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FOREIGN TECHNOLOGY DIVISION



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by

Chang Cheng-Min

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LOOKOUT EYES AT THE FLYING SCHOOL

Chang Cheng-Min

I

Another sunny spring day. Air force X X flying school is bustling with flying training at a fast pace. Trailers and fuel tanks are crisscrossing the runway apron and mechanics are busy fueling the Fighting Eagles. Aircraft are ready for take-off one after another and waves of Fighting Eagles are roaring down the runway and lifting off into the sky where aircraft are flying formations and executing various fighting maneuvers, dive, etc,...

On the tower, calmly and methodically like traffic police, the flight controller, with the microphone in his hand, guides the take-off and landing of the Eagles. On his side, the radar man wears a head set and microphone and is holding a marker pencil in his hand. Attentively, the operator draws arrows on a plexiglas plate laid over a military map marked with directions and distances, Fig. 1. Behind the operator, radar station commander Chen Liang is quietly talking with a new enlisted man.

"Sir, what do these arrows stand for?" asks the soldier curiously.

"They represent the positions of the aircraft at a certain time in the sky; connecting these arrows we will know in which region the aircraft is carrying out its activities." Pointing to the glass plate, he continues to explain: "This is the coordinate display board. The



Fig. 1 Monitoring the aircraft's flight on the display board

center point is the location of the radar station. The radar observer relays the aircraft activity shown on the fluorescent screen to the man in charge of the display board who then draws the situation out. From the display, the commander will have full knowledge of the air situation."

"Oh, so the radar must then be the controller's eyes?"

"You may put it that way. However, it is not simple to be good eyes. Come along, we will take a look in the radar room." With that, the two walk down the tower.

The new enlisted man is Wang Chi-Kang who has just been assigned to the radar station. Since Wang was a kid, he has been reading stories about radar soldiers and decided to be one so he can defend the nation's air territory by watching out for enemy aircraft and directing out airplanes in combat. And now, the excited Wang has just become a radar man. When he learned that he was to become a radar soldier at the flying school, he really felt let down. How am I going to find the shadow of an enemy aircraft, not to mention defending the air territory! Having realized the

soldier's disappointment, Comrade Chen Liang decided to have this chat with Wang to make him understand that every activity in the flying school is a contribution to the training of pilots who are experts as well as red. Every revolutionary soldier should do what the party wants him to do, and do it well. So the commander is showing Wang the airport so he can familiarize himself with the situation. When Wang heard that it is not simple to be good eyes, he locked his eyebrows and made up his mind that he would be the good eyes of the controller and live up to the expectations of the party and the people...

"There is our radar, Wang." Chen's words interrupted Wang's thought. Looking in the direction Chen was pointing, Wang saw several tall abele trees and through the tree branches he noticed the revolving antenna and the radar room beside the antenna. They walked through the door into the darkness of the room. After a while, they started to see the flourescent screen and the faint pilot lights. Chen introduced Wang to the two observers and the recorder in the room, and showed Wang the milky yellow dot on the screen. "This is the reflection wave from the plane. The radar observer should promptly locate the signal, identify and analyze it, and quickly transmit the message to the display board. Observers really are the key to the radar's clairvoyance!" Chen then continued to introduce Wang to the duties of the recorder and the generator operator. The recorder is in charge of writing down all the situations reported by the observer and keep record of the important conversations. The generator man's duty is to start the oil electric generator and supply power to the radar in case the external electric power is interrupted.

Realizing all the different jobs in radar operation, Wang couldn't help to ask, "What will I be doing?"

"What do you like to do? Let us hear your opinion." Chen answered with a question. Wang thought for a second, and standing straight, answered, "I will obey whatever duty the organization assigns to me!" Commander Chen chuckled and said, "Very well, the party branch office has evaluated the situation and you will be the radar observer."

"Yes, sir!" Wang gladly answered. He felt like he had just been assigned to an important mission.

II

Several days passed. Wang had been anxious to start to take his shift as an **observer**, but the commander ordered senior observer Chang Hua to help Wang's learning for a few days. First, Wang learned to practice the correct military way to pronunciation: "7" as "Kuai," "0" as "Tung," and "9" as "Kou," pronounced in a crisp, loud and clear voice. He then memorized the performance of various airplanes and the wave form of them as they appear on the radar screen. In those few days, Wang really made use of every minute in learning and practiced the entire Sunday, beyond the call of duty. Wang figured he was more than ready to take his shift but, to his dismay, Chang Hua required him to memorize the towns, railroads, rivers and mountains around the airport, space coordinates of training flights from this airport, and characteristics of different flight training drills. Wang had always thought that sitting in front of the screen and reporting the situation was simple enough -- "Wherever the airplane goes, I will report its position" -- and all this learning was really superfluous. He was getting more and more discouraged. Commander Chen knows all this and is prepared to help Wang along to the next step.

The day finally came when Wang got permission to start on the machine. (Fig. 2) He felt he had never been happier. Sitting squarely before the screen and focusing his eyes on the origin, he operated the sliding scale and reported the positions of the aircraft in the sky. Following Chang Hua's instruction, he first announces the batch and then the direction and distance, like: "01 (batch), 120 (direction), 33 (distance)", "02, 030, 25", and so on. Standing beside Wang, Chang Hua makes use of the time gap between reports to give Wang tips on increasing the report speed and accuracy. As soon as Wang finished reporting "01, 130, 40", Chang suddenly said, "Watch out, '01' straying out of assigned region." Wang was wondering what has happened and intended to ask; in the meantime, two more waves of aircraft joined in and Wang could not find a chance to ask.



Fig. 2 Wang started his job on the machine

The radar receiver is making noise as if in competition with Wang's clear and loud reporting voice which is transmitted along the wires to the control tower several kilometers away. Wang again reports several positions of the "01" aircraft and Chang comments that the situation is

back to normal. A few moments later, the commander showed up behind them and spotted that "07" has entered the wrong air space and should be alerted. Wang is puzzled by another question: how did the commander know that "07" had gone into the wrong space by taking just one look of the returned wave? The situation board attendant immediately relayed the commander's report to the flight controller who then directed the aircraft to their assigned air space and averted a possible accident.

The moment the machine is shut down, Wang blurted out a series of questions like a machine gun. Chen Hua laughed and said: "Take it easy. One does not become a fat man from one meal. Let me answer your questions one by one." Pausing for a second, Chen asked, "Tell me what is our mission."

"Our mission is to ensure the safety of flight training!" Wang answered quickly.

"There you are!" Pointing to the circles on the military map, Chen continued to explain, "With so many aircraft in the sky, we can guarantee their safety only if they stay within their assigned air space for training. Our duty is to find aircraft entering the wrong region or straying from their assigned space early in time and report it to the controller so that collision or missing can be prevented."

Wang was still puzzled, "How can you see it while I cannot?"

"You memorized the center points of various air spaces, remember? When we report the position of a certain wave of aircraft, we know right away if they are in their assigned air space. We must keep in mind, which region the aircraft enter right after they take off so that we can judge if they have gone to a wrong region right from the beginning. If you can do that, you have a map imprinted in your head and watching the reflection

wave on the screen is like seeing those aircraft moving on the map." The commander answered Wang's question.

Chang Hua comments further: "We also have to know the activities in various flight training courses to tell whether the aircraft are making normal flights. For instance, we have to watch if the aircraft are keeping good direction, are they making correct turns, and so on. Only then, can we be in control of the situation."

"Oh, I see." Wang was beginning to see the light, and quickly he wrote down this conversation in his exercise notebook. He is also embarrassed.

III

After a period of theoretical learning and practical exercise, Wang is making fast progress and meets the requirements standard of a radar observer. In the flying jargon, he is ready for "solo."

On one hot flying day, temperature reaching 40 degrees Celsius, the comrades are working in the radar station's dark radar room, which is like working in an oven; but no matter how hot the day is, the radar soldier's red hearts are hotter. Reflection waves crowded on the radar screen, wave after wave of aircraft diffuse from the center and more move toward the center. The whole wide sky is displayed on the small fluorescent screen. Chang Hua and Wang have the great feeling of being able to make some contribution to the training of future pilots. They are kept busy reporting the air situation. Sitting in front of the screen, they rub their tired eyes and take a drink of water and keep on working.

Cross country is on today's agenda. A large number of aircraft close together on the flight course is a challenge to the radarman. Wang is concentrating on the radar screen, rapidly rotating the scale and reporting to the controller, "01, 168, 99," "02, 168, 49"... Three hours passed and the training flight continues without incident. The neat formation of airplanes is a beautiful picture to watch.

"Caution, '28' early turning point, 175, 120." Wang reports an abnormal condition to control. "Acknowledged, continue observation," came the reply. Wang is well aware of the regulation that 50 kilometers distance must be kept between aircraft and if the turning point of one is advanced, it amounts to taking a short cut and will catch up with the one in front. This is a dangerous move. The controller is now instructing "28" to slow down and correct its direction to return to the normal flight.

There were fifty sorties scheduled for today and now only two airplanes left to go, and Wang breathed with relief. "Don't get off the alert yet, trouble often happens at the last minute," warns Chang Hua. It just so happened that batch "49" made an early turn at the first point which Wang reported, and then was lost from the screen. Batch "50" is approaching the airbase following normal course, and is passing the second turning point at "220, 120."

"The next point should be '210, 115' now," Wang reminds himself, but the next point signal disappeared out of sight. The antenna made one revolution and a point appears at "220, 110." -- Is this "49" or "50"? While he was thinking, the antenna made one more revolution and another point at "220, 120" is moving toward the airport. The two aircraft are dangerously close! They must be instructed to pull distance but

first they must be distinguished (which is "49" and which is "50"?) before they can be instructed about what to do. If "49" is in front of "50" then instructing "49" to accelerate and "50" to slow down will increase their distance; but if it is the other way around, the same instructions will lead to a collision. The display situation room is urging identification. After a quick analysis, Wang judged that "49" must have identified the wrong land marking and turned too early at the first turning point, while searching for the second turning point land mark, "50" took over "49" and is now in front. Wang then reported out "50, 220, 105," and "49, 220, 115." Based on the reported situation and the land marks observed by each pilot, the controller confirmed Wang's judgement and instructed the aircraft to pull apart and averted a possible accident.

A red flare burst in the blue sky and the airbase concluded a day's flight training. Wang stayed in the radar room with Chang Hua and learned how to cope with machine malfunction so that he can manage alone in the future. Helping and learning from each other, they have forgotten the fatigue from a whole day's work. By the time they went back to their barracks, the moon is already on the tree top.

IV

For several days in the company, strategic education sessions were held for countermeasures against any surprise attack by the Soviet Revisionsits. These sessions sparked an idea in Wang. He said to himself, in case the war broke out, we will be the ones to fight it. We should not be satisfied with the flight trainings aimed at the protection of our own airfield; more should be learned to meet the

challenges of war. Upon sharing his idea with the commander, he was endorsed by all the comrades. The commander then initiated a vigorous and practical battle training program including watching the movie "Red waves on the blue sea."

One afternoon, comrades in the radar station received emergency orders to assume battle stations. Instantly the antenna started revolving and intense electromagnetic waves resonated in the air. The commander picked up the phone, "Dispatch? What is the operation?" The answer came back through the wire: "One aircraft missing from adjacent unit needs radar guidance to land." Yes, we will definitely do our best," said the commander as he put down the receiver. Wang requested, "Please let me take care of the situation." "Very well, you and Chang Hua will be in charge of the observation duty. You two be determined and calm and handle this like facing a battle situation."

On the fluorescent screen, mostly reflections of mountain ranges were seen, and hidden in them, fleeting glimpses of the aircraft. With a radarman's sharp vision, Wang spotted five aircraft among the mountain reflections, but could not identify offhand which was the missing airplane. Display panel suggested the missing aircraft to maintain altitude and carry out a 45 degree spiral and the controller transmitted the instruction. Wang then discovered a spiraling bright dot at 270 degrees and 102 kilometers. By this time, Chang also noticed the dot and suggested Wang to look carefully and make sure there is no similar activity at other locations. Wang turned the knob to increase the reflection intensity and Chang controlled the antenna rotation handle to a slow search in that direction and both were busy analyzing and evaluating the signal.

On the screen, a silvery trace was sweeping around the center and groups of reflections showed up against the dim background. All of a sudden, all reflections disappeared from the screen and the whole room was in darkness. "Trouble, the power is out!" Wang exclaimed. The power outage could not have happened at a worse time. Very calmly, Wang located the distributor, and checked the fuse. After he confirmed the problem was external, he quickly pushed the distributor switch to the "diesel generator input" position. After a short delay, the signals reappeared on the screen and the two radarmen quickly identified the dot as the missing aircraft. Under the guidance of the radar, the missing plane was approaching their airport.

"Attention, another outside aircraft at '72, 310, 95,'" Wang reported to the display panel. This aircraft, southbound on the display panel was fast approaching the missing plane. What if the two aircraft were at the same altitude? The atmosphere in the tower and the radar room suddenly turned tense. Just as they began to measure the aircraft altitude, it disappeared into a big patch of fixed target reflections. Considering the difficulty of observing the fleeting glimpses of reflection among the fixed reflections, one can easily imagine the near impossibility of measuring its altitude at the same time. Time was never more precious and data more important than this moment. Time did not allow the measurement to be delayed until the reflection emerged from the background. Was there any way out? Viewing the entire screen, Wang spotted a narrow gap, a few kilometers wide, among the big area of fixed reflections. "Got it, we have to measure its altitude right here." Pointing to the screen, Wang spoke to Chang. Chang and the commander nodded their agreement. Wang quickly

measured the distance to the gap and figured out the signal to noise ratios of aircraft at various altitude at this distance. At the instant the aircraft passed the gap, Wang reported its altitude to be 3500 meters, 500 meters higher than the missing airplane. Information was relayed to the controller from the display panel and arrows of two different colors crossed on the display panel and each continued to its destination.

After Chang and Wang reported the positions of each aircraft, the missing aircraft was getting close to the airfield. Just as the job appeared to be finished, something else happened. Severe noises, looking like rain, appeared on the screen and scrambled all the reflection signals. Chang judged from his experience, "It must be the neighboring unit doing their anti-interference exercise." If the interference was not taken care of immediately, the radar would be unable to guide the landing of the missing aircraft and all the work would be wasted. Following the commander's order, Wang stood up and quickly turned on the anti-interference circuit and changed the frequency of the transmitter and the receiver. The reflection then clearly reappeared on the screen.

With the engine roaring, the missing aircraft slowly touched down. Upon examining the fuel level, the mechanic found it was almost dry. Another potential accident was averted. The unit of the missing plane called up to express its appreciation, especially to the comrades of the radar station, who in turn replied that they still had a long way to go from the war time readiness.

(Translator's note: last paragraph faint beyond recognition)

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