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THE DAM BUSTERS
I'm sitting with 20 other pilots in condemned WWI temporary housing. The English wind, this early spring evening in 1943, is bitter cold. Half the men don't have on proper squadron uniforms.

The Wing Commander rises slowly, and begins the briefing in a deliberate voice. "Gentlemen, you all know a good deal about the danger of low-level bombing. Well, all that's a tea cake next to what we've got on. Our mission is to fly in at 60 feet and bomb three dams that provide most of the water for the chief concentration of German industrial production in the Ruhr Valley."

It's been two and half years since the Battle of Britain, when the Luftwaffe outnumbered the RAF five to one, when they blitzed London, and still they were beaten back. Churchill's words rang in all our ears:

"We shall go on to the end, we shall fight in France, we shall fight on the seas and oceans, we shall fight with growing confidence and growing strength in the air, we shall defend our island, whatever the cost may be, we shall fight on the beaches, we shall fight on the landing grounds, we shall fight in the fields and in the streets, we shall fight in the hills; we shall never surrender."

But, the Germans are still entrenched on the continent and another supreme effort is required if we are to throw them back the final time.

The Wing Commander went on: "These are three of the most vital targets in Germany, deep inside their border. You will be flying modified Lancaster bombers and have to navigate without error, repel enemy fighters and barrage balloons, and then drop a massive underwater bomb under the most exacting conditions."

So this was it. I listened carefully to every word as he began to describe the detail. On this flight there was no margin for error.

Like the young pilot on that perilous flight of 1943, you will have to focus your mind in the face of danger and perform at the highest levels in order to succeed.

TO BEGIN
Insert the disk in the drive and turn on your Apple Computer.
To restart the game (return to the title screen), press the control key and R key simultaneously.
Hit the space bar to leave any title screen, the dam scene after dropping the bomb, or the status screen after being killed.

OVERVIEW
There are three levels of play:
1. Practice Dam Approach (no enemy action)
2. Start over the English Channel
3. Take off from Scampton Field
You should work your way up through the levels.

First you should practice the bombing run itself (level one). There are a number of steps to be done quickly, but enough practice will make this virtually automatic.

In the next level of difficulty, you begin over the English Channel. You will man numerous positions in which you navigate, fly the plane, fire the guns and watch your engines. One key is that you must know each of the necessary tasks so well that they can be performed almost instantly. You must also develop a pattern, as real pilots do, for monitoring different operations. Your flight to Germany will be fast and furious. You need to know which things have to be handled immediately, such as barrage balloons and fires in the engines. You will probably spend a good deal of time in the front gunner position. When the pace is too hectic, hit the space bar. This freezes the action and gives you a moment to think until you press the space bar again to continue play.

It will take considerable effort to perfect individual tasks, such as shooting a fighter that is bobbing and weaving while firing at you. Remember the flying ace Baron Von Richthofen (The Red Baron) was a superb bird hunter before the war. In aerial combat you must aim in the same way by leading the target, and shooting where it will be next.

The highest level of difficulty is the Squadron Leader level. In taking off from Scampton Field, you must set your flaps and engines correctly, then adjust engines and retract flaps and landing gear once in the air. You will fly south from England and you’re ready for the rest of the mission: across the English Channel and European continent to the target.

**TO PLAY**

**Positions**

In your Lancaster bomber there are eight positions. Press the corresponding number to go to that position.

1. Pilot
2. Front Gunner (also Bombardier)
3. Tail Gunner
4. Bomb Specialist
5. Navigator
6. First Engineer
7. Second Engineer

When a crew member’s position is in trouble, his number will flash at the bottom of the screen.

**Pilot #1**

Use the joystick to bank, climb or dive (it works the same as in a real Lancaster). The lights on the horizon, and the horizon gauge (second from the right) let you know the orientation of the plane. From the pilot’s position you can see approaching barrage balloons, fighters and search lights (which you also see from the front gunner position).

The altimeter gauge on the left shows your altitude. When both needles are straight up (12 o’clock) you’re on the ground. Each quadrant (15 minute mark) indicates 400 feet for the small hand and 25 feet for the larger hand. Plan to fly between 100 and 1000 feet—high enough to avoid the ground and still lower than enemy radar can readily pick you up.

The compass gives your correct heading and the green marker line indicates the direction to the target as selected on the map screen by the navigator.

A pilot can maneuver to avoid the enemy: dodging spotlights, and doing a cork-screw to escape ME110 fighters—diving left, pulling up, climbing, then diving to the right. However, if you don’t shoot down or escape the fighters, they’ll eventually kill your gunners and damage the Lancaster.

**Note:** The Lancaster Bomber is heavily laden and sluggish in response to climbing and descending in altitude. Because of this inertia, there will be a delay in attempting to pull out of a dive, even though the nose of the aircraft is pulled up (above the horizon).

**Navigator #5**

The beginning player should set his course at the very start of play. The navigator has two different map views. The first shows your current position, with a plane moving across the map. Push the fire button to switch to the second view, which displays the navigator’s cursor on the map. Move the cursor to the edge of a screen to go to the next map (if there is one in that direction).

Switch to this position at the very start of play, and your cursor will be on a map of England. Go south one screen, and east two screens, to reach the area of Germany with the three dams and their corresponding lakes. Position the cursor on a dam.

As you move the navigator’s cursor, the compass heading at the top of the screen will change—so will the green marker on your pilot’s compass. This shows you the heading to take when you return to the pilot’s position.
The six maps of Northern Europe contain colored symbols that stand for major landmarks:
- green crosses — military installations
- black aircraft — military airport
- blue circles — city
- purple smoke stack — industrial center

**Figure 4**

**Front and Tail Gunners (#2 and #3)**

Enroute you must shoot barrage balloons as soon as they appear. If not, their lines entangle your craft and you crash. Thus whenever you get a flash for ‘‘2’’ on the bottom of the screen, quickly select the front gunner. Both gunner positions operate much the same, with a cross hair sight (see figure 5).

You must also shoot down enemy fighters. Spray a pattern of bullets left and right. They can be knocked down even at a distance if you’re skillful enough.

**Figure 5**

It’s easier to hit searchlights when they first appear in the distance at the top of the screen (they’re moving slower). When they’re at the base of the screen they’re a fast moving, hard-to-hit target. If you don’t shoot them, you’ll have the dubious pleasure of waiting while they light up your plane and smash you with flak, which eventually damages the plane. If a number of searchlights are coming in succession, it’s best to just stay with the front gunner and get as many as you can.

The front gunner controls twin 303 caliber F.N.5 machine guns, and in the rear four F.N.20 303 caliber guns. (See “Bombing” for how the front gunner mans the bomb sights.)

**First Engineer (#6)**

The first engineer controls the engines and propellers for the Lancaster. See “Scampton Field” section for detail on the second engineer (position #7).

The first engineer’s screen has four throttles (bottom left), four boosters (bottom right), and corresponding gauges. There’s a fire extinguisher (upper right) for each engine (see figure 6).

**Figure 6**

To change throttle or booster settings, position the white arrow below them, hold down the fire button and press forward or back on the joystick. Position the white arrow below the center of each group in order to control all four at once.

The throttles are like the accelerator on a car. The boosters (which control the angle or pitch of the blades) are like the gear on a car. Set both high for top speed. These must be in balance for efficient use of power and to avoid over-revving.

An engine is over-revving if the rpm needle is flashing in the red zone. Reduce throttle immediately. If it won’t reduce, the engine is on fire. Use the extinguisher before the fire can spread. Place the white arrow next to the appropriate extinguisher, press the red button and move the joystick down.

Use extinguishers with care. Once an engine is doused, it’s permanently out. In order to keep flying straight, decrease throttle on the opposite side. If you extinguish engine number one, reduce throttle on number three or number four. Even losing both engines on a side can be handled by moving the trim to its highest setting.

**Figure 7**

**Figure 8**

**Bomb Specialist (#4)**

The role of the bombing specialist is to set the preliminary switches (bomb rotator and spotlights) for the bombing run. The spotlights shine down on the water, and when their reflections are just touching each other, the plane is at the right altitude. Timing is crucial, since setting the rotator changes the front gunner function to that of a bombardier. Thus you will have no machine gun defense against frontal attack. However, set the switches too late and you’ll miss the target.
BOMBING STRATEGY

At the very beginning of the bombing run, you must turn the plane so you can get lined up with the dam while still over the land, then fly straight over the lake to the target (see figure 9).

If you’re too high as you begin your approach, lower your nose so you’re dropping toward 60 feet (see figure 10 for correct setting of altimeter). Then switch to the engineer screen, #6. Position the joystick down in the center beneath the set of throttles, in order to adjust all four at once. Press the fire button and tap down on the joystick to lower the engine speed. Do the same for the boosters on the right. Continue using this method to adjust both sets of controls until the throttle gauges read one o’clock at the same time the booster gauges are straight up (high noon).

Next, return to the pilot’s screen to check your speed. When the needle flashes at one o’clock, you’re flying at 232 mph (see figure 11).

Go to position #4 (see figure 12). Place the joystick arrow below the bomb rotation switch on the left, press the red button and push up on the joystick to set the rotator. On the right, throw the spotlight switch the same way. Avoid doing this over enemy territory—it makes you a beacon for enemy gunners. Now go back and forth on the joystick until the two balls of light overlap. Your plane is now at the perfect height of 60 feet. Setting the rotator, changes the front gunner function (position #2) to that of the bombardier.

Closer in, the dam appears on the horizon as a white line. Aim straight for it, and make sure the plane is flying level. Your altitude should be close to 60 feet (altimeter reading roughly around 12:50). Periodically re-check your altitude and speed.

Switch to the bombardier (#2), who is now controlling the bomb sights (see figure 13). When the dam towers are positioned between the bomb sights (horizontally and vertically), and touch them, you are the proper distance from the dam, 800 yards. Press the fire button and... bombs away!
With success, the bomb skips over the water above the torpedo nets and hits the crest of the dam, sinking along its face to 300 feet below the surface, which fires the depth-sensitive hydrostatic pistols and sets off the blast (see figures 14 and 15). If you've missed, try again. Your Lancaster carries several bombs.

Figures 14 and 15

Status and Damage (#8)
This screen shows your number of flak hits and how you've fared with barrage balloons, fighters and searchlights. Damage to your plane and personnel are indicated.
If your plane crashes, the status and damage screen is displayed.

Scampton Field Level
On this level you take off from the runway at Scampton Field, north of London—which involves several adjustments at the second engineer's position (described below).

Second Engineer (#7)
The second engineer must first set the flaps down for takeoff (see figure 16). The flaps are an extension of the wing that increases the wing area and so gives greater lift. Give the engines full throttle and adjust boost (position #6).

You will be able to pull up the nose of the Lancaster once takeoff speed is reached.

Figure 16

Once off the ground, you must lower the throttles and boosters as soon as possible in order not to over-boost the engines. Also retract the landing gear and the flaps to increase airspeed. Pull back slowly on the joystick to increase altitude, and you're off.
The rudder trim on the second engineer's screen adjusts your flight left or right. Moving the joystick up, with the red button pushed, will guide your plane to the right. Moving the joystick down turns the aircraft to the left. Moving the trim to its highest setting will compensate for losing both engines on one side.

Good luck!

---

War Office,
10 Downing St.,
London, W1, England

May 16, 1943

Squadron Leader:
You have been chosen to lead one of the Royal Air Force's finest crews in Squadron 617. During the past months you have risked your life in low-level flying exercises and attack simulations in preparation for this dangerous mission.
By now you will know the targets of this crucial mission—the great power dams of the Ruhr Valley—the Möhne, the Sorpe and the Eder. Destroy these dams and you will have dealt the Axis war machine a deadly blow.
The mission will commence tonight at 21:15 hrs. You will fly in formation led by Wing Commander Guy Gibson.
As you embark on this mission, know that my heart and those of your countrymen are with you.
Good Luck and Godspeed!

Winston Churchill
REPORT ON THE FORMATION AND TRAINING OF 617 SQRN.
WITH NOTES ON THE LOW-LEVEL PERFORMANCE OF THE MODIFIED LANCASTER BOMBER

By Guy Gibson, W/C, RAF.

Wing Commander Guy Gibson, DSO, DFC, was chosen by Air Marshall Harris as Commanding Officer of “Squadron X”. He began assembling the handpicked crew, some of whom were chosen by himself, at Scampton Airfield on March 21, 1943. Some of the crew members have completed more than ten operations (an operation is 25 bombing sorties) over enemy territory. Gibson himself had completed no few than 33 operations. The crews range in age from 20 to 32. There are currently 21 pilots serving with 617—three from the Royal Australian Air Force, one from the Royal New Zealand Air Force, and twelve from the Royal Air Force. This last figure includes two U.S. born Squadron Leaders, Young and McCarthy.

The speed with which the squadron had to be formed presented various difficulties. Initial facilities at Scampton were quite limited, and indeed, until the arrival of the Type 464 Provisioning Lancastrians, only ten aircraft on loan from other squadrons were available to the men. Their accommodations were less than luxurious, being a group of condemned wooden billets of First World War vintage. Each hut housed 24 men. In the interests of bringing the motley group together, it was suggested that each night they do callisthenics before retiring. A newcomer to the crew who arrived one evening in the midst of these exercises was photographed by the officers in an annex of the local memorial institute.

The 700 men of the squadron raded other squadrons for furniture—beds and chairs. With AVM (Chrame’s intervention), supplies such as uniforms and blankets for the 617 were given top priority. Official pressure resulted in the appearance of spark plugs, tin cans of the five types of thumb screws and winches.

On March 27, 1943, I was issued with “most secret” written orders, which outlined the plan of attack without naming the targets. 

“617 Squadron will be required to attack a number of lightly defended, special low-level targets over enemy territory in moonlight with a final approach to the target at 60 ft. at a precise speed, which will be about 240 mph. It was noted that the exact speed would be determined later and visibility might well “not exceed one mile”. It was assumed that aircraft would be dispatched at ten-minute intervals to attack the target. When this was destroyed, subsequent aircraft would be diverted in the air to the next target and so we had to ensure that navigation was accurate in moonlight, at a height which would be as secure as possible against fighter attack. Air position indicators would be available, but training was to proceed without them. Accordingly, the squadron has been performing low-level night flying exercises almost non-stop to date. The efficiency attained in the operation to date has been most gratifying.

According to Barnes Wallis’s specifications of the deployment of the bomb, each Lancaster must release the bomb at 240 mph, 60 ft. above water and exactly 800 yards away from the dam.

Visual sighting at night is difficult to impossible because of the existence of a sort of grey no-man’s-land between the surface of the water and the aircraft flying so close at high speed. Several different techniques were tried and all were rejected due to measuring error or impracticality. Finally, a single solution was found, using two spotlights, one at each end of the aircraft. As the aircraft flies over the water spots shine down upon the surface of the water. The spotlights are angled such that when the two spotlights touch, the aircraft is flying at 60 ft. with virtually no error.

The distancing problem had a similar trivial solution involving angles. The front gunner, using the bomb aimers’ bubble, will sight on the twin towers of the dam, through a V-shaped darkening sight with the markers on the end of the sight, the aircraft is exactly 800 yds. from the dam, again with virtually no error.

The conventional airmanship indicator used by the Lancaster is accurate enough to render an airmanship reading within acceptable tolerance. Therefore, I have the honor to report that 617 Squadron is, in all respects, ready for battle.

INTELLIGENCE—TACTICAL REVIEW
prepared by J.A. Franklin-Smith, M.S., INTEL

GERMAN DEFENSE SYSTEMS

Light anti-aircraft poses formidable problems for low-flying aircraft. The basis for nearly all German 20MM models is the FLAK 30, capable of 120 rounds per minute with a ceiling of around 6000 feet. A wide range of heavier flak guns, including those mounted on concrete towers or formed into mobile railway batteries, will also prove dangerous if the crews stay too close to the ground. A well developed integrated defense system manned by the Luftwaffe has been deployed in Northern Europe. Coordination from local radar operators controls fighter planes, anti-aircraft guns and spotlights.

A) Flak towers on the coast give the direction and range of attackers up to 100 miles but are unable to determine altitude.
B) Mobile Wurzburgs with a range of 45 miles are used by ground controllers inland and many fighters have airborne Lichtenstein sets accurate up to two miles.
C) Flak guns are in operation. The flak towers in Involved Operation Chastise must contend with this defensive organization: Fighters with airborne radars, and a strong array of flak weapons assisted by searchlights and radar and often gathered around vulnerable targets.

One advantage to the 617 Squadron is that the German ground radar is ineffective at aircraft below 1000 feet, espe-
cially in the relative haven of the German flak defenses. The two broad flak gun ranges of the two mayor German radar sets are not effective in scanning downwards from their regular operating altitude. Thus, flying as low as possible at night offers the Lancaster the optimal chance of survival.

From the inception of the operation, a Mosquito reconnaissance aircraft has flown daily at 25,000 feet over the dams, taking photographs of rising water and the defenses. The Mosquitos are flown in such a manner that to the Germans it appears they are cruising over the dams by accident.

During the afternoon of May 14, a photo-reconnaissance aircraft was flown at 30,000 feet over targets in the Soest area. All of the morning’s training and bomb dispersal activities had been successfully photographed so as not to draw attention to the dams. This information was combined with other results to show that there was no unusual activity in the target area.

CERTAIN ASPECTS OF HARD-CASING EXPLOSIVE BEHAVIOUR AT DEPTH

By R.B. Walls M.S.E., F.R.S.

PREFACE

One strategic theory holds that the bombing of enemy factories and centres of population beyond the battlefield will cause a collapse of production capacity and severe deterioration in civilian morale. The Air Targets Sub-Committee has identified three targets of special strategic significance: the Moehne, the Eder, and the Sorpe dams. All are in the Ruhr valley and account for a large portion of Germany’s industry.

The Moehne is the largest of the dams and contains about 100 million cubic yards of water. Its dam is 100 feet high and 900 feet long. The Sorpe dam is also 100 feet high and 1100 feet long.

The Eder is 110 feet high, 1000 feet long. The Moehne lake is 6000 acres, the Sorpe 5000 acres. 

The Moehne creates Moehne Lake. The level of this lake is maintained so that he up to 900 feet and a dam would have a capacity of 20 million cubic yards of water. The Sorpe dam is used for water storage and is maintained at 100 feet high. The Eder dam is used for water storage and is maintained at 100 feet high.

The Moehne and Eder are designed to flood the lower Ruhr and cause widespread disaster. There would be a serious shortage of water for drinking purposes and industrial supplies.

All three dam sites are in the Ruhr valley and are designed to flood the lower Ruhr and cause widespread disaster. There would be a serious shortage of water for drinking purposes and industrial supplies.

The Eder also has the advantage of being easier to protect against attack. The Sorpe dam is much better protected against attack. The Moehne dam is in a more remote area and has a much smaller water area. The Eder dam is in a more remote area and has a much smaller water area.

The Eder and Eder River to form Eder Lake—212 million tons of water. It controls the level of Germany’s second most important waterway, the Mittelland Canal, and prevents flooding of surrounding agricultural land and towns. Several power stations lying along the river would be damaged or destroyed by a breach in the dam, and transportation on the Mittelland would be seriously hampered to the point of a virtual cessation of traffic. The Sorpe holds a similar position.

The Moehne is 112 feet thick at the base, 100 feet high and 25 feet thick at the top. The Eder, also a gravity dam, is even bigger. It is calculated that the dam could not be breached even if it were damaged by a high-pressure water jet. These dams are also protected by nets against torpedoes.

The Moehne dam is 212 million tons of water. It controls the level of Germany’s second most important waterway, the Mittelland Canal, and prevents flooding of surrounding agricultural land and towns. Several power stations lying along the river would be damaged or destroyed by a breach in the dam, and transportation on the Mittelland would be seriously hampered to the point of a virtual cessation of traffic. The Sorpe holds a similar position.

Concerning this issue, it is clear that the three dams are a vital part of Germany’s industry and would be extremely difficult to replace if damaged.

The water supply of Germany is dependent on these dams. The water is used for drinking, industrial purposes, and agriculture. Without these dams, Germany would face a serious water crisis.

The dams are designed to flood the lower Ruhr and cause widespread disaster. There would be a serious shortage of water for drinking purposes and industrial supplies.

The Eder dam is in a more remote area and has a much smaller water area. The Moehne dam is in a more remote area and has a much smaller water area.

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The Eder dam is in a more remote area and has a much smaller water area.
DAMBUSTING BOMB DETAIL

ED825/0 carried out test dropping of the cylindrical mines, but was not selected to be one of the attacking aircraft. Underneath can be seen the mine support cylinders and centring mechanism for spinning the mine prior to release. The specially fitted .303 can be seen silhouetted just behind the starboard landing gear (British Official).

LANCASTER B MK I/III (DAMBUSTER)

This modified version of the Mark III has been especially adapted for this mission. The original Mark I/III had H2S radar, a downward looking radar, used to obtain directional bearings from the local landscape. This has been removed in the Dam Buster Lancaster to increase the bomb load capacity. The bomb bay doors were removed and jettisoned to allow for two V-shaped caliper arms which protrude from the front of the bomb bay. These calipers hold the mine between two points and a 20-inch diameter disk mounted on the inside of these extremities engages a track at the end of the cylinder. A hydraulic motor attached to the track (used for steering the hydroplane operator in submarines) is mounted on the floor of the fuselage. This motor is used to spin the mine backwards at the required 300 rpm.

SPECIFICATIONS OF THE LANCASTER MK III

| Crew       | Seven                  |
| Powerplant | Four Rolls-Royce Merlin 24s |
| Dimensions |                        |
| Span       | 102 ft                 |
| Length     | 50 ft 6 in             |
| Wing Area  | 1,300 sq ft            |
| Weights    |                        |
| Empty      | 37,000 lb              |
| Normal Load| 65,000 lb              |
| Performance|                        |
| Max Cruising Speed | 275 mph              |
| Service Ceiling | 24,500               |
| Range      | 25,800 miles with 7,000 lb. load |
| Armament   | EIGHT .303 machine guns |
|            | Two in nose turret     |
|            | Two in dorsal turret   |
|            | Four in tail turret    |

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Designed by Sydney Development Corp.
Adapted by Distinctive Software, Inc.
QUICK BRIEFING
for Apple II Series

- First, insert the disk in the drive and turn on your Apple Computer.
- Your mission is to fly to and bomb one of three German dams.
- Press the space bar to leave any title screen.
- Press the CONTROL and R keys simultaneously to re-start.
- Use the keyboard keys 1–8 to go to the various positions. When a number flashes at the bottom of the screen, go there.
- First, try level one, the Practice Dam Approach (see detailed instructions on the other side).
- Second, try level two, the English Channel level. For this second level: Immediately set the navigational cursor on a dam. Regularly cycle through the three most important positions (#1, #2 and #3), the pilot and the gunners. Monitor the pilot’s position (#1) to see that you’re on course—keep the dark green marker in the center of your compass. Maintain at an altitude of 100–1000 feet and check the horizon lights to fly level. Always respond to the #2 position—front gunner. Shooting out barrage balloons takes top priority—they make you crash. Also shoot enemy fighters and searchlights. Quickly extinguish fires in the engines (position #6). Plan to make a wide turn so you’ll have time to line up while still flying over land. Then fly straight over the lake to the dam. See the other side of this card for bombing instructions.
BOMBING STRATEGY

Airspeed

Go to engineer's position (#6). Put the joystick dot centered below the set of throttles and tap down several times. Press the fire button and tap down on the joystick to lower the engine speed. Do the same for the boosters on the right. Continue using this method to adjust both sets of controls until the throttle gauges read one o'clock at the same time the boosters are straight up (high noon).

Return to the pilot's position and check your airspeed. The needle showing your actual speed should flash (around one o'clock) at the correct air speed.

Altitude

At the pilot's position (#1) push the joystick forward to reduce altitude to about 60' (altimeter at 12:40).

Go to the bomb specialist's screen (#4). Throw the bomb rotation switch (on the left) by pressing the red button and pushing up on the joystick. On the right, throw the spotlight switch the same way. Move the joystick forward and back until the two balls of light in your screen completely overlap. You are now at precisely 60'.

Distance

Go to front gunner (#2), who's now the bombardier. The dam should appear on the horizon. Align the sights by moving left/right with the joystick. When the dam towers are positioned between the bomb sights, and touch them, you are the proper distance from the dam. Press the red button and...bombs away!