APPENDIX I

OPERATING THE NORDEN BOMBSIGHT

NORDEN BOMBSIGHT OPERATIONS

Acknowledgement: Information from Dickweed Heavy Bomber Group, http://www.bombergroup.com/
Images from Aviation History Magazine, March 2014.

1st Lt. Robert G. Abb talking to the pilot (George), turret gunner (Remmell) and photographer (Beezy) during bombing run in Europe –

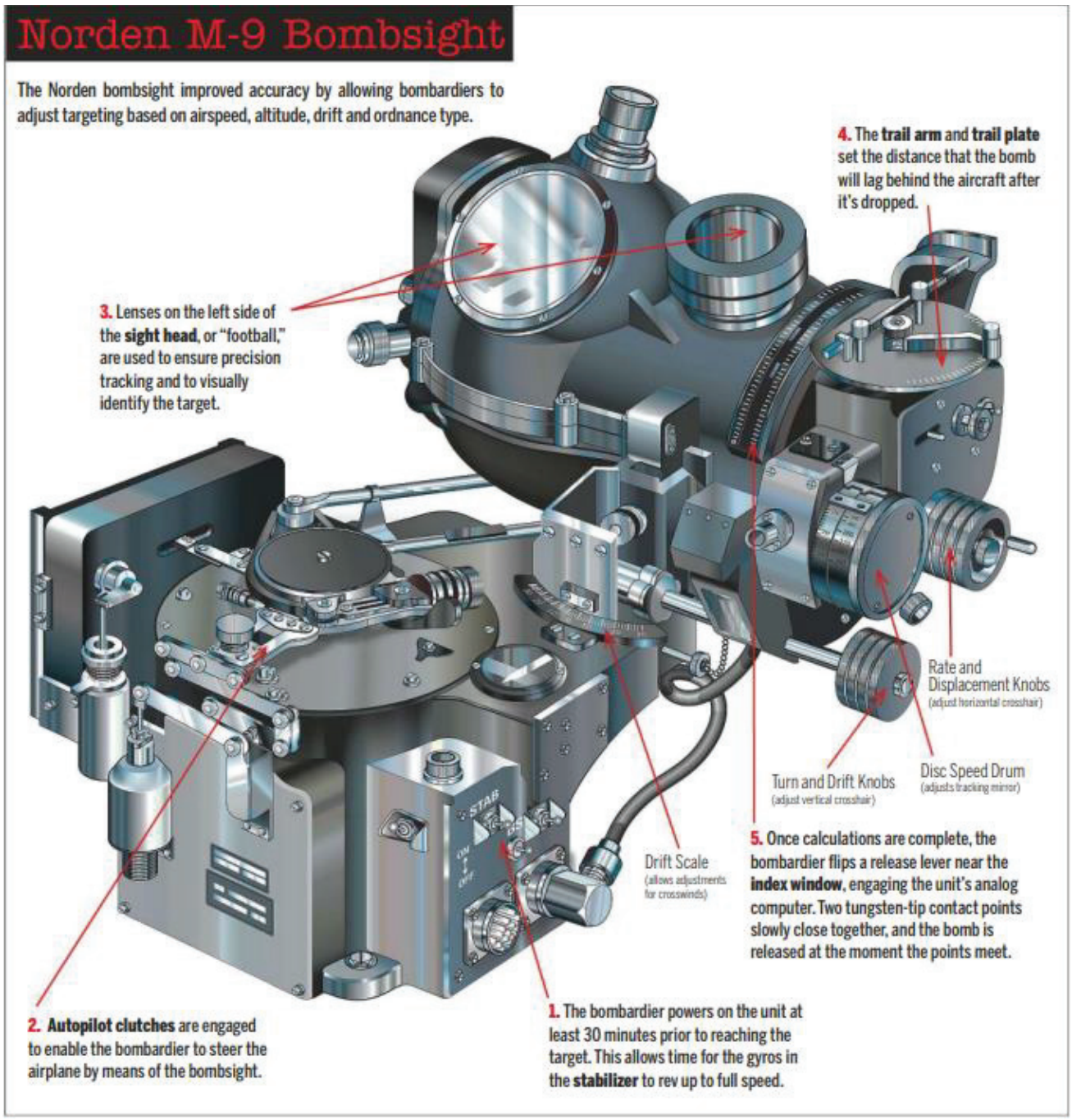
"Target ahead…'bout 15 degrees left… maybe six miles…watch that formation, George…
stay in there tight and when I call for a level, that's what I mean, quick…
watch toward the sun for fighters…
lead group is going in now…
Top turret! Fighter at 11 o'clock our level…they look like Fw-190s….
Get that SOB Remmell!…
now flak, closer… start evasive action, George…
here he comes, top turret…c'mon, Remmell, hit him!…nice shooting…think you got him!
Approaching IP [the point beyond which the bombardier controls the fight],
Give me a level, George…start the camera, Beezy…
hold that level…watch the air speed…
bomb bay doors open…
steady, steady, just a little longer now, level dammit, level…
hold 'er level…level!…steady!…bombs away!…
Let's get the hell outa here!
Flak on the other side now…there goes a Fort out of formation ahead…
bomb bay doors closed…camera off, Beezy…
boy, the eggs were right in there, gang, swell bombing…
look at the smoke down there… wotta mess!
Take over, George, and take 'er home!"

Until late 1943, the Norden bombsight was always protected by exceptionally heavy security. Sights were normally stored in air-conditioned, dustproof vaults that were patrolled by armed guards. During training, USAAF bombardiers had to swear a solemn oath to guard the secret weapon with their lives, and they were responsible for destroying it in the event of an emergency landing behind enemy lines. Whenever a bombardier or ordnance technician carried a sight out to an aircraft, two armed guards accompanied him.

After hundreds of Norden-equipped bombers were shot down over enemy territory during 1943, Allied officials knew that the Germans had surely studied the bombsight and learned its secrets. As a result, security was finally relaxed. When the war ended, details of the ingenious device were finally made public. But U.S. intelligence experts received a shock when they interrogated Luftwaffe personnel: The Germans had known the bombsight's secrets even before the war, thanks to a spy at Norden.

Herman W. Lang, a naturalized U.S. citizen, had been employed as a draftsman and inspector at the Norden factory during the 1930s. American authorities didn't know that he had served as Nazi stormtrooper in Germany between 1923 and 1927. Recruited as a member of the Duquesne Spy Ring, in 1938 Lang gained access to the plans for the bombsight and hand-copied the blueprints, which were then smuggled to Germany via ocean liner. He traveled to Germany for a "vacation" to assist Luftwaffe technical experts, receiving 10,000 Reichsmarks for his efforts. Lang returned to his job in America, but was later betrayed by a double agent, convicted of espionage and sentenced to 18 years in prison.

How It Works



Operation of the Norden Mark 15/M-Series Bombsight

I. PREPARATION FOR BOMBING RUN - to be performed 30 to 45 minutes before the airplane is expected to reach the target area.

A. Check stabilizer gyro to insure that gyro is operating and has attained normal running speed before proceeding further.

B. Check torque motor to insure torque motor is operating.

C. Check PDI to insure PDI system is operating properly.

D. Turn on the bombsight gyro by moving the bombsight toggle switch to the "ON" position.

E. Align bombsight clutch by aligning the course centering marks on the bombsight clutch connecting rod with the course centering pointer.

F. Make train bombing adjustment. If train bombing is to be used the sight should be adjusted to place the mean point of the impact on the target. Loosen the knurled nut on the trail sporting arm, moving the trail arm to the correct mil value, and tightening the knurled nut on the trail sporting arm.

G. Compute true air speed and bombing altitude using the E-6B computer, or equivalent.

H. Set disc speed and trail from the bombing tables and set this data into the sight.

1. Set the disc speed into the sight by turning the altitude knob in a clockwise direction. Make sure the "change speed" lever is in the correct position.

a. Move the telescope motor toggle switch to the "ON" position and check disc speed with a type 43D-3 bombsight disc speed tachometer.

b. Adjust the altitude knob until the correct disc speed reading is obtained on the tachometer.

c. Continue checking and adjusting until the correct speed, within 1/2 rpm, is obtained on at least three checks.

d. Move the telescope motor toggle switch to the "OFF" position.

2. Set trail into the sight by loosening the knurled nut, moving the trail arm to the correct mil value as indicated by the scale on the trail plate and tightening the knurled knob to lock the trail arm at this setting.

I. Check the reflex optics - on bombsights equipped with the type X-1 reflex sight, check this unit to make certain that its indicator is coincident with the telescopic indicator.

1. If these indicators are not coincident, align them by moving the reflex optics clutch to its inoperative position, manually rotating the reflex optic head until its indicator is at the same angle as the bombsight telescopic indicator, and re-engaging the clutch.

2. Turn the rheostat which controls the light that illuminates the reticule of the reflex sight to provide the desired intensity of illumination of the cross on the reflector plate.

J. Move the telescopic motor drive clutch into engaged position and make sure the telescopic sector indicator is positioned at, or near, the maximum sighting angle for convenience in picking up the target when it is first sighted.

K. Preset dropping angle from the automatic bombing computer, or from the E-6B, and use the rate knob to move the rate sector indicator to the proper setting on the tangent scale.

L. Adjust the B-7 bombsight mount to level the stabilizer. Use the leveling bubbles mounted on the top of the bombsight gyro housing to judge the vertical. Make sure that the bombsight gyro is caged and that the airplane

is flying straight and level before performing this operation. Care exercised in obtaining a good level will eliminate the necessity for making large corrections to level the bombsight gyro during the bombing run.

II. BOMBING RUN - the synchronous bombing run is started when the airplane reaches the initial point specified at the preliminary briefing. The bombardier should contact the pilot on the interphone at this point and coordinate the remainder of the run. The actual technique that will be employed will vary with the nature of the mission. In general, however, each of the following steps must be performed in much the same sequence as they are presented.

A. Switch on the bomb rack by moving the toggle switch or switches to "ON" position to select the desired bomb bay or rack.

B. Open bomb bay doors by moving the bomb bay door toggle switch to the "ON" position.

C. Un-cage the bombsight gyro as soon as the airplane is flying straight and level.

D. Swing the sight onto the target, or if equipped with the type X-1 reflex optics, align the vertical cross hair with the target.

1. Grasp the directional arm jaws with the left hand, if flying on the autopilot, and hold the autopilot clutch to avoid turning the airplane while lining the sight up with the target.

2. Grasp the turn and drift knobs with the right hand and swing the bombsight head into alignment with the target.

E. Use the search knob or displacement knob to swing the horizontal cross hair onto the target.

F. Move the telescope motor toggle switch to the "ON" position.

G. If evasive action is to be taken, disengage autopilot clutch to permit turning the airplane with the bombardier's turn knob.

H. Start evasive action, if these tactics are to be employed during the approach to the target. These maneuvers, when employed, will be limited to turns of from 5 degrees to 15 degrees and the time on each leg will be from 10 to 20 seconds. The bombardier will turn the airplane in these maneuvers by moving the bombardier's turn knob in the appropriate direction and amount. These turns should be planned to as to gradually work the airplane upwind so that the final turn onto the target can be made in a downwind direction.

1. Level the bombsight gyro, if necessary, by using the leveling knobs to center the bubbles in the spirit-type levels mounted on the gyro housing.

2. Hold the bombsight manually to keep the line of sight on the target until the bombsight clutch is engaged to stabilize the bombsight in azimuth.

3. Move the horizontal cross hair back on the target with the displacement knob.

4. Make a note of the sighting angle which will indicate the time to turn onto the target to complete a bombing run of the desired duration. This value can be obtained from the automatic bombing computer, or the bombing tables, for 30-second runs. For runs of longer or shorter duration the proper sighting angle will have been computed on the ground before takeoff.

5. Watch the telescope sector indicator for the time to turn on the target for the bombing run and plan the evasive action accordingly.

6. Stop evasive action and turn the airplane on the target for the bombing run when the telescope sector indicator reaches the sighting that signals the start of a bombing run of the desired duration.

I. Obtain drift angle from the automatic bombing computer, or from the E-6B computer, and turn the airplane, while holding the line of sight on the target, until the correct drift angle is indicated on the drift scale. Engage the bombsight clutch as soon as the drift has been preset.

J. Place the vertical cross hair on the target with the turn knob. Double grip the turn and drift knobs to stop relative motion between the cross hair and the target. Only very fine adjustments should be required, inasmuch as the operation will consist simply of refining the course that was established when the drift angle was preset.

K. Check level of bombsight gyro to make sure the airplane is flying straight and level.

L. Place the horizontal cross hair on the target with the displacement knob. Use the rate knob to stop relative motion between the cross hair and the target. Care should be exercised not to over control at this point. Only very fine adjustments of the rate knob should be required, inasmuch as this operation will consist simply of refining the rate that was established when the dropping angle was preset.

M. Move the release lever up to firing position and lock in firing position by moving the lever upward to the limit of its travel and pressing the small locking pin into the operative position.

N. Extreme caution must be taken not to over control at this point. If the preceding operations have been carefully performed, a good course and a good rate have been established. Any adjustment made at this point should only be for the purpose of removing any very small errors still present. The gear ratios are such that any major adjustments at this time in course and/or rate may well result in much larger bombing errors than if the small remaining errors are accepted and the cross hairs moved back on the target by means of the turn and displacement knobs.

O. When the telescope sector indicator drives into coincidence with the rate sector indicator bombs are released automatically.

P. Notify the pilot that the bombs have been released.

Q. Prepare the equipment for possible violent evasive maneuvers.

1. Close bomb bay doors.

2. Cage bombsight gyro.

3. Engage autopilot clutch and disengage bombsight clutch.

4. Turn off telescope motor.

5. Turn off bombsight gyro.

6. Latch release lever.

7. Turn off switches to bomb rack or racks.

8. Return altitude knob to minimum speed stop.

9. Return telescope sector indicator to maximum setting.

10. Return trail arm, and trail spotting arm if sight is so equipped, to zero.

11. Cover bombsight.