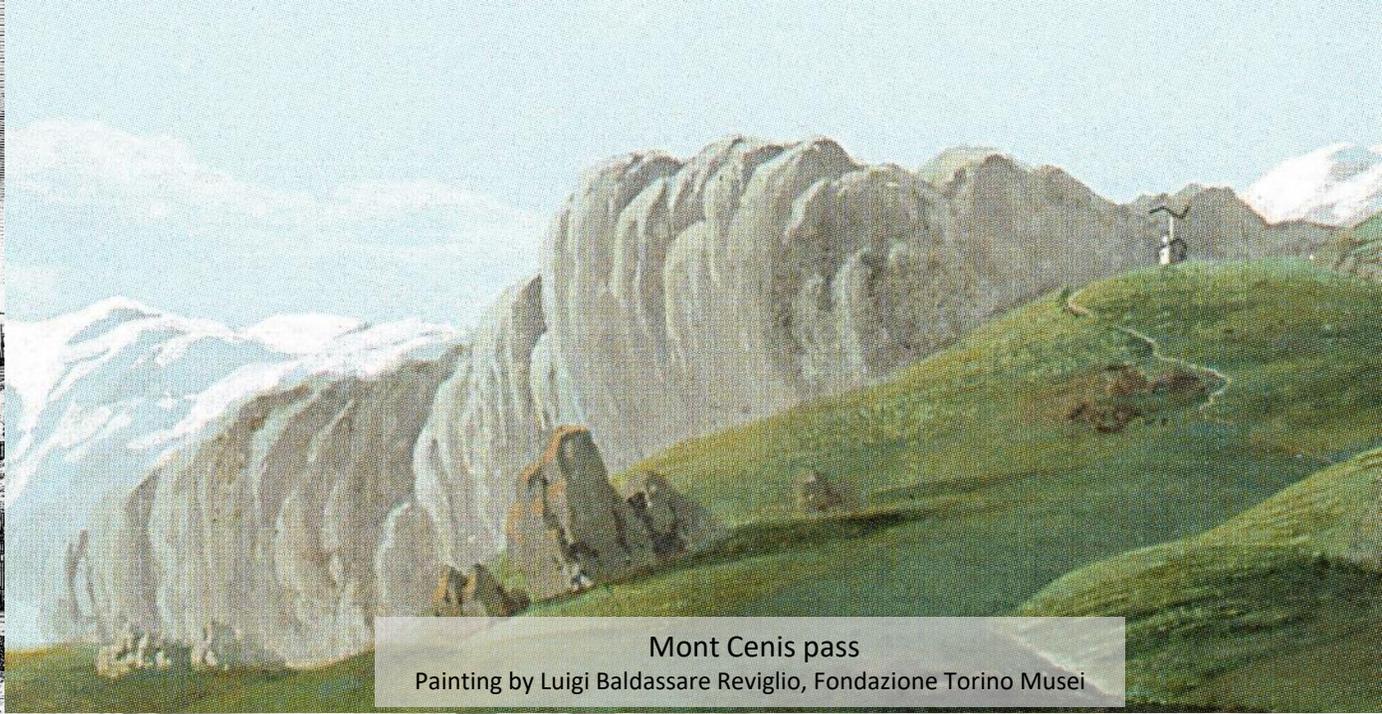
Source: Article by John Barrow on the Telegraph, Supplement to the fourth, fifth and sixth editions of the Encyclopaedia Britannica, 1824

Development during the Napoleonic Wars: 1794 - 1815





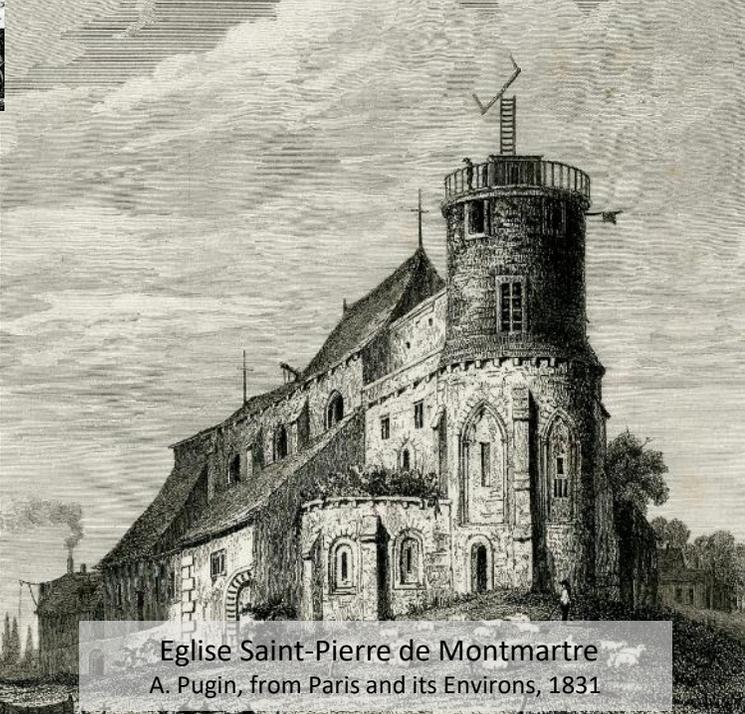
Divers projets sur la descente en Angleterre
Anonymous engraving from Belloc 1888



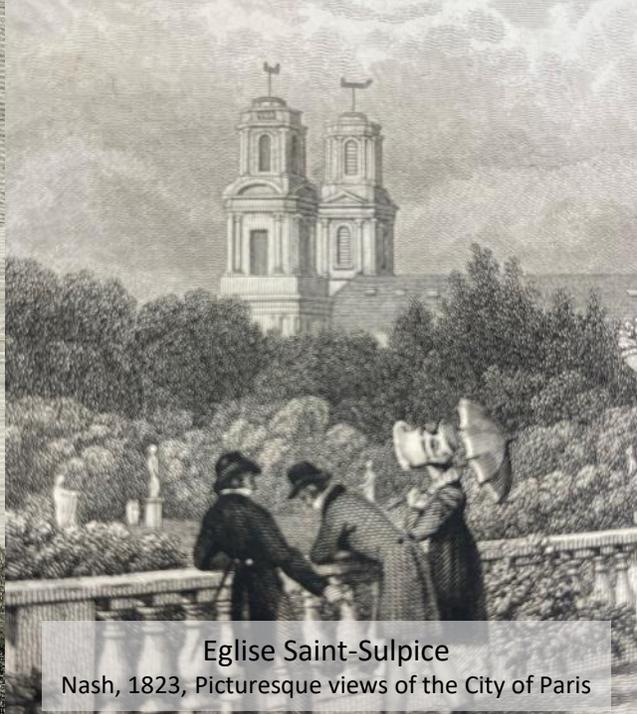
Mont Cenis pass
Painting by Luigi Baldassare Reviglio, Fondazione Torino Musei



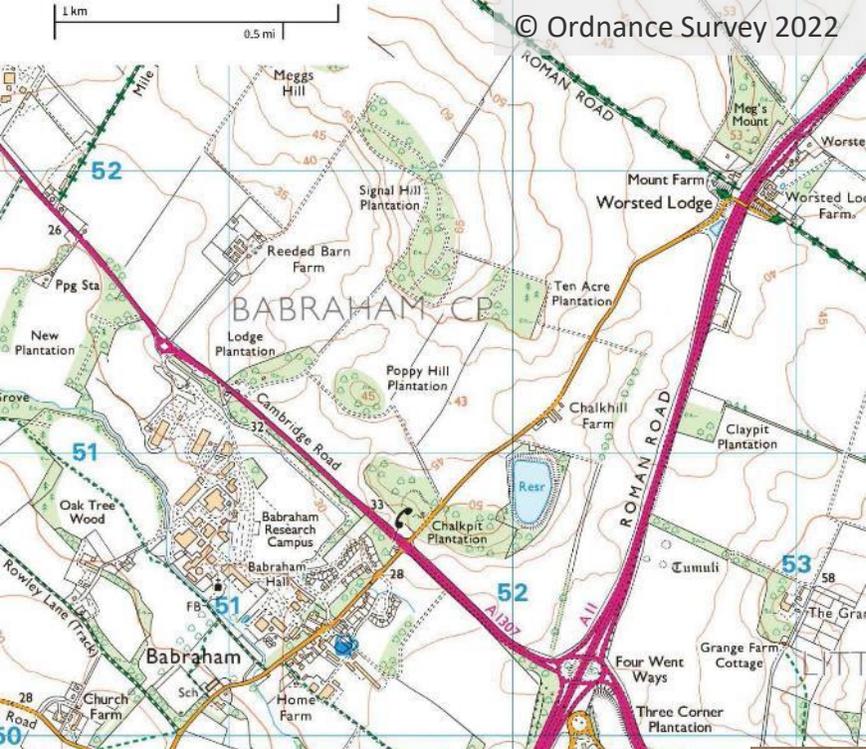
Garde-Meuble Place Louis XV
Nash, 1823, from Picturesque views of the City of Paris



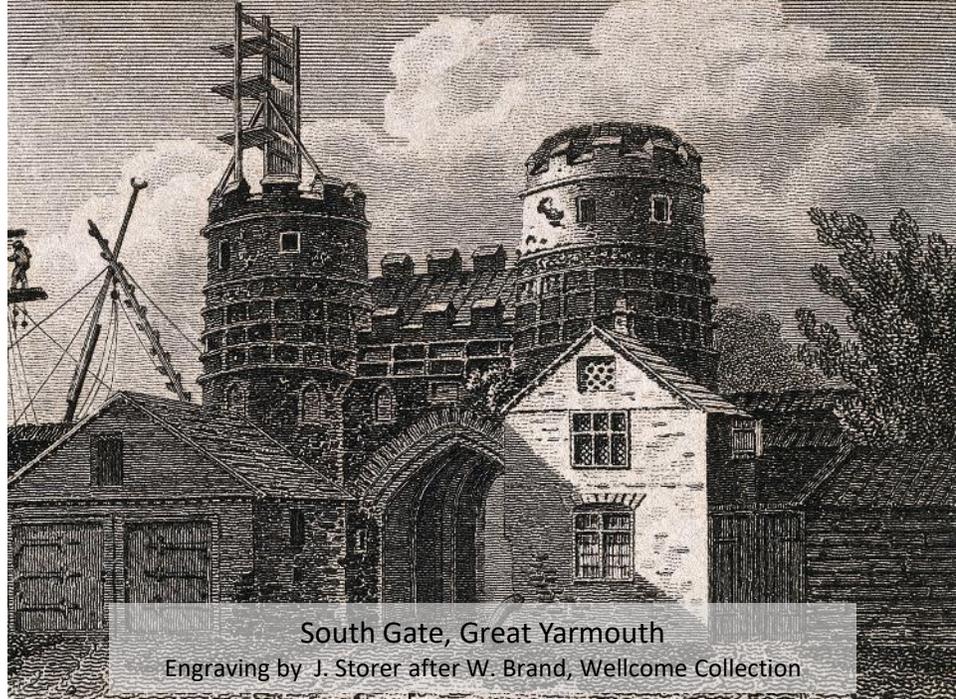
Eglise Saint-Pierre de Montmartre
A. Pugin, from Paris and its Environs, 1831



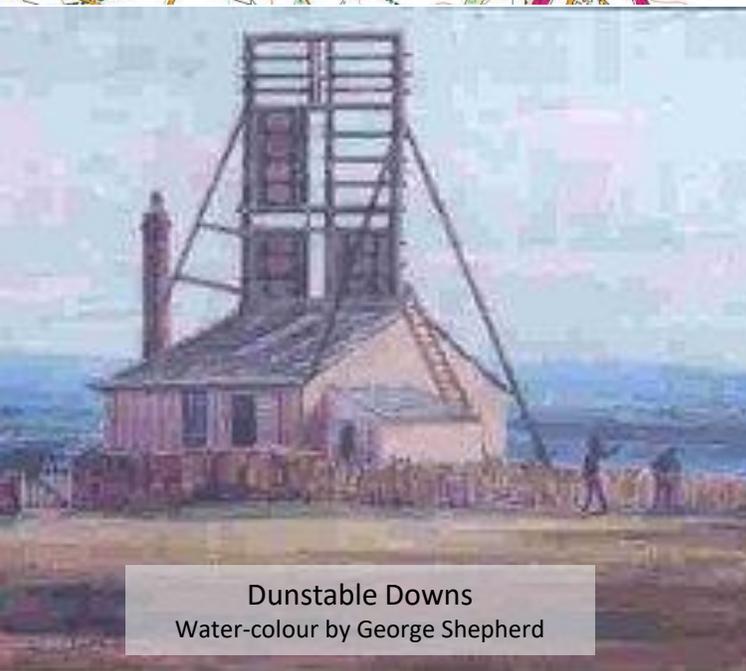
Eglise Saint-Sulpice
Nash, 1823, Picturesque views of the City of Paris



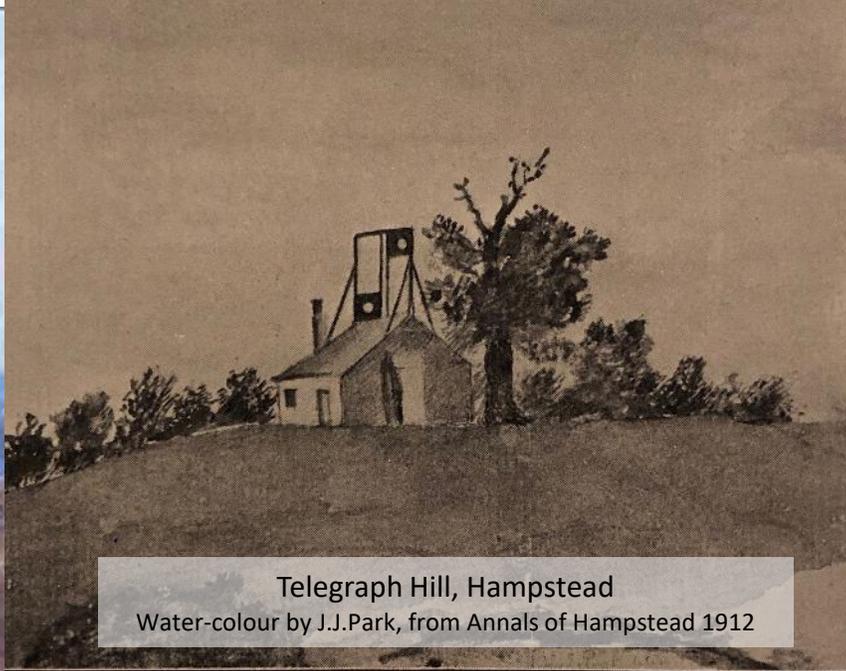
Telegraph Hill, Nunstead
Engraving by J. Anderson, from 'Grove Hill, A Descriptive Poem', 1799



South Gate, Great Yarmouth
Engraving by J. Storer after W. Brand, Wellcome Collection



Dunstable Downs
Water-colour by George Shepherd



Telegraph Hill, Hampstead
Water-colour by J.J.Park, from Annals of Hampstead 1912



St Albans
Water-colour by George Shepherd, British Museum

Optical telegraphs after the Napoleonic Wars



The first commercial telegraph network

Prospectus

Watson's General Telegraph Association

Under the sanction and support of her Majesty's Government, the Honourable East India Company, the Elder Brethren of the Trinity House, the Committee at Lloyds's, &c.

Capital £20,000, in 2,000 shares of £10 each.

Objects proposed.

The reporting to Owners, Consigners, and Subscribers generally, from the chief headlands round the coast, the arrival off or the passing of vessels

The transmission of orders to vessels as to destinations, &c. on arrival off any stations

The conveyance of information, whether public or private, along the continuous lines

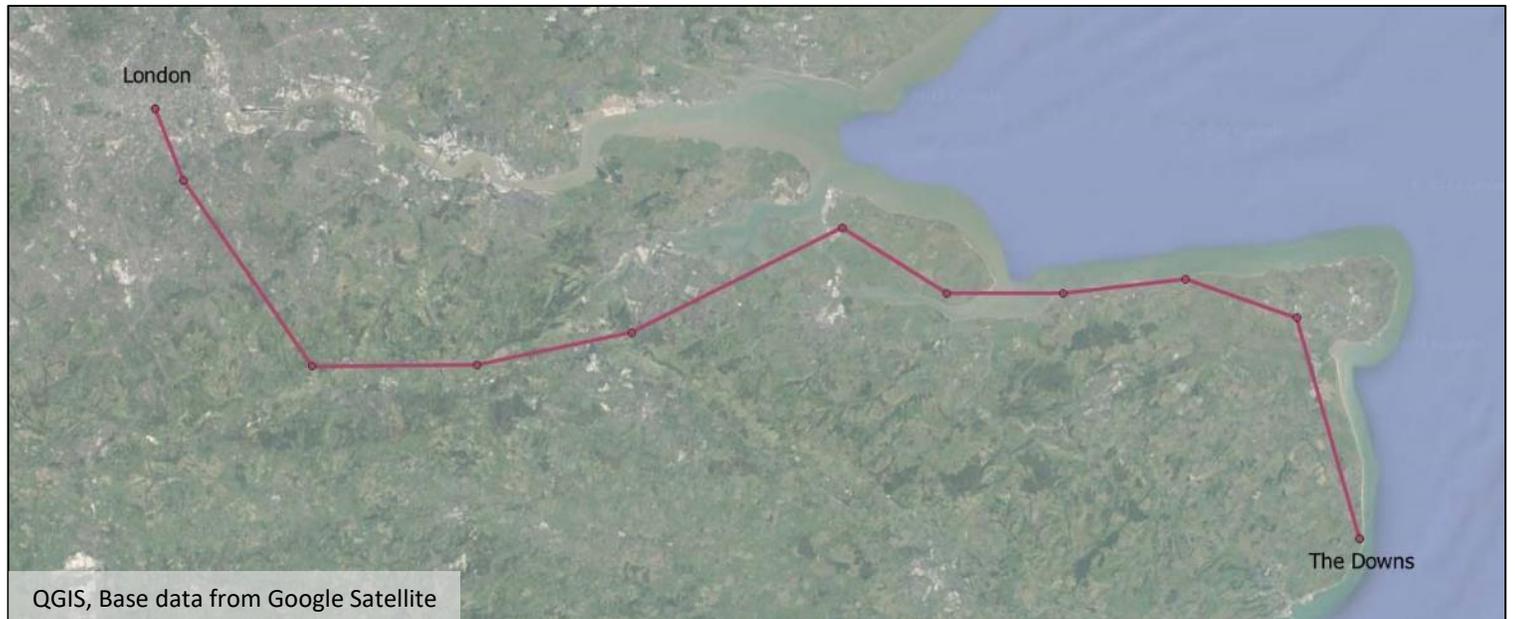
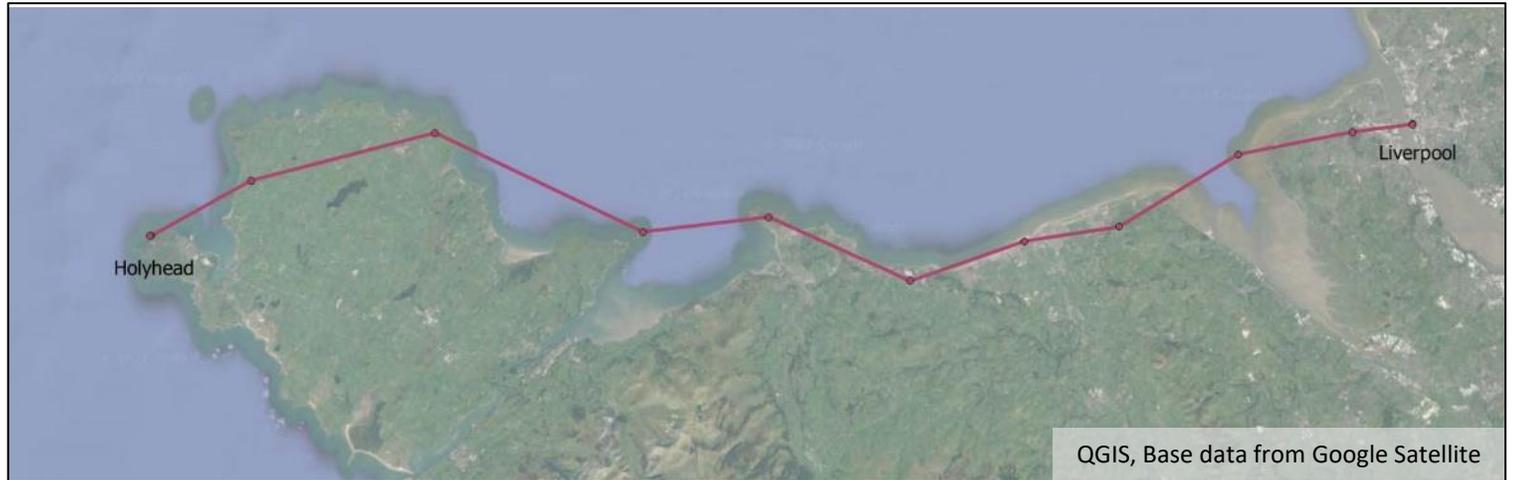
The establishment of one universal system of communication between vessels and the shore, and between vessels at sea, whether in the merchant service or her Majesty's navy

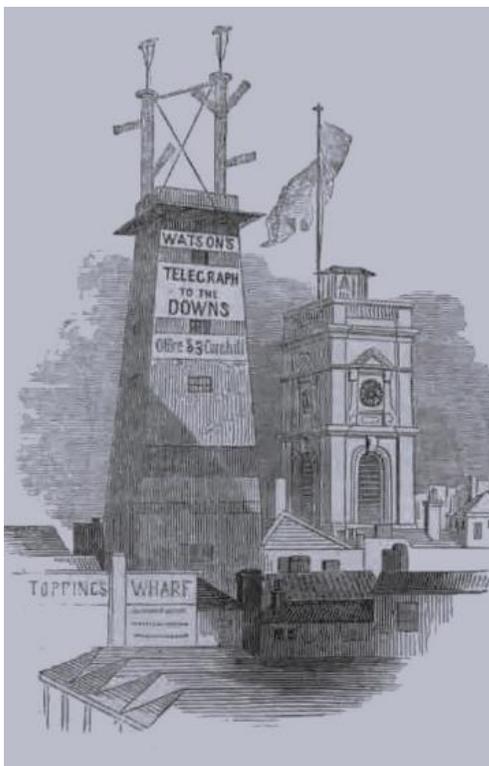
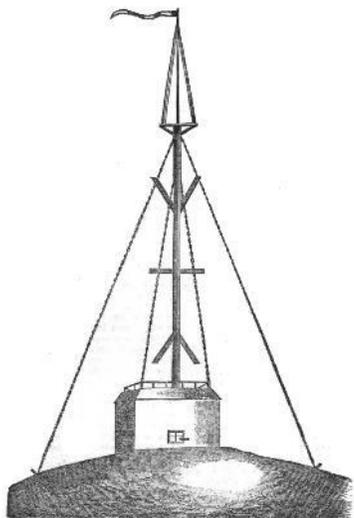
Subscription 20s per annum for each vessel

Arrangements will be made to avoid any additional expense to such vessels as are already provided with signal flags

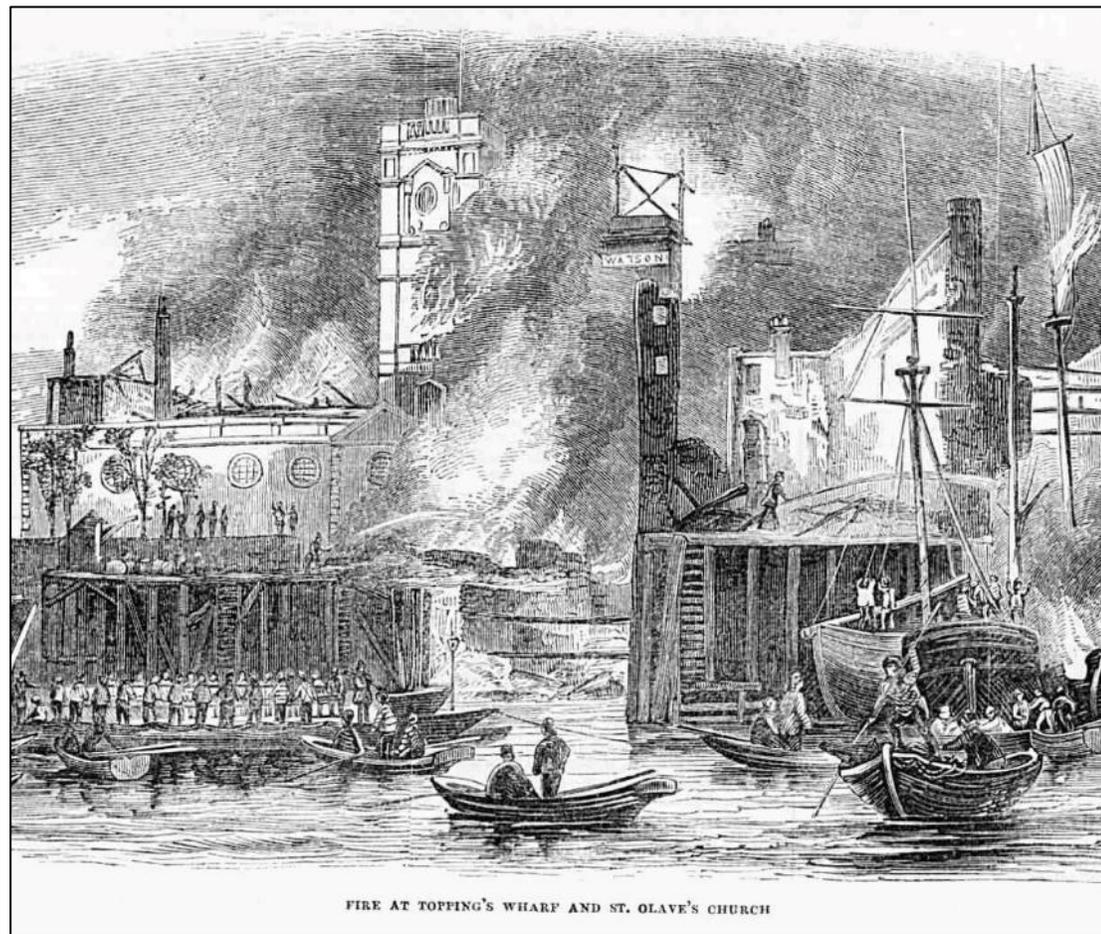
Vessels reported direct to owners or consignees (being subscribers) from each of the stations

Source: Shipping & Mercantile Gazette, September 9th, 1842





LIV		LOO	
No.		No.	
888	Has been struck with lightning	921	LIVING
889	Very vivid lightning	922	LOAD, s, ed, ing
890	LIGHTER, s	923	Loading for
891	Lighters are discharging her cargo	924	LOAF, ves
892	Send lighters to her assistance immediately	925	LOAN
893	LIGHTHOUSE	926	I shall be obliged by the loan of
894	Bidston lighthouse	927	LOCAL, ity, ly
895	Holyhead lighthouse	928	LOCK, s, er, ed, ing
896	Hoylake lighthouse	929	LODGE, r, ing, s
897	Leasowe lighthouse	930	Procure lodgings for
898	Point Lynas lighthouse	931	LOFTY
899	Point of Ayr lighthouse	932	LOG, s, ged, ing
901	Rock Perch lighthouse	933	Log book
902	South Stack lighthouse	934	Log line
903	LIKE, s, ing	935	Water logged
904	What is she like?	936	LOGWOOD
905	LIKELY, iness	937	LONDON
906	Is likely to	938	LONG, s, ed, ing
907	Is not likely to	939	Long boat
908	LIKEWISE	940	LONGER
909	LINE, s, d, ing	941	LONGEST
910	LINEN, s	942	LONGITUDE
911	LINK, s	943	Longitude as follows:
912	LINT	944	Longitude by chronometer
913	LIQUOR, s	945	Longitude by dead reckoning
914	LIST	946	Longitude by lunar observation
915	List of	947	LOOK, s, ed, ing
916	LISTEN, s, ed, ing	948	Keep a good look out
917	LITERAL, ly	949	Look out
918	LITTLE, LESS, LEAST	950	LOOM, s, ed, ing
919	Very little	951	LOOP, hole
920	LIVE, s, d, ing, ly, v. LIFE		



Fire at Topping's Wharf, 18th August 1843
Source: The Pictorial Times 26th August 1843

Sources: Watson, 1827, The Telegraphic Vocabulary;
Illustrated London News, July 16th 1842, Telegraphic Dispatch

“A messenger far outstripping the wind in its speed”

Bertrand Barère speaking to the National Convention, on behalf of the Committee of Public Safety, August 1794

Citizens, of the four places delivered through treason to Austria, the second has just been returned to the rule of the Republic (applause). We announced, a few days ago, the retaking of Landrecies; today, the Committee announces the retaking of Le Quesnoy (more applause) ...

We take this opportunity to tell you of a new organisation created under the auspices of the National Convention, of a machine by means of which the news of the retaking of Le Quesnoy was brought to Paris two days ago, an hour after the garrison entered it. An ingenious means has been invented to transmit thought by a special language which, repeating step by step, between machines separated by 4 to 5 leagues and which arrived in a few minutes, over great distances, does honour to this age of enlightenment

Newspaper report in the Kentish Gazette, 1st March 1795

Tuesday morning at day-break, the Espiegle sloop of war, Capt. Roberts, which was stationed with a cutter off the Texel, to watch the motions of the enemy, discovered the Dutch fleet coming out to sea. Captain Roberts immediately dispatched the cutter to Admiral Duncan, in the Downs, with the intelligence, while he followed the enemy to see the course they stood. The cutter arrived at Deal, on Wednesday afternoon; and soon after, the intelligence was conveyed to the Admiralty by means of the Telegraph.

The celerity of the communication was quick beyond example; the news of the sailing of the fleet was known at Deal in about 32 hours after; and it was only four minutes and an half in reaching the Admiralty from Deal.

Newspaper report in the Liverpool Mercury, 9th November 1827

The first telegraphic communication along the whole line from Holyhead to Liverpool was made on Monday morning at nine o'clock, when it was announced that the wind had changed at the Head from southwest to west. The same change did not take place at Liverpool until an hour later, and, as the telegraphic communication was made in five minutes (the distance being 128 miles) it may be said that this is a messenger far outstripping the wind in its speed.

Telegraphic intelligence will soon be as regular an item in our newspapers as the accounts of exports and imports. The expedition with which intelligence can be communicated by the best constructed telegraphs is almost incredible

Questions?

swunger@swunger.com