

Meteorology and D-Day, 6 June 1944

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Some are weatherwise, some are otherwise.

Benjamin Franklin (1706-1790)

Of all human activities, war is one of the most intense. And it is carried on in the open air. So wind and weather almost always play a part. For most recorded battles, the winning side has had the wind on its back. At sea, this became 'having the weather gauge'; on land, with the wind on your back, your arrows, spears and stones fly farther and, with good planning, your opponent's fall short¹. At Towton, 1461, during the Wars of the Roses, snow blew into the losing, Lancastrian, side's eyes. Even during the cold war of the mid-20th-century, since upper winds blow mostly from the west, they would usually have carried nuclear fall-out clouds over western Europe back east. Had the Soviet Union waited for an unusual period of easterly upper winds, its occurrence should have raised the level of alertness in the west.

It would be the major Allied operation of 1942 and 1943, a substitute for an expedition across the English Channel which had originally been planned, but which had been abandoned in June as strategically unsound at that stage of the war.....

Conditions for landing were estimated to be unfavorable four days out of five during the late autumn. There was thus the strong possibility that our armada would find itself waiting the weather, having lost the immense advantage of surprise

The shape and scope of Allied Force Headquarters developed naturally from the fact that the Commander-in-Chief was American, that the operation it was planning would in its nature be amphibious throughout, that Air would play a vital part both in the operation itself, and in the exploitation of its success, and finally that the forces employed would be drawn from all three services of both the United States and the United Kingdom. I was determined from the first, to do all in my power to make this a truly Allied Force, with real unity of command and centralization of administrative responsibility. Alliances in the past have often done no more than to name the common foe, and "unity of command" has been a pious aspiration thinly disguising the national jealousies, ambitions and recriminations of high ranking officers, unwilling to subordinate themselves or their forces to a commander of different nationality or different service

Sixteen days before the operation, meteorological forecasts were favorable, but some days later a depression, originating over NEWFOUNDLAND, was traveling towards the BAY of BISCAY. The strong Southwesterly winds which resulted were not likely to affect North Coast landings, but at CASABLANCA it was blowing dead on shore. Mercifully it has subsided on November 1st, and, except for periodical rain storms of unprecedented violence, the weather became then fine and clear. It appeared certain on November 7th that the landings could take place on schedule.

**Report of the Supreme Commander to the Combined Chiefs of Staff
on operations in North Africa (TORCH) [Autumn 1942]**

¹ For much of history, too, it also helped to have the sun on your back: as your opponent looked up to avoid your arrows he was hindered by looking into the sun. Inevitably, there are exceptions. During a critical part of the naval Battle of the River Plate, for example, the German *Admiral Graf Spee* was silhouetted against the setting sun whilst the British squadron to the east was shrouded in the dusk.

Geopolitics

Tuesday 30 November 1943 was Winston Churchill's 69th birthday. He spent it in Teheran with Roosevelt (whom Churchill always calls 'The President') and Stalin. It was at Teheran that they and their staffs agreed² that Operation 'OVERLORD' would be launched during May 1944, in conjunction with an operation against Southern France. The latter operation would be in as great a strength as availability of landing-craft permitted..

Later, Churchill commented that

The cross-Channel invasion was fixed for May, subject naturally to tides and moon. It was to be aided by a renewed major Russian offensive. ... the proposed descent upon the French southern shore by part of the Allied Armies in Italy... made it easier to secure the landing-craft necessary for the success of our Italian campaign.

In the event, the availability of landing craft (balancing needs for Normandy, Italy, the eastern Mediterranean to encourage Turkey to join the Allies, and the Pacific), was one critical factor in the choice of the date to be called D-Day. As it turned out, resistance in Italy was strong (Monte Cassino fell to the Allies on 18 May 1944 and Rome on 4 June) so the Allies were in no position to launch an attack on southern France during the summer of 1944.

Climate

Partly as a result of his experience in invading North Africa and Sicily, where he had a team of meteorologists always by him, Eisenhower (whom his 1944 staff always called 'the Supreme Commander', even many years later) expected the effects of weather on the assault on France to be complicated³. For OVERLORD, he had some three million men and women under his command with a variety of tools and weapons, each susceptible to the weather in different ways. For the soldiers to be carried to the beaches by ship and landing craft, strong winds causing rough seas led to sea-sickness⁴ and lowered efficiency on arrival. Earlier trials on the English south coast had shown that landing craft, and tanks with flotation collars, had handling difficulties in rough seas and could even founder. Whilst the large-scale assault and transport of troops were naval, the air forces carried the initial shock troops, injecting them by parachute and glider. The air forces were also responsible for attacking supply lines and maintaining for as long as possible, in the mind of the opposition, the likelihood that the main thrust would be in the Pas-de-Calais rather than Normandy. As late as 3 June, the minimum weather requirements for different parts of the air forces were still being discussed.⁵

For central planning before the event, the weather requirements of the various arms⁶ had been simplified to

- (a) D-Day to be within the period of one day before to four days after new or full moon;
- (b) D-Day itself to be quiet and followed by a sequence of three quiet days⁷;
- (c) Cloud to be less than 3/10 cover below 8,000 feet and visibility more than 3 statute miles, OR
- (d) Cloud base generally above 3,000 feet and with morning mist or fog not excluded.

Climate statistics were known to be unreliable as an indicator of the weather in the English Channel on any particular day. They were, however, a helpful planning aid. Of course, several weather elements had to be right at the same time, and the more elements that had to be right the smaller the chance they would occur together. The

² The Second World War , vol. 10, Assault from the Air, by Winston S. Churchill, Cassell, London, 2nd Edition, 1965

³ There are 19 mentions of weather in his report on Operation TORCH. Weather in the Channel is usually much more complicated than that on the coasts of North Africa.

⁴ Those carried in gliders sometimes suffered similarly [Crichton-Miller, C., Met. Office SDTM 48, 1943]

⁵ Freeman, Flight Officer Lady E., PRO (now TNA) AIR 37/1213.

⁶ Air Publication 1134, Appendix 9, Air Ministry, Air Historical Branch, 1954.

⁷ A quiet day was defined as one with surface wind (i.e. at a height of ten metres above ground or sea) less than Beaufort Force 3 onshore and Force 4 off-shore on the Normandy coast of France.

statistics gave racing odds of obtaining (a), (b), (c) or (d) as follows:⁸

	Chances to one against		
	<u>May</u>	<u>June</u>	<u>July</u>
I <u>Without a new or full moon</u>			
(b) and (c) but not (a)	9	9 to 2	19
(b) and (d) but not (a)	4	2	5
II <u>With new or full moon</u>			
(b) and (c) with (a)	24	13	50
(b) and (d) with (a)	11	6	16
III <u>Full moon only</u>			
(b) and (c) with (a)	24	13	33
(b) and (d) with (a)	49	24	100

Clearly June was the best of the three months. To attack when the moon was full or new would ensure a low tide around sunrise on the Normandy beaches so that mines and obstacles could be countered, but this roughly trebled the odds against having the required wind and cloud. To insist on a full moon, enormously advantageous for the initial impact by parachute and glider landings, lengthened the odds of favourable weather still further. Overall, the odds were something like ten to one against the weather being even broadly acceptable.

No-one liked this. The Navy and Army looked for wind and waves similar to those which had blessed the 1940 evacuation from Dunkirk. The Air looked for clear skies to ease navigation, to increase the accuracy of weapons dependent on a clear line-of-sight and generally to achieve air superiority. In their planning of an invasion of southern England in the autumn of 1940, Operation SEALION, the German authorities thought much the same. The Luftwaffe's failure in the Battle of Britain, as well as the advancing autumn weather, caused Hitler to cancel SEALION. (It also increasingly conflicted with plans to invade the USSR from Poland, Operation BARBAROSSA, the following summer⁹.)

Churchill summed up the problem when announcing the invasion to the House of Commons on 6 June 1944. Referring to Operation NEPTUNE, the naval component of OVERLORD, it was, he said,

the most complicated and most difficult that has ever taken place. It involves tides, winds, waves, visibility, both from the air and the sea stand-point, and the combined employment of land, sea and air forces in the highest degree of intimacy and in contact with conditions which could not and cannot be fully foreseen.

Seven-day forecasts

During the planning stages it had become clear that commanders at a number of levels would need to make many weather-dependent decisions seven to ten days ahead of the actual assault. Some ships from northern bases would take a week to reach the assembly area in mid-Channel, so an initial decision would be when to set them on their way; then, the Supreme Commander needed to choose, at least four days ahead, a day, D-Day, when wind, cloud and visibility would not prohibit or wreck landings. To allow the build-up of the forces in Normandy, D-Day

⁸ *Meteorological Implications in the Selection of the Day for the Allied Invasion of France June 1944*, 22 June 1944. A report to the Supreme Commander, SHAEF; copy in Met. Office Archives. Also AP 1134 (see footnote above).

⁹ The weather, or rather the much more predictable climate, was a determining factor in *Barbarossa* too. Following his *blitzkrieg* advances through western Europe in the spring and early summer of 1940, Hitler thought he could reach Moscow from the line of partition of Poland in eight weeks from Sunday 22 June 1941. Consequently, even allowing for some proportionate delay, his troops would have all the resources of the Soviet capital in their control well before the onset of the bitter Russian winter, and were more likely to achieve their aim if they travelled light. A German meteorologist, who was serving with the troops on the Easter front, has told me that their vehicles had no anti-freeze and, like the other troops, he had no winter clothing.

also had to be the first of two or three with similar non-prohibitive weather.

British forecasters knew that the state of meteorological knowledge meant that it would almost never be possible to forecast to the required accuracy so far ahead¹⁰. An American USAAF forecaster, Col. Irving P. Krick, thought otherwise. He had had some success with his analogue method¹¹ in the meteorologically more-uniform United States. Some British meteorologists, though, used words like ‘charlatan’. Krick was, amongst other things, good at identifying with his customers’ needs and also an ‘opportunist in time’: good at knowing what weather was needed and then identifying, with the maximum possible notice, when a suitable occasion might arise in a particular area (chiefly during periods with slow-moving anticyclones). Forecasters at HQ RAF Bomber Command had an analogous role ‘opportunist in space’ in helping identify for the night ahead which of the potential target areas were likely to be the most suitable from the weather point of view. Krick, of course, had the ear of his USAAF generals. Indeed, whilst the public at large received no weather information during the war, senior officers of the armed forces at all levels had their own team of forecasters briefing them on likely weather impacts on their own operations. By the end of the war, the UK Met Office alone had a staff of ten thousand; there were a thousand observing stations in the UK.

In 1943 and early 1944, the UK’s Meteorological Research Committee, recognizing the value for many activities of forecasts of useful accuracy for longer periods ahead, had generated at least eleven reports on research into extended-range forecasting, including an examination of the technique advocated by Col. Krick. The overall conclusion was that useful forecasts were usually not possible beyond about 18-24 hours ahead although the general character of the weather could usually be given for a further 24 hours. Nevertheless, fifty years later Col. Krick and his colleague Lt Col. Ben Holzman were still credited by the US Air Force weather magazine *Observer* with having given the Supreme Commander “*a time period that that would permit the invasion to happen*” – and crediting them with giving the forecast which “*prevailed*”.¹² At a time when all were under stress, and forecasting was not a systematic process, differences between the practitioners were great and disputes between their protagonists continue. In fact, see below, it was on 23 May that the Supreme Commander announced his decision that D-day was provisionally fixed for 5 June, with 6th and 7th as alternatives.

Forecasting for normal day-to-day operations

In 1944, weather forecasting was little different from what it had been since the coming of the electric telegraph had made it possible about 80 years before. A scattering of observing stations by land and sea measured quantities such as the pressure, temperature and humidity of the air, visibility, rain, snow and other types of precipitation, and types, amount and heights of clouds. These observations were plotted on charts so as to enable the forecaster to draw patterns of the pressure distribution, reduced to what it would be at sea-level, and to estimate, from recent changes in pressure, the distribution of pressure at some time in the future. This was known as the synoptic method. Wind strengths and direction, could be deduced and future weather estimated. In addition, soundings of the upper air were carried out using radio-sondes developed in the 1930s to measure temperature, pressure and humidity as they ascended to heights usually above those at which aeroplanes then operated. Initially, winds were measured by triangulation on the airborne radio-transmitter (only after the war did radar come into general use for this purpose, although the Met Office had one or two by D-Day). In addition, both the RAF¹³ and Luftwaffe¹⁴ sent long-range aircraft out on routes over the Atlantic to measure wind, pressure, temperature and

¹⁰ Even with a large anticyclone settled over or near the Channel small variations could cause unexpected prohibitive wind or cloud. The UK’s Meteorological Research Committee had been organizing studies of the problem for years and concluded such ‘medium-range forecasts’ unfeasible on any scientific basis.

¹¹ Based on a collection of 40 years of daily weather maps of the northern hemisphere.

¹² Mundell, Lt. Gen. Lewis L. in *Observer – Your magazine for Air Force Weather*, August 1996, vol. 43, no. 8, p. 14.

¹³ *Even The Birds Were Walking: The Story of Wartime Meteorological Reconnaissance*, J. A. Kington, 2000, Tempus, Stroud, UK, & Charleston, USA

¹⁴ *WEKUSTA: Luftwaffe Meteorological Reconnaissance Units & Operations 1938-1945*, J. A. Kington & F. Selinger, 2007, Flight Recorder Publications, Ottringham, U.K. ISBN10: 0 9545605 8 2; ISBN-13/EAN: 978 0 9545605 8 4

humidity as they went and to make a few ascents and descents to reveal the vertical structure of the air. In UK, the Central Forecast Office, evacuated to Dunstable, Bedfordshire, for the duration (and known as ETA), distributed the information to other forecast offices securely via a network of land-line teleprinters which had mostly been installed between 1938 and 1939¹⁵.

The Germans had similar arrangements for making observations over land. Because of the size and dispersion of their holdings on the continent, however, and the speed at which they had captured them, they exchanged their observations and their digested information by radio. By the time of D-Day, a main task of the German U-boats was to make and transmit weather observations, again by radio. Information from both these sources, as well as information from the Luftwaffe weather flights was often intercepted. In co-operation with Bletchley Park, all was routinely deciphered and often plotted on the charts at Dunstable almost as soon as it was in Berlin—to contribute to the Allied forecasting effort. (Perhaps because of the possibility that they—or any other opponent—might have broadcast artificial, misleading, information, this routine deciphering of German wartime weather information was kept secret until 1994.)¹⁶

By D-Day, some limited routine charting of the upper air was possible and, using these upper-air charts, Dr R. C. Sutcliffe, whilst working for 3 Group of RAF Bomber Command, had developed a science-based technique¹⁷ which gave some qualitative indications of where synoptic-scale weather systems were likely to develop and how they might change subsequently. The application of this ‘development theory’ then, and for many years afterwards until it was superseded by modelling in supercomputers, was through human interpretation.

The general nature of the atmosphere was known: it was, and is, known to be turbulent in nature, driven by energy from the sun, which is reflected to differing degrees by the underlying surface and clouds. Air which is warm in some places and cool in others, and having patterns of motion within it, moves in different directions at different levels and continually interchanges with the air above and below it. This vertical exchange itself depends greatly on the prevailing vertical temperature-distribution which itself changes as a result of the vertical exchange of air. This is just one of many feedback-mechanisms: the distribution of clouds at any time, for example, affects the absorption of the sun’s rays at the surface and so the future distribution of clouds. Similarly, the surface of the sea may moisten, heat or cool the air above it depending on the sea’s own distribution of surface temperature; this distribution, in turn, depends to a large extent on the water’s interactions with the weather systems which have passed over it¹⁸. Similarly, a recent weather system may have covered the land with snow, changing entirely the amount of heat the land absorbs from the sun and the heat the land can add to, or take from, the air passing over it. In autumn, a strong wind removing leaves from the trees alters their drag on subsequent winds.

It is the multitude of such feedback mechanisms that make the atmosphere-land-ice-ocean system inherently chaotic. Its future state can be foreseen, depending on the space-scale of interest, only in varying degrees of detail for varying, usually rather short, times ahead. Despite the way the D-Day forecasts may have been presented, the next day’s weather did not exist outside the informed imagination of the forecaster¹⁹. Just as, now, it does not yet exist outside the calculations, based on detailed physics on a range of space- and time-scales, of a supercomputer.

By D-Day there were some intellectual models of atmospheric behaviour in mid-latitudes²⁰, of the typical

¹⁵ Indeed, Dunstable and Bletchley Park were chosen at least partly because they were close to a main trunk of the landline telegraph system.

¹⁶ German charts show a few observations on the British mainland, apparently observations passed to Allied aircraft by Air Traffic Control at their intended landing field. Ireland, as a neutral state, continued with its pre-war arrangements and sent its observations into the international exchange system via the UK, which did not pass them on. They were, of course available in Ireland and so to the German Embassy in Dublin. Pilot balloon ascents were made from the roof of the UK embassy in neutral Lisbon to measure upper winds in that area.

¹⁷ So-called thickness patterns.

¹⁸ In the extreme, a hurricane needs warm water under it to provide much of its energy but leaves cooler, and deeply disturbed, water behind it.

¹⁹ Just as, on the eve of a battle, or an election in a truly democratic country, the outcome of the next day’s struggle exists only in the imagination of the protagonists.

²⁰ Qualitative guidance on the construction of forecast synoptic charts (PREBARATICS), for example, was given by C.K.M.

cyclone or depression, of masses of air with broadly similar characteristics and of rain-bearing fronts of advancing or retreating cold air with warm moist air being forced upwards to produce cloud, snow and rain. Fronts had been adopted as models during the 1920s, following their visualization by Norwegian meteorologists during the First World War when the three-dimensional bounding surface of the advancing or retreating cold air was seen as analogous to the movements of armies. Overall in 1944, weather forecasting was an intellectual art, based in science and yet depending greatly on the memory, experience and imagination of the practitioner.

It was also true that the distance between observations usually allowed analyses of the situation by different people to differ in significant respects. Thus, it is not surprising that different practitioners offered different opinions based on the same evidence. Even today, observational coverage can be insufficient to give a unique analysis on the synoptic scale – that of fronts, depressions and anticyclones. This, coupled with the reality of the so-called butterfly effect, means that the world's most advanced meteorological computing centre, the European Centre for Medium-Range Weather Forecasts at Reading, UK, routinely finds it possible to fit 51 slightly different analyses to the initial data, and so produce 51 different forecasts of the distribution of air pressure and upper wind for any particular period ahead²¹. Where the products of this so-called Ensemble Prediction System (EPS) agree closely, users may have confidence in the mean forecast, sometimes out to five days or more. Where there is more scatter between the 51 forecasts, users should have less confidence.

In 1944, forecast charts (known as PREBARATICS or PREBARs) were prepared each six hours for a time only 18 hours ahead. This was the principal guidance from Dunstable to all forecasters at Met Office UK outstations and to forecasters of the Royal Navy in the waters around UK. On the relatively rare occasions when a large anticyclone promised a period of settled weather, its duration beyond about 48 hours was just not knowable, though an opinion that settled weather was likely to continue might well be expressed more confidently than was usual for such a period ahead.

RAF Bomber Command, for much of the war, held regular meteorological telephone conferences between forecasters at individual airfields and the Group headquarters, and between the Group HQs and HQ Bomber Command. For security, these took places using 'scrambler' telephones. Different views were resolved and it was generally thought that better forecasts were issued as a result: in particular, the more experienced meteorologists at Group could guide less experienced forecasters at outstations, many of whom were teachers of mathematics or physics temporarily serving as forecasters after a few months' instruction in meteorology.

Meteorological arrangements for D-Day

In addition to the normal arrangements continuing so that all commanders had access to weather advice, a small high-powered meteorological team was established at Supreme Headquarters Allied Expeditionary Forces (SHAEF) to serve the Supreme Commander and his staff. This team worked out the climate statistics and, as the planned D-Day approached, regularly briefed the Supreme Commander, weekly at first in May, then daily and eventually twice a day. This gave him the opportunity to assess the useful accuracy of the forecasts and to assess the forecast team's own confidence in the product. Once the Supreme Commander had moved his HQ to Southwick House²², near Portsmouth, a team of three attended the briefing, which was usually given by Group Captain Dr James Stagg RAFVR or his deputy Col. Don Yates USAAF, accompanied by Cdr. John Fleming RN. Between them, they wore the uniforms of the three arms, navy blue, khaki and light blue. Equally, they represented both the main allies working on OVERLORD, USA and UK. Such things helped keep together a multinational, multi-force, operation.

At the weekly, Monday morning, briefings, a forecast was required for the following Thursday (regarded as a dummy D-Day) and for the immediately preceding and following days. The meeting then decided whether that Thursday was suitable as D-Day. On the following Monday, an inquest looked at the previous week's decision.

Douglas and J. Harding in SDTM 43, Met Office, February 1943.

²¹ <http://www.ecmwf.int/research/predictability/projects/index.html>

²² Codenamed SHIPMATE.

In fact, of course, the science of meteorology was not up to this task then, and would be hard pressed in some circumstances always to be useful even today (and even with massive scientific and computing advances and no attempts by an enemy to suppress information). So, it is no surprise that around 28-31 May, the time when decisions had to be taken for the sailing of the ships from bases in northern Britain for the then scheduled real D-Day, no definite forecast for 5 June could be given: on 28 May, the Supreme Commander was advised that the evidence was that mainly quiet winds would continue during the following five days; nothing helpful could be said about wind and cloud on 5 June, though the risk of a gale in the Channel seemed rather small.

This advice was the result of a scheme of telephone conferences between the main forecasting centres adopted to provide the Supreme Commander's meteorological team with guidance on the day-to-day meteorological situation and the weather that could be expected in areas of interest. Connected to Southwick House were forecasting teams at the Admiralty in London, where Royal Navy forecasters²³ specialized in forecasting the state of the sea, at ETA in Dunstable, which had the forecasters with the greatest experience of UK weather²⁴, and at Bushey Park, near Teddington, the headquarters of the US Army Air Forces (known as Widewing)²⁵. Also connected, but mostly listening, were forecasters at the HQ of the Allied Air C-in-C at Stanmore²⁶, at the HQ US 8th Air Force at High Wycombe²⁷ and in Stagg's office, also at Bushey Park but as part of the Supreme Headquarters Allied Expeditionary Force (SHAEPF), where Squadron Leader G. R. Robinson RAFVR of the Met Office, kept a watching brief on Stagg's behalf.

There has been criticism of this arrangement, as being bound to lead to disagreements and so confusion in the minds of those being briefed. To a large extent, though, this was counteracted by the strong, dour, character of the Scotsman Stagg, who distilled a logical and convincing story from the sometimes stormy conference debates²⁸. It was an example of the value of an assessment of many different views, akin to the EPS forecasts of ECMWF and a few other forecasting centres²⁹. Three heads were better than one.

Timing of the assault primarily a naval matter³⁰

“With the approach of the invasion target date (May 31), a definite decision on D-day and H-hour, was required. No single question had been discussed more often. Until obstructions were discovered on the beaches, the number of days when an acceptable combination of tidal and light conditions would obtain was not severely limited. Confirmation of the existence of such beach obstacles required a re-examination of the question of the timing of the initial assault. At a Meeting held at Supreme Headquarters on 1 May, the situation created by the extension of obstacles was discussed. It was decided that they must be dealt with dry shod in areas in which they stood in less than two feet of water.¹ This necessitated the adjustment of H-hour, which in turn required the fixing of a target date for D-day. After some days' consideration, Admiral Ramsay decided:

²³ Instructor Commanders G. M. Wolfe RN and John R. Thorp RN and Instructor Lieutenant Larry Hogben RNZN.

²⁴ In particular, C K M Douglas, whose experience of flying and meteorology went back to the First World War and Dr Sverre Petterssen, a Norwegian with a deep knowledge of synoptic meteorology and author of a standard textbook.

²⁵ , And, incidentally, the post of Lt. Cols. Krick and Holzman. Back in February 1944, Krick had successfully foreseen at least three days of clear weather over Leipzig beginning three days ahead,. General Arnold US Army said the subsequent five days of daylight bombing of German factories by the 8th and 15th US Air Forces “changed the history of the air war”.

²⁶ Col. Norman Spencer Jr USAAF and Dr R. C. Sutcliffe, Met Office.

²⁷ Captains Roberts and Pruitt USAAF.

²⁸ Stagg was criticized, too, by military forecasters because, by trade, he was neither forecaster nor military man. Like many other Met Office staff serving the forces, his RAFVR commission was a very temporary one for the occasion. He was, however, a skilled geophysicist with the right character for the job. He had a knowledge of the latest developments and a general appreciation of what was important and what was not. In 1984, at an American Meteorological Society meeting at Fort Ord, G. D. Robinson said he thought that the conference system had produced the best result possible.

²⁹ E.g. <http://www.atmos.washington.edu/~ens/uwme.cgi>

³⁰ This section copied verbatim from <http://www.ibiblio.org/hyperwar/USN/Admin-Hist/147.5-ComNavEu/ComNavEu-6.html>

- a. That five different H-hours would have to be accepted, one for each assault force;
- b. that the earliest acceptable dates for the assault from the Naval point of view, were the 5th and 6th June, and,
- c. that the 7th June could be accepted in case of extreme necessity. General Eisenhower was informed of these conclusions at a meeting on 8 May.

The Supreme Commander, on 23 May, signalled his decision in special code that D-day was provisionally fixed for 5 June.² At 2330, 25 May, local naval commanders were directed to open their operation orders and to "execute operation NEPTUNE". For the Armies, the target date for Neptune by "which all preparations will be completed is 31 May; the exact date of D-Day will be notified in due course"³¹.

The report by the Allied Naval Commander-in-Chief goes on "The first convoys to sail with destinations in the assault area left Oban, Scotland, south bound between 0700 and 1030 on the morning of 31 May." On Monday 29 May, for the five days until Friday 2 June, mainly quiet winds (less than Beaufort Force 4) were forecast (with moderate confidence) to continue, except for force 5 in the extreme western Channel on Thursday and Friday, along with an increase in cloud (for which confidence in the forecast was lower).³²

It was then, and is now, a fact of a forecaster's life that clients' needs often exceed the science's ability to meet them: clients press forecasters beyond the reach of reason and into feeling based on experience. Clients, of course, know they must make a decision and their own forecasters are best placed to give the most reliable advice available, however inadequate it may seem.

The team at Southwick House, after discussion with the other forecasting centres, at 0830DBST³³ on Wednesday 31 May and 0845DBST the next day, indicated that winds in the Channel from Sunday 4 June did not look as favourable as they had done earlier, though there was no firm evidence that they would be above Force 4 for long periods. Nothing helpful could be said about clouds on 4 and 5 June.

From 2 June, forecasts became increasingly detailed, and of deteriorating weather. But, for the decision to set ships moving from the northern bases, there was minimal meteorological input, nor would any meteorologist used to forecasting for the waters around the British Isles at that time have had any valid, more detailed, scientifically-based, opinion to offer on the matter. As later events would show³⁴, even a settled anticyclone was no guarantee of a desired outcome.

Early June

The morning of Thursday 1 June was drizzly, although low cloud broke in the afternoon and the next few days looked unsettled, with travelling depressions and fronts. Expecting D-Day on Tuesday 5 June, commanders meeting at SHIPMATE (the code name for Southwick House) were deeply anxious.

For the briefing at 2130 DBST on Saturday, 3 June, the weather outside SHIPMATE was reasonably fair and the wind light. But the forecast was that warm moist westerly winds in the Channel would be up to Force 5 in places, making the seas rough and bringing heavy low cloud, mainly 10/10 cover with its base about 500 feet above the sea³⁵. In effect, weather was being forecast for 5 June which was too bad for landings from sea or air and that other operations to achieve air superiority would be hindered.

³¹ Headquarters Second Army: *An account of the Operations of Second Army in Europe 1944-1945, Appendix 1*. A copy is in The National Archives, Kew, WO 219/5161

³² AP1134 Appendix 10.

³³ Double British Summer Time, two hours ahead of GMT or Universal Time. In June in southern England, it was light until about 11 p.m. Official documents for D-Day often omit the time standard. It is usually fair to assume DBST. For their operations meteorologists worldwide used, and still use, Greenwich Mean Time (Universal Time or UTC).

³⁴ E. g. 17-20 June 1944, when the tides were again right for an assault on the Normandy beaches, and in September 1944 for Operation Market Garden at Arnhem.

³⁵ Freeman, Flight Officer Lady E. *Notes on the planning and preparation of the Allied Expeditionary Force for the invasion of northwest France in June 1944*. National Archives, Kew, AIR 37/1213. This comment is based on notes kept by Air Vice Marshal Robb who was present.

The Supreme Commander thought that “*the desirability for getting started on the next favorable tide is so great and the uncertainty of the weather is such that we could never anticipate really perfect weather coincident with proper tidal conditions, that we must go unless there is a real and very serious deterioration in the weather*”³⁶ Moreover, he “*realized that it was unlikely that so great an operation could be started and then stopped again without complete loss of secrecy*”. Another consideration was “*the possibility that the next favorable tides in mid-June would have even less satisfactory weather*”³⁷. Nevertheless, that evening, in fine weather, but because of a forecast of bad weather on the Normandy beaches, he “*made a provisional decision to hold up Operation NEPTUNE on a day-to-day basis*” and confirmed the decision early next morning. Convoys already at sea were ordered to turn back and seek shelter.

At 2130DBST the next day, Sunday 4 June, the Supreme Commander, the Commanders in Chief and their Chiefs of Staff assembled in the Library at SHIPMATE. Outside there was driving rain, “*the trees in the copse opposite were swaying in the rising wind and the clouds scudding across*” as a cold front passed³⁸. Stagg was accompanied by Yates and Fleming. They knew that a weather ship specially stationed south of Iceland had been reporting rising pressure since 1200DBST that day. If these rises were to continue a ridge of high pressure could be developing behind the cold front which was now moving south-eastwards and was expected to clear the assault area within two or three hours: there could be an interlude in the unsettled weather over the Channel and the assault area just for the critical hours on Tuesday 6 June. On Monday night and at H-Hour on Tuesday morning weather would be suitable for the heavy bombers. Later on Tuesday, operations might be curtailed by large areas of cloud but the cloud was likely to be high enough for spotting the fall of shot from naval heavy guns.

Let's Go!

The exact words of the Supreme Commander remain under discussion but it was at this Sunday evening briefing he decided to launch the assault³⁹. Paradoxically, for a second time, a decision was made on a forecast of weather very different from that outside⁴⁰. Everyone knew the forecast wind and weather were far from ideal: Admiral Ramsey wrote “*it is clear that forces will have an uncomfortable initial journey*”⁴¹.

In the event, waves were five to six feet in mid-Channel – just tolerable—whilst wind, weather and cloud permitted the injection of troops by air and most of the airborne bombardment, both in Normandy and of enemy supply lines. During the hour before the seaborne landings a mixture of cloud and clear air allowed bombing of some shore defences and not others. Whilst the wind had decreased, so that there was morning mist inland, the seas had not settled and the surf was rough enough to hurl landing craft on the beaches: many smaller ones were swamped and some tanks fitted with flotation skirts were lost. A depression moving south down the North Sea brought cloud into areas of north-eastern France which hindered some bombing operations there.

Overall, the Supreme Commander had launched the invasion in marginal weather and achieved a great surprise.

For OVERLORD, the weather had been a principal hazard but the safeguard of the best available forecasting service had reduced the risk till it was acceptable. Eisenhower had used his forecasters to help make his own luck:

³⁶ Chandler, Alfred D. Jr, Ed., *The Papers of Dwight David Eisenhower, The War Years: III*. John Hopkins Press, Baltimore & London, 1970 (p. 1905). Also Ferrel, Robert H., Ed., *The Eisenhower Diaries*, W. W. Norton & Co., New York & London, 1981 (p. 120).

³⁷ Pogue, Forrest C., *The Supreme Command, United States Army in World War II, The European Theater of Operations*. Department of the Army, Washington, D. C. 1954. (Written under a directive from General Eisenhower and based on his personal files.) (p. 168).

³⁸ Schofield, Vice Admiral B. B., *The Story of HMS Dryad*, Kenneth Mason, 1977.

³⁹ Subject to review of the weather again at 0415DBST the next morning when the decision was confirmed.

⁴⁰ Leaving SHIPMATE beneath an overcast sky Rear Admiral (Later Admiral of the Fleet) Sir Philip Vian, Commander of the Eastern Task Force, commented “*It looks to me like bloody nonsense*” (Schofield, above, p. 82).

⁴¹ Chalmers, Rear Admiral W. S. *Full Cycle, The Biography of Admiral Sir Bertram Ramsey*, Hodder and Stoughton, London, 1959 (p. 221).

curiously, too, his troops, as they landed, had the wind at their backs.