GEE AS A HOMING DEVICE

Written by John W. Howland

Chaplain James Good Brown accurately describes a problem that confronted all the men who flew out of England during World War II. In his fine book, “The Mighty Men of the 381st: Heroes All” he writes:

“*While sitting with the fliers, I sometimes hear the remark, “The flier’s worst enemy is the weather.” What an enemy it can be: strong, defiant, mean , ugly, treacherous, unconquerable.*

I pity the fliers more when they face this unbeatable weather than at any other time. They come into the room with sweat running down their faces. Black streaks mark their cheeks, Their eyes are red with strain, and they look haggard and worn.

The Germans may have gotten weaker in recent months, but the weather has not. These men face the same foggy weather as had been faced by the fliers in 1943.”

The recently-arrived American pilots and crews were confronted with the fact that weather was a serious problem that affected flight operations out of all the bases in England. There were only two options available to pilots and flight crews. You either learned to fly in bad weather and live—or you didn’t.

The famous English pea-soup fogs were only one part of the problem. Low clouds, fog, industrial smog and thousands of aircraft competing for the airspace over the Island Empire all contributed to the dangers. The 381st Bomb Group at Ridgewell was better equipped than most U S airbases in England. An instrument Landing System (ILS) was installed for home base of the 381st Bomb Group, 40 miles northeast of London.

THE DIP SIGNAL

Colonel Conway Hall, our highly respected Executive Officer in 1944, and later Group Commander, tells of the shortcomings of this ILS.

"While making a final approach, the Ridgewell ILS would transmit a false signal. We called it the 'Dip Signal'. We practiced ILS landings in clear weather and trained ourselves to ignore the false signal that always appeared just a few seconds before touchdown.

"On one occasion, I was caught in the air by some very bad weather and was forced to use the Ridgewell ILS. The hardest part of the ILS approach through the fog and rain was ignoring that dip signal to lower the nose. Finally, the wet runway came into view and I landed and rolled to a stop.

"I relaxed my arm muscles and let go of the wheel. Then I relaxed another muscle and let go of the seat."

There were other aids to landing in bad weather that included the use of sodium vapor flares strategically placed so the pilot could line up with the runway on his final approach and touchdown near the first flare. The British dug trenches alongside the runways and filled them with blazing gasoline to guide planes safely home. However, there was one magnificent aid to blind landings that American navigators and pilots soon learned to adapt as a life saver under bad weather conditions. The tool they used was known as the GEE Box.

INTRODUCTION TO GEE

Shortly after our arrival at Ridgewell, I was ordered to go to the radio shack and receive instructions on the use of the GEE box. This was a brand new experience for me. As I listened to the technician, I could hardly believe what he was saying.

Time required to take a fix, 15 seconds.

Accuracy, plus or minus 25 feet at sea level.

May be used as a homing device under foul weather conditions.

Range usually limited to coastal regions of the continent due to enemy jamming.

I was all ears. The GEE box was exactly what I needed while trying to home in on Dernyacross Ireland and Prestwick, Scotland during our flight across the Atlantic.. Perhaps this remarkable tool could help a navigator become master of his own destiny. I became a very attentive student.

The technician went on to explain that a Master and a Slave station were involved, but I didn't quite understand what he was talking about. When it came time for hands-on instruction, I soaked it up like a sponge. The GEE box was very easy to use.

Tune-in to the two radio stations. The frequencies were shown on the flimsy issued before each flight. Data was printed on rice paper and navigators were instructed to eat the paper if in danger of being captured.

Each station would create a "time-line" on the scope of the cathode ray tube (CRT).

The live blip moved right or left above the time line.

The marker blip, below the line, was moved right or left with a knob by the operator.

To obtain a fix, first, work with the upper time line, Station "A" (i.e.: red Gee lines)

Move the marker blip right or left to line up the left leading edges of the upper and lower blips. Immediately throw a switch and read the position of the marker blip on the Strobe scale that replaced the time-line.

Go to the second time-line and repeat for station "B" (i.e.: green GEE lines).

Refer to your GEE chart and find your position at the intersection of the red and green GEE lines.

With practice, an operator could perform these tasks in about fifteen second and determine a position that was accurate to plus or minus twenty five feet at sea level. I was soon a staunch advocate of GEE and readily willing to swap my Fairchild A-10 octant for a GEE box at any time.

One of the technicians noted my deep interest in the GEE box and remarked, "Lt. Howland, you can see that one of these GEE lines almost exactly parallels runway 28, the main runway at Ridgewell. Perhaps you could use that GEE line to help bring you home in bad weather." That casual remark started the wheels turning. The more I thought about the idea, the more enthused I became. Finally, I talked to my pilot Jim Tyson and explained my GEE approach theory. I suggested we try it out the next time we flew a plane equipped with a GEE box and determine whether we could home-in on the runway using GEE signals to guide us.

The use of pulsed radio signals called GEE (Ground Electronic Equipment) was first proposed by Britain's R. J. Dippy in 1937. His original intent was to use GEE as a homing device to help bomber crews return safely to their base under foul weather conditions. This was our chance to test Dippy's

theories. We practiced our homing procedure in the air every time we were lucky enough to draw a GEE equipped plane while making a practice flight.

Our procedure was relatively simple. My job started as Jim was running up the engines just prior to takeoff while we were on the runway. This is the spot where we would touch down on our return. I lined up the leading edges of the Station A & B blips with the strobe marker blips and recorded the numbers in my log. For illustrative purposes let us say the A Station was 24.5 and the B Station was 36.8 on the strobe marker scale. If all went well, these blips would be in exactly that same position when we landed after the flight.

We usually started our approach about fifteen miles east of Ridgewell at an altitude of 1500 feet. Every one on the plane had an assigned duty. Jim Tyson and I were in constant contact by interphone. I was busy watching the course line and range blips on the CRT (Cathode Ray Tube). Jim was busy piloting, and watching magnetic heading, airspeed, altitude, rate of climb and traffic. Bill Doherty, our co-pilot, watched for traffic, and monitored airspeed, altitude, rate of climb, flaps and wheels. Everyone else on the plane watched for traffic. The left waist gunner also watched for the tower of a church to whiz by just before touchdown on runway 280.

We followed the GEE line that paralleled the center line of the runway at Ridgewell. Normally, we landed from E to W. This meant that I could set the marker blip at the same coordinates noted in my log (24.5) and line up the live blip with that marker blip as far as fifteen or twenty miles east of Ridgewell. I relayed course corrections to the pilot on the interphone and kept the live blip lined-up with the marker blip. All we had to do was adjust altitude and speed so that we were ready to touchdown when the runway came into view. Fortunately, the wonderful GEE box showed two separate stations on the CRT at the same time. In the illustration, Station A shows course line data. When we were at our first checkpoint, we were 15 miles east of Ridgewell, or about 7 minutes from touch down. Three minutes later, Jim started his descent at 250 ft. per minute and 120 MPH IAS. I then re-set the marker blip of Station B to the touchdown point at Ridgewell (36.8). This caused the live blip to shift far to the right. However, it was moving steadily to the left and would eventually line up with the marker blip at the touchdown point on runway 28. Meantime, constant course corrections were being made whenever the live blip of Station A deviated right or left. Jim usually used his gyro-compass to maintain the heading. Bill Doherty, the co-pilot, watched for traffic. He also monitored airspeed and rate of descent, and made certain we did not drop below the red-line altitude of 200 feet.

During practice approaches my head was jammed into the scope of the GEE box, and I had no visual references to the outside world. It was always comforting, and a great personal pleasure to hear Charles Churchill, our left waist gunner, yell over the interphone, “There’s the church tower!” and a few seconds later to hear Jim Tyson quietly say, “Okay, I’ve got it now.” Even more satisfying was the visual sight of the runway dead ahead just prior to touch down.

During February and March 1944 we practiced our Ridgewell approach procedure every time we made a practice flight in a GEE equipped plane. The system worked perfectly every time we tried it. Further, each time we tried it we gained faith in our wonderful GEE box. Our confidence soared because we had an “ace-in-the-hole” to beat the foul English weather in case we were caught in the air when bad weather moved in.

GEE TESTIMONIALS

The 303rd Bomb Group at Molesworth was the base where navigators were trained on a system called “GEE-H” used late in the war. When I asked for information on their website, I didn’t get a reply from any GEE H navigators. However, I did receive the following letter from Jack Rencher, a former pilot

with the 303rd BG.

Jack Rencher

When we first got to England, before we were assigned to a Bomb Group, the Pilots and Navigators Were sent to a base near London (It might have been named Bovington—My forgetter has worked) It lasted about 2 weeks or so and was a lifesaver several times for our crew. I experimented with it extensively and loved it. It was unbelievably and extremely accurate. It was a radio system of getting a fix and navigating. It consisted of 3 radio stations. A Master station and 2 slave stations. It measured your distance from the two slave stations by measuring the TIME DIFFERENCE it took a signal to get to your position from the Master and the two slave stations. This time difference was measured by the GEE box (cathode ray tube) and placed you on a line of position. The line of position was a hyperbolic curve drawn on the navigator's GEE chart. While homing in on a runway at low altitude, it was accurate to less than 5 feet.

The information for the Navigator was displayed on a scope about 4 inches in diameter. It could be adjusted by the operator to select a LOP (line of position) by adjusting the lower blip to a designated setting. There were two lines (known as timelines) on the scope. Each line had a blip on it that was about a 1/4 inch long. Blips above the line went up. Below the line blips pointed down. This was shown on the top half of the little scope. The second line was displayed in the bottom half of the scope and was a duplication of the upper pair. Each of the of lines was on the receiving end of a master and a slave station. The blips showed where you were in relation to it's station and the upper (live) blip moved as you got closer or farther away from that station. The lower blip on the pair of lines could be adjusted by the operator to where he wanted to go by referring to his special GEE map. When the two blips were exactly one above the other you were exactly on a line of position. When you had both pairs of blips lined up you had an EXACT FIX, the point at which two LOPs crossed.

Rex Markt, our navigator, and I worked out a system using the GEE for instrument landings. We would draw an imaginary line through the center line our runway and extend it 10 or 12 miles down wind and home to that position. We would get to that position at about 1000 feet and take the runway heading at about 120 MPH. We would first kill our drift until we were maintaining a course parallel with our center line and note the exact course on the gyro compass. Then I would get back on the center line and pick up our course on the gyro compass. I'd get the gear and flaps down. Airspeed down to about 100 depending on load and altitude down to about 300 feet. Rex would say" 1 mile 5 feet right of center. I wouldn't try to turn for 5 feet but hold a bit of left rudder just a bit. Get down to 150 feet or so and 95 MPH or so with just a bit of power on. If I got off the center line over 2 or 3 feet Rex would say so. I'd use just a bit of rudder again. Next Rex would announce 200 feet off the end. I'd get down to 40 feet on the altimeter. I'd get down to 30 feet and 85-90 MPH Then head for 20 feet when Rex would say you are over the end of runway. I'd pray, Pull most of the power off raise the nose and wait for the squeak. We practiced this when we could see. We probably did this 10 times or so never missed the runway once. One time we went up to test fly a plane that had aborted from a mission. The Squadron Engineering Officer who was not a pilot went as copilot. We had Rex of course and Gus our engineer. When we landed it was absolutely 00. After we got on the ground and stopped we opened the window, stuck our head out and could not see the ground with a flashlight. It was daytime. When we landed the Engineering Officer was very nervous. I touched down a little tail first and bounced. The Engineering Officer started counting the bounces to hide his nervousness. When he got up to six, I told him he might just as well quit counting. I was not going around.

Jack Rencher - 303rd BG Pilot from Molesworth

Jack describes the use of GEE as a homing device quite accurately. It is remarkable that the bad-weather landing procedure he and his navigator developed for landing at Molesworth was almost identical to the system devised by Jim Tyson and me for blind landings at Ridgewell. I might add there were no text books to guide us and we worked independently.

Bill Dickinson

Bill Dickinson arrived in England in September 1944. He was stationed with the 385th Bomb Group at Great Ashfield Station. He states that all the aircraft at his base were equipped with GEE, and each navigator was issued a GEE Homing Card (copy shown below). As may be seen on the GEE homing card, Great Ashfield Station was very fortunate to have not one, but two runways that were paralleled by GEE lines making it an ideal "port in a storm" airdrome. Runway 131-311 shows almost perfect alignment of the blips for Station A (upper blips) at the east end and west ends of the runway. Runway 077-257 shows very good alignment of the blips on Station B, (lower blips) at the east and west ends of the runway. Basically it was the parallel alignment of the runway and GEE lines that facilitated the use of GEE as a homing device. Bill Dickinson flew a full thirty five-mission tour of duty during the war and remained in the reserves following the end of hostilities. He is the only navigator I have met who used both the British GEE box and the U.S. AP-9, AN/APN-70 LORAN system. Comparing the two systems he rates the British GEE above the American LORAN, principally because the GEE box showed two stations on the CRT scope at the same time. The American Loran system showed only one station at a time and required more time to obtain a fix. Further, the early models of American Airborne LORAN scopes required 18 separate delicate adjustments to make the system work. It was very easy to get a set out of adjustment. As one navigator expressed it, "*At such times the LORAN scope was only useful as a place to hang your hat."* Another navigator named Ted Graser was even more emphatic when he stated, "*As a navigator with over 6000 hours in military aircraft....I never did trust LORAN, especially the APN-9.*

LeRoy Christenson

Navigators (at Molesworth) were supplied with an 8-1/2 x 11" mimeographed map of Molesworth with appropriate GEE value lines for the end of the runway. I was a navigator on Owen Knutzen's crew. On several occasions I talked him into an approach to the field by following one of the lines to the end of the runway. I then gave him the heading for the runway with wind correction. It was a surprise to Owen how I could tell where the runway would be. We would break out of the fog, and there were the burning barrels of oil and the runway straight ahead. It was a fun system to work with.
LeRoy Christenson - Navigator - 359th Squadron, 303rd Bomb Group (Molesworth)

Roy Halsey

Not all recently arrived American navigators were eager or quick to adapt to the GEE box. My former commanding officer of the 535th Squadron of the 381st Bomb Group was a prince of a fellow named Roy Halsey. He was aware that I was an ardent fan of the GEE system and it was he who recommended me for the position of Pathfinder Navigator with the 1st Bombardment Division.

Several years ago he wrote and described a situation he once ran into. I cannot improve on his words or descriptions, so I have copied it exactly as I received it.

Long Beach, California

July 13, 1986

"*Your analysis and study of the GEE box was very interesting to me, and I wish I had had more time to know as much about it as you did. When we got our first GEE box on the base, I made it my business to get with a good navigator and learn as much as I could in one short session. Thank goodness, because shortly after that it was my turn to fly the weather ship before a mission. The weather ship was usually some ship from any squadron and the crew was anyone available that was not assigned to fly that day. We took off about three hours before the mission and flew the assembly route that was being used that day. I told the navigator that I was starting out on a course to point A and for him to take over from there and advise me when we were there. After awhile I felt that we should be there and asked the navigator, "How much more time?" He replied, "You are there now."*

I said. " OK, I'm turning for point B. Check your navigation and give me any correction in course." I made my report and settled down to observe the weather and make my notes. No correction in course was made, and I was feeling point B should be coming up. Called the navigator. Same thing. "You are there now." OK, give me a heading for point C. I then made my report to Wing, only this time I could hardly read the return transmission. Then the navigator gave me a heading that I knew had to be way off. I called him and told him to get on the GEE Box and give me our exact location. He came back with, "What's that?" Well, you can imagine what hit the fan then. I got out of my seat, went downstairs , turned on the GEE Box and discovered we were over the Channel near the coast of France. I immediately got us on a course back to England. I then asked the radio operator to get us a QDM to Ridgewell, which was no easy task. The radio operator had never heard of a QDM. To make a long story short, we got back to Ridgewell eventually and discovered the mission had been scrubbed and everyone had forgotten we were even up tooling around. When I got hold of the Squadron C.O. and his Operations Officer that set up that "Twilight Zone" crew, all hell broke loose. It turned out the navigator had just arrived on the base a couple of days before, and the rest of the crew were so new they hardly knew where the mess hall was…….."

Roy Halsey - Lt. Col (Ret.) - USAAF

Roy Halsey wasn't the only person to have such an experience. I had a similar experience the day before D-Day. The Pathfinder Force was extremely busy the four days prior to D-Day. As part of Eisenhower's deceptive plan to tie down German troops in the Pas de Calais area, we led through-the-cloud attacks on Pas de Calais on June 2nd, 3rd and 4th. Of course GEE and H2X Radar were essential to the shoreline attacks made through the clouds. In fact, we spent two full days practicing coordinated GEE /H2X radar attacks camera bombing a pier at Skegness in the Wash on May 29th and 31st.

On June 5th we were again alerted to lead a newly established group. This time our target was gun batteries on the Normandy Beaches. As usual, following a preliminary briefing, we flew from our Pathfinder Base at Bassingbourn about midnight to the Group we were scheduled to lead. Early the following morning we were briefed with the rest of the Group. At this time I was just four missions shy of completing my thirty mission tour of duty and had accumulated fifteen missions in the capacity of lead or deputy lead navigator, primarily for the 1st Combat Wing.

One of the things I was taught in navigation school is, "five minutes work on the ground is like thirty minutes of work in the air." I was a firm believer in this philosophy and was always the last member of the crew to arrive at the aircraft. I spent every minute possible laying out the flight plan and charting the entire course we intended to fly on the mission. The June 5th raid was no different except that I knew we would be flying within range of GEE stations so the entire mission was plotted on a Pembroke-Paris GEE chart.

As usual, I arrived at the plane just prior to engine time and crawled through the hatch into my flying

office in the nose of our B-17. A co-navigator was usually assigned to fly in the nose by the Group we happened to be leading. A young lieutenant. had already preceded me, and a sparkling new Mercator chart stretched out across the navigator's table. Not a single line had been drawn on it. In addition, right in the middle of everything sat a Fairchild A-10 Octant. I was dumbfounded.

"Who are you?" I asked.

"I am Lt. _____", the young man replied. "I am the Lead Navigator on this mission."

I looked at the blank chart and that A-10 Octant and said, "Tell me something, lieutenant; how many lead missions have you flown?"

"This is my first lead mission", was the reply.

That A-10 Octant drew my eyes like a magnet and I went on to ask, "Tell me something else. How many missions have you flown?"

"Oh, this is my first mission," was the reply.

I was not at all gentle when I told him, "Get that crap off my table, especially that stupid A-10 Octant." I then handed him a pilotage chart with the assembly area drawn in and told him, "Your job on this mission is to feed me position reports in latitude and longitude when I ask for them. Furthermore, the positions are to be accurate, and you are to stay the hell out of my way."

With things under control in the nose of the ship, we took off and made our assembly, but not without problems. Jim was having his difficulties with his co-pilot, the major who was the Acting Wing Commander. During assembly he insisted upon making minor changes in the flight plan, which was very upsetting to me. I presume the major had about as much combat experience as my co-navigator, and it showed in his performance.

The GEE box was "user friendly" and newcomers to the 8th Air Force easily adapted to it.. Frank Farr describes an experience that happened shortly after he arrived at Bassingbourn and another incident involving GEE on a combat mission

Frank Farr

It was a particularly vicious day, when you couldn't see three miles and it seemed B-17s were popping out at you from all over. The formation was scattered all over the sky. I was navigating (as a vet of five missions) with a brand new crew, and I told the pilot I'd direct him in. I hunkered down over the gee box, plotting as fast as I could, calling in course corrections to the pilot. Finally, I said, "Rusty, you ought to be able to look right down and see the runway now." Sure enough, there it was! You should have heard that new crew cheer! It was food for a scared 20-year old navigator's heart. I had one other notable success with the GEE. I loved it. It's so much more fun to recall our successes than our goofs! Here's my other GEE story.

I was flying with Val Maghee, who was my pilot and on his second tour. It was one of those messy, half-cloudy days when pilotage navigation was especially iffy. We were over West Germany, probably north of the fabled Ruhr Valley. I didn't know for sure just where we were, and I had the distinct feeling that the Wing lead didn't either. The GEE was jammed, and I was trying to get through the jamming. Suddenly I was through and the blips were clear. I took two quick fixes and called Val. I called my pilot on the radio and said, "Val, we're headed straight for the Frisian Islands! We ought to take a heading of 280 degrees." Val said he'd call the Wing leader.

What seemed only seconds later, the entire Wing wheeled around to the left to take up my heading. It

was a sobering moment. What if I'd been wrong? I called my pilot and said, "Val, what did you say to the colonel who was the acting Wing Commander?"

Val replied, "I told him my navigator says you are all screwed up, and we ought to be on a heading of 280 degrees."

For years I thought about that, and I thought, "Probably the Wing lead got clear of the GEE jamming at the same time I did." And I thought, "I wonder if Val really said that to the Colonel?" Then just last year, Val's son Morgan told me that it was real. He said that before he died, Val used to laugh over telling the Colonel they were all screwed up and seeing them correct to my course. Val was an old man (30) and on his second tour. The way he made a cigarette shrivel up with the first draw was legendary. At his advanced age, he probably wasn't as much in awe of the colonel as I was. Maybe, also, his willingness to address big brass with such cheek contributed to the fact that he was still just a 1st Lieutenant and not flying lead although he'd flown 40+ missions.

Frank Farr - Navigator - 91st Bomb Group

Mel Dart

I was testing GEE as a letdown device. As you know, there was one line that ran fairly parallel to the runway. (At Bassingbourn) Although I never had to use GEE as an approach aid, I did test it out. On a practice mission one day, I took exact GEE readings while parked on our hardstand. I had worked out the altitude we should be at various distances from the field and called them out as we letdown. So I would not cheat, I kept my head in the scope and called out heading changes to keep on line and ranges from the field. When I called out that we were there, I looked out and we were not at the end of the runway. We were over our hardstand! This convinced me that, if necessary, we could make blind approaches this way.

Mel Dart - Navigator - 91st Bomb Group

I am sure that Mel used the centerline of the runway the next time he established GEE readings for homing-in to Bassingbourn. A navigator from the 25th Bomb Group also had an eye-opening experience using GEE.

Otis E. Bower

Otis Bower was a member of the 25th Bomb Group and the 652nd Reconnaissance Squadron stationed at Alconbury. They flew long solo missions, largely over water collecting weather data. Their flights were made in good weather and bad with far more exposure to the elements than other Bomb Groups which were usually grounded when the weather was bad. A Ground Control Approach (GCA) radar station was installed at Alconbury, and they often practiced approaches on practice missions during daylight hours. On such occasions, the first pilot flew behind a screen to hide visual contact with the runway. The co-pilot watched his progress and gave corrections orally. It was the practice for the navigator to take a GEE fix on the end of the runway (prior to takeoff). It was also the duty of the navigator to follow through on the landing approach by observing progress along the course line and range line by watching the blips on the cathode ray tube of the GEE box.

On one occasion Otis and his crew returned from a night flight to find that fog had settled over the United Kingdom. The Ground Control Approach at Alconbury was being calibrated, and therefore, not in use. Heroic efforts were made to disperse the fog by parking four or five B-17s near the end of the runway and blowing the fog away with the blast from their propellers. However, the effort was unsuccessful. As Otis explained, "It was now up to me. It was "show-time."

I used the GEE coordinates I had noted in my log prior to takeoff for the end of the runway. We followed the GEE line representing the center line of the runway and were ready to touch down if the runway ever appeared through the fog. The pilot followed my instructions faithfully, and we broke out at twenty five feet of altitude. The left wheel was just off the side of the runway but the pilot put the B-17 into a sideslip and plunked it down with one of his better landings.

Otis put things in perspective when he told me, "After fifty-five years I still get goose bumps when I tell that story."

Otis E. Bower - Navigator - 25th Bomb Group - 652nd Reconnaissance Squadron

Quentin Ellis

Quentin Ellis was based at Bassingbourn, home of the 91st Bomb Group. When I talked with him about the use of GEE his reply was straightforward.

On Dec. 31, 1943. We went on a mission to southern France where we could not see the primary target. Therefore, we were directed to an alternate target. This resulted in our spending more time in completing this mission. As a result, some planes were having problems with low fuel. Secondly, since it was one of the shorter days of the year, it was getting dark earlier. The decision was made to direct our plane, and others to land at an airfield in England which was closer than our home field in Bassingbourn. The cloud cover was very low, and getting dark. As Phil Mack and Daniel Bramble were properly circling the British field, suddenly another B-17 was circling in the opposite direction.. Fortunately, Phil and Dave were able to sight this plane in time to avoid a collision. Bramble said, "Let's get out of here and go back to our base."

The darkness was closing in, and the ceiling was very low. That's when the GEE box proved its great worth. With this instrument, I was able to direct our plane back to our base. When we popped out of the low ceiling, we were directly over the runway of our base in Bassingbourn. "As far as I am concerned, the effectiveness of this instrument (GEE) is one of the most well kept secrets of WW-II. This was an outstanding piece of equipment, invented by the British. It served me in an outstanding manner but has never been given its due credit.

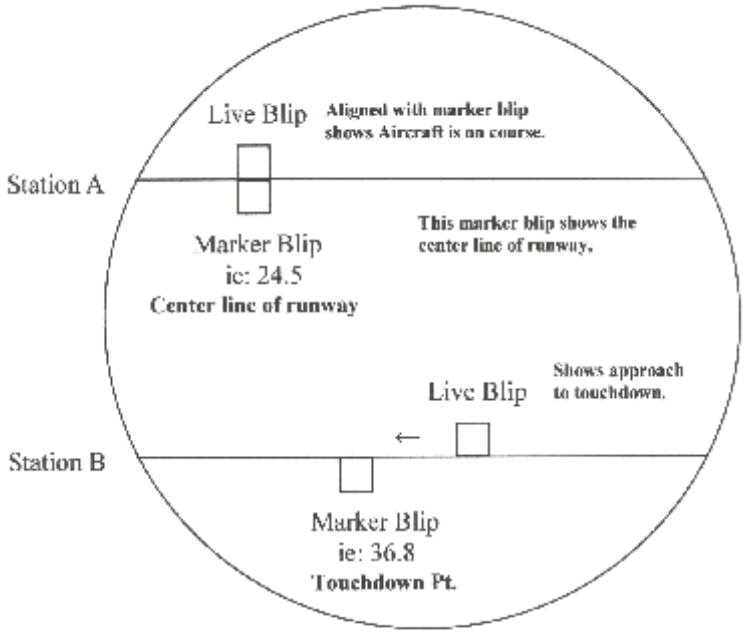
Quentin Ellis - Navigator - 91st Bomb Group (Bassingbourn)

I certainly agree with Quentin's evaluation of the GEE Box. There were no lights in the wartime English countryside. The towns were completely dark. There were no lights anywhere, not even on the highways. Further, anything not obscured by darkness was likely to be blanketed with low clouds, smog, or English fog. Members of the Pathfinder Force often flew at night, and we were well aware of this pitch-black darkness and the hazards it presented. Normally, we were alerted to a mission about 1900 hours (7:00 PM). Following a preliminary briefing at our home base, our planes were loaded with unfused bombs and we flew to the various bases in the 1st Bombardment Division we were scheduled to lead.. We usually took off about midnight. On one occasion we were flying from Chelveston to Ridgewell. High clouds obscured the moon and the stars, and it was ebony-black below us. My GEE Box was working fine, and everything was well under control from a navigation standpoint. Suddenly the green grass grew tall three times on the scope of my Cathode Ray Tube, and the image turned to electron scatter. This was a signal that enemy intruders were in the area and I would have to tune-in to the 1st emergency frequency shown on the 'flimsy' we always carried for each flight.

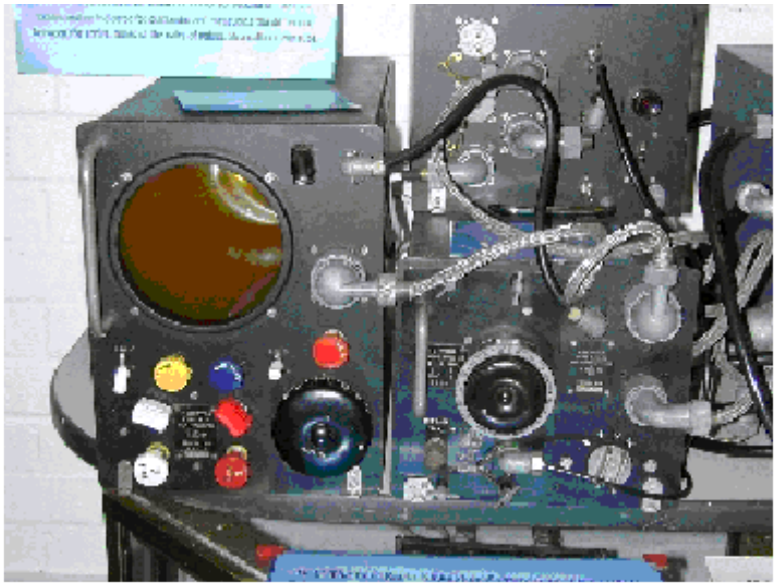
I re-tuned the GEE Box and the blips appeared once more. I was able to take only one fix when the green grass grew tall three times once again. The screen went blank, and I had to re-tune the GEE Box to emergency frequency number 2. We arrived at Ridgewell about ten minutes later and landed without

incident. However, all the gunners were alert and at their posts because German intruders liked to knock down sitting-ducks like us who were flying in the landing pattern.

In summary, there is no denying that GEE was a trusted and reliable aid to navigators who flew with the 8th Air Force out of England. Courage, determination, high quality equipment and the industrial might of America helped defeat the Luftwaffe. But., GEE, the ingenuity of many navigators and pilots, and the wizardry of Brits like Robert Watson-Watt and Robert J. Dippy helped us overcome the navigational challenges and legendary pea soup fogs of England.



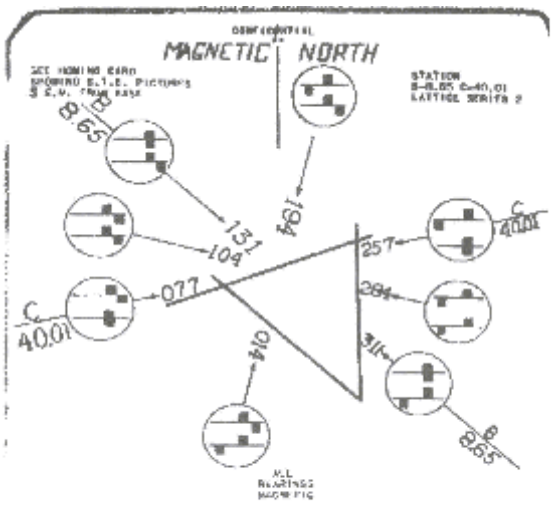
In the above illustration the left edges of the live blip and marker blip for station A are lined up at 24.5, the number of the GEE line paralleling the center line of runway 280 at Ridgewell.
The lower live blip for station shows the aircraft is approaching the end of the runway shown as 36.8 on the marker blip.
The navigator could check the actual distance in about ten seconds by referring to the strobe scale.



The British GEE box is the unit with the cathode ray tube (above left). Basically, the GEE box is an oscilloscope, an electronic instrument that produces an instantaneous visual display or trace of electron motion on the screen of a cathode ray tube. Only the unit with the cathode ray tube sat on the navigator's table. The other two support units were mounted in other parts of the aircraft. The GEE box at the left is displayed at the Pitstone Navigation Museum in Pitstone, England. It should be noted that this unit does not have a daylight visor used by 8th Air Force navigators. The RAF bombers always flew at night and the light shields were not required.

Rear, L to R: 1 Lt J B Millard, Pilot
2 Lt M W Procknow, Co-pilot
2 Lt W E Dickison, Navigator
F/O R J Dowell, Bombardier

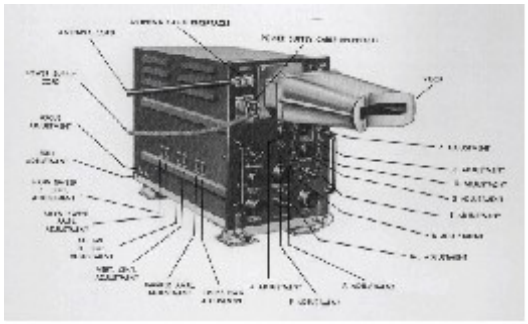
Front, L to R Cpl Roy Bagley, Flight Engineer
Cpl Walter Kmiec, Radio Operator
Cpl William Baker, Waist Gunner
Cpl D. J. Sims, Waist Gunner
Cpl Fred Green, Ball Turret
Cpl Darell Clark, Tail turret



R.F. UNIT TYPE INFORMATION

TYPE	S TUO	LATTICE SERIES	INFORMATION 'A' GHOST BLINKS NO IDENTIFICATION
25	1	NO (4)	
	1	SO (3)	3
	2	NE (6)	1
	4	EA (2)	2
24	3	SW (5)	5
	5	ITALIAN	
27	105 to 110	CH (CHANNEL)	4

GEE homing card issued to all navigators of the 548th Sq. of the 385th Bomb Group, Great Ashfield Station of the 3rd Bombardment Division.



LORAN—Receiver Indicator R-65/APN showing the eighteen separate adjustments required to keep the unit operational.

Lt. Col. C. L. "Roy" Halsey

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