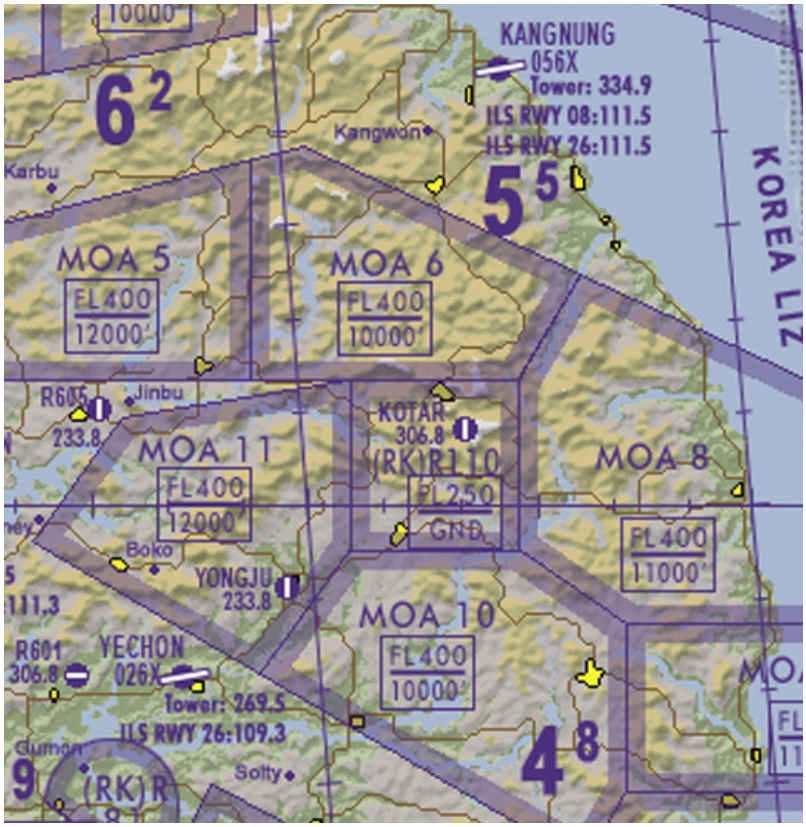
KOTAR Range Operations:

KOTAR stands for KOrean TActical Range. The purpose of KOTAR is to provide Falcon pilots a place to practise air to ground weapons delivery in a no threat environment. Targets are multiple and suitable for GP bombs, LGB, GPS bombs, Air to surface missiles and gun strafing.

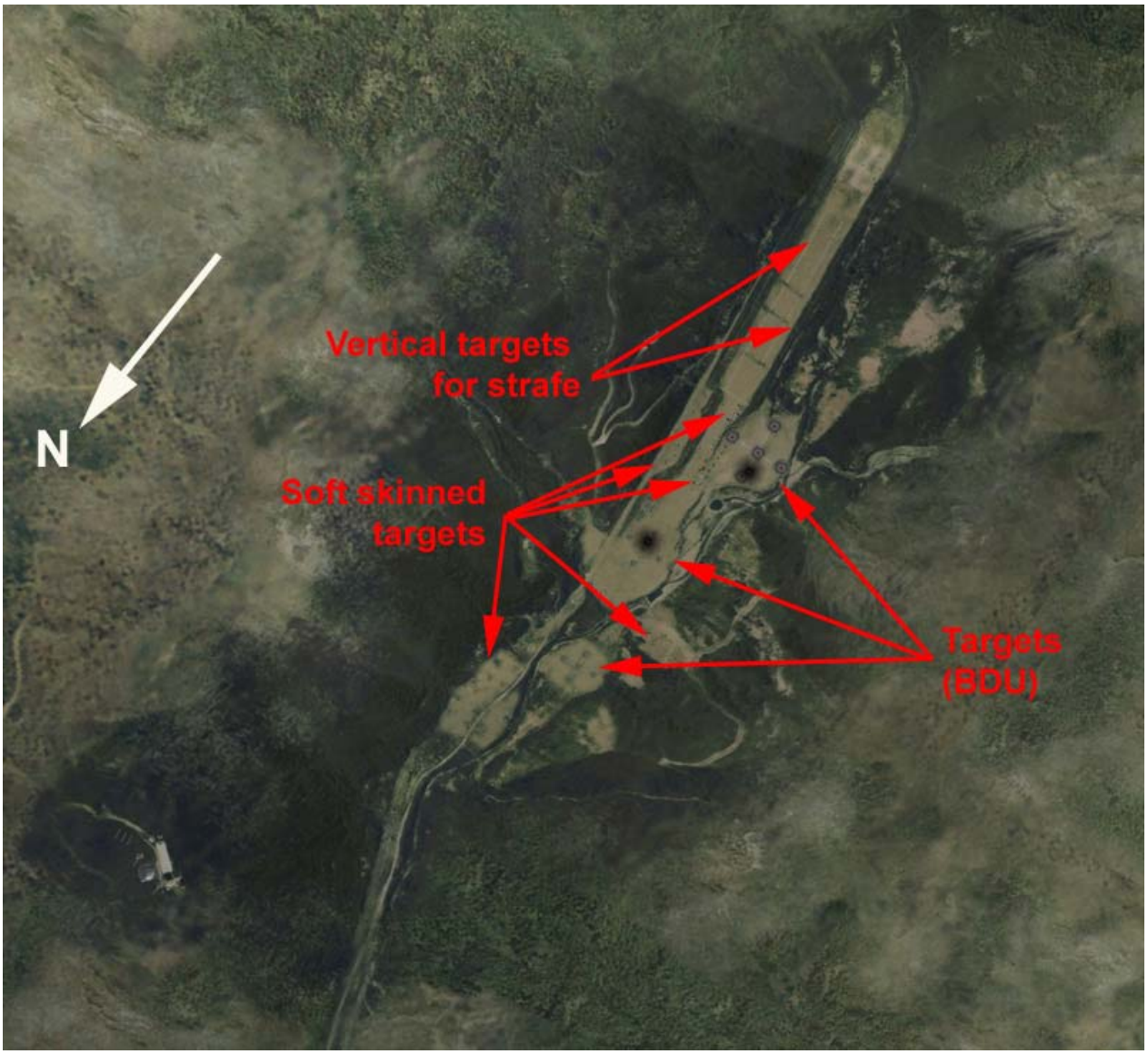
It is located in Restricted zone (RK)R-110 which is active from Ground to FL250. Coordinates: N 37° 08.60' E130° 20.81':



The range is located in a North/South valley surrounded by high terrain especially on the East and the West. The main Run In axis is 180° heading. 360° attack heading is prohibited because of the city north of the Range. As a consequence, the Run-in axis is fixed to 180° plus or minus 40° in case of offset or POPUP event. The closest airbases in case of emergency are Yongju airstrips, yechon airbase (026X) and Kangnung airbase (056X)

KOTAR Range data:

Airspace: RKR-110 Ground to FL250
GPS: N 37° 08.60' E130° 20.81'
Run-In: 180°
Range elevation: 2854 feet



Range Radio

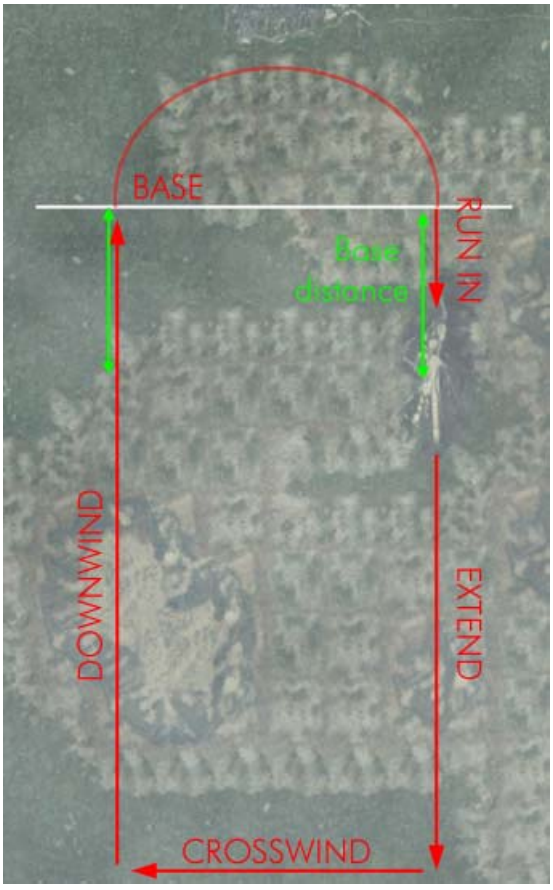
Kotar frequency is Uniform 306.8
This frequency is to be used as UNICOM for all aircraft using the range when they are within RKR-110 airspace – That is even without airborne range controller present. Range manoeuvres are to be called on this frequency so any joining flight can maintain SA on what is happening within the range airspace.
In case of control by an airborne range pilot, the controller will be on this Uniform frequency and will clear the airspace and call the BDA for the training flights. This frequency is capable of broadcasting the local altimeter setting.

Training ranges are usually manned by ground personnel to ensure flight safety and strike coordination. Unfortunately, we don't have that luxury in falcon with the current ATC code. As a consequence, we have two scenarios available to us.
1. The lead of the strikers takes responsibility for safety and coordination during range operation.
2. A specific pilot may join the mission and act as an airborne range controller.

1. Range Occupancy & BOX pattern without range controller

Due to the small airspace around the range, the number of aircraft active at one time is limited to four. Only one flight of four aircraft (or two flights of two aircraft) can be working the range at one time.
All aircraft within the range airspace MUST monitor the same frequency 306.8. Arriving flights should also tune to the range frequency prior to enter the area to make sure that the range is available or to check in with the airborne range controller if present.

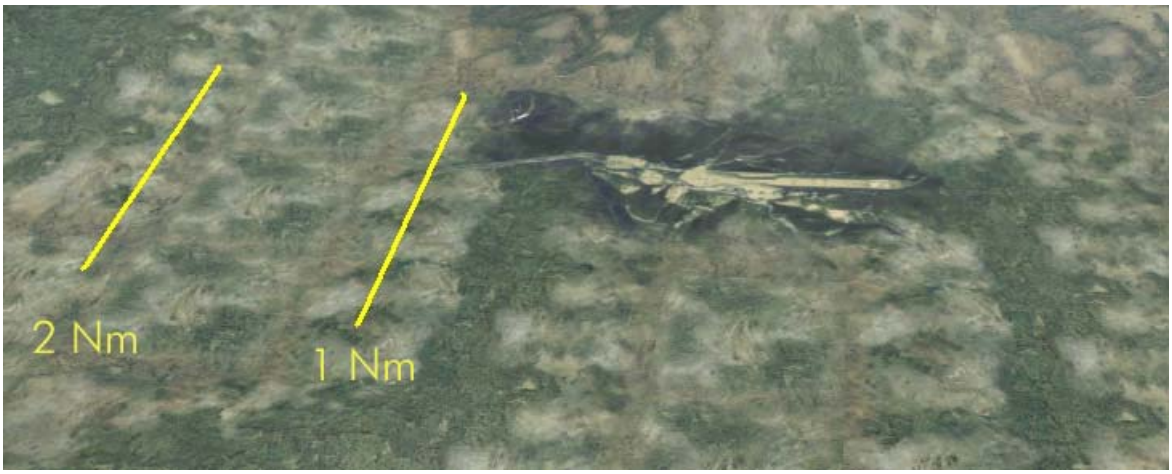
A flight of four using a typical box pattern usually needs 25-30 minutes for range work. As a consequence, plan on having a slot of 30 minutes for a 4 ship flight. The first pass in the pattern is usually a dry pass called a spacer pass to allow all pilots to position correctly and get the correct spacing. It is also a great opportunity to get local winds. Of course, the lead needs to ensure that all flight members are on local altimeter setting provided by Kotar frequency.
The flight flies the run in heading at 480kts ground speed in left echelon formation. The flight lead breaks right over the target entering the pattern, each aircraft breaks every 7 seconds in sequence. That should provide enough separation for a closed box pattern. After flying downwind, the flight lead will turn base and make a dry pass, as briefed. All pilots execute the same dry pass, which is a good way to set the separation in the pattern and to perform final checks for range work.



Basic pattern for range work is a BOX pattern - RIGHT turn. Please note that BASE and CROSSWIND legs are not straight legs but a 180° turn to/from Downwind.

The most common mistake made by new pilots flying to the range is to miss the base turn point and extend downwind farther North.

The base point is where you start your base turn and is the most crucial point in the box pattern!
In the sim it is really not easy to get correct visual cues when reaching that point. A common mistake is to extend too far North before turning base. That should be avoided as it spoils the event geometry and all preset settings (dive angle, distance, aiming, …), without mentioning the mess in the aircraft separation.
If it happens nevertheless, fly a dry pass and remain at base altitude.
The table below gives you base distance which is a horizontal distance from target where the base turn should be started depending on event. Usually, that distance is close to 2Nm (12000feet). The best way to judge that point is visually. Study the picture below which was taken on downwind during a box pattern at minimal FOV. When that 2Nm line is abeam on your right, start your turn. After a while, it will become second nature.



On the base leg, the pilot observes the target and tries to determine if his range is correct. When the target is at his 1.5, 2o'clock, he initiates the final turn. During the turn, the pilot overbanks the aircraft for 90°+ the planned dive angle (for instance for HADB45 90+45=135°). If, during the base leg he has noticed that he is further than the planned distance, he can correct by turning 30-45° of heading on the horizon and then overbank the a/c. When the a/c reaches the desired dive angle, he continues with 90° bank to holds it. When the target reaches the top of the HUD (gun cross), he unloads and rolls for wings level. He then has to push and hold the stick ***''hand forward''*** to set 0,7 – 0,9 g to hold the fpm at the aim of distance, or else the a/c will do a ''banana pass''
After weapon release, execute a climbing safe escape manoeuvre (CSEM) to climb back to the briefed event altitude. The climbing safe escape manoeuvre is a no turn 5G pull for 2 seconds to get the fpm on the horizon followed by a 20-30° climb back to base altitude. Directly after the CSEM, start your 180° RIGHT turn to downwind while reaching the next event briefed altitude.
On the range all turns are done at MIL power, pulling to maintain event speed (see table below)

Radio calls on the range are ALWAYS done on the range UHF frequency: 306.8.
Basically, all flight members will need to make 3 calls.
BASE, IN and OFF
Shepherd 1 is base happens when lead turns base
Shepherd 1 is IN happens when leads start his pass (at this time #2 should report base)
Shepherd 1 is OFF happens when leads has dropped his weapon and start his CSEM (at that time, #2 should report IN.) If for any reason, the bombs don't come off, the call should be: SHEPHERD 1 is Off, Dry.
A tempo MUST be timed by listening to the range calls
1 base …. #1 in …. #2 base ….#1 off …. #2 in ….#3 base ….#2 off …#3 in …. #4 base …#3 off …#4 in ….#1 base … #4 off … #1 in etc etc
Of course the interval between the calls has to be constant and any longer leg by any pilot will disrupt the pattern of the whole flight. Maintaining correct separation also allows easy visual contact in the pattern (especially with the airborne range controller if present.)
It is very important to get the best tempo as possible and if a pilot can not reach the correct parameter for the event, he should not try to correct by extending his pattern but rather fly a dry pass to maintain the range tempo and sequence.

Range weapons & event

Any live weapon can be used on the range. One new training weapon was introduced specifically for range work: the BDU-33 practise bomb unit. It weights 48Lbs and emits a white smoke for easy BDA. Three can be loaded on a regular TER and if you try to load more, the TER will be replaced with a SUU-20 carrier in which 6 BDU-33 can be carried. Please note the 4 rockets in the Suu-20 are not loaded as the F-16 pylon intervalometers are not wired.

The BDUs are considered marking weapons and although they have the same aerodynamics as the GP Mk-82 & BSU-49, they don't frag the targets. As a consequence, aiming has to be very precise for the target to be listed (if hit) into debrief.
In debrief, only direct hits will be listed. That is why the airborne range controller adds a nice dimension to range work by calling the BDA after the pass to help the pilot correct his aiming and provide better debrief.
Most bombing event can be practised on the range. An event is a planned bomb pass that is standardized with known settings:

- 10° LALD = 10° dive Low Altitude, Low Drag
- 10° LAHD = 10°dive Low Altitude, Hi Drag
- 20° LALD = 20° dive Low Altitude, Low Drag
- 30° DB = 30° Dive Bombing
- 45° HADB = 45° High Altitude Dive bomb
- 45° HARB = 45° High Altitude recovery bombing (when you need to recover above a certain threat altitude.
- STRAFE = Air to Ground Gunnery on the vertical targets

All those events have their own settings in the following table:

Event	Base Alt in thousand of feet AGL (MSL)	Base Distance Nm	Base Airspeed (Kcas)	PRA (Planned Release Alt.) AGL (MSL)	MRA (Min Release Alt.) AGL (MSL)	Rel Airspeed (Kcas)	% BFL (Bomb Fall line)	Fuse Arm	Bomb TOF (time of Flight)	Foul altitude AGL (MSL)
10° LALD	3.0 (5.8)	2.3	375	1.5 (4.3)	1.3 (4.1)	450	55	4.58	5.73	1.0 (3.8)
10° LAHD	2.0 (4.8)	1.8	375	0.6 (3.1)	0.4 (3.2)	450	25	3.11	2.7	0.1 (2.9)
20° LALD	5.0 (7.8)	2.1	350	2.0 (4.8)	1.7 (4.5)	450	39	4.58	4.91	1.0 (3.8)
30° DB	8.0 (10.8)	2.07	350	3.1 (5.9)	2.8 (5.6)	450	39	4.58	5.67	1.5 (4.3)
45° HADB	14.0 (16.8)	2.2	300	7.7 (10.5)	7.2 (10)	450	51	4.58	10.3	4.5 (6.3)
45° HARB	20.6 (23.4)	2.7	300	14.2 (17)	13.0 (15.8)	0.85/415	80	4.58	17.3	10.0 (12.8)
Low angle Strafe	2.1 (4.9)	2.0	400	-	-	450	-	-	-	0.5 (3.3)

Flying an event is simply flying the pattern applying the above parameters. The most important point is the Base turn and the above settings let you know where you should be when turning base. As said before, the trick is to turn Base at the right moment.
Do not allow any error on base, if you are outside parameters, simply declare a dry pass and overfly the target at the Base altitude, keeping your place in the pattern.

- Base Altitude is the altitude where you should be before turning base. It's in thousands of feet and be aware it is AGL, the range is 2854 feet elevation, so a base Alt of 3.0 is actually 3000+2854 = 5854feet. In the table above, the first altitude is AGL, the second one takes Kotar elevation into account (MSL) remember to be on Kotar local altimeter setting.

- Base distance is the horizontal range from the target where you should start to turn base.
  As seen above, the best way to gauge that distance is visually but you van also trick the system by using the CCRP base distance to target. Make sure the steerpoint of interest is the target, select CCRP and check base distance to target in the HUD given in the bottom right of the HUD.

Bear in mind that the range started with F (because ranged with the FCR) is the slant range taking the altitude into account, that is the hypotenuse of the triangle where base distance is one of the straight side. Another way is to use the offset aim points (OA1 & OA2) to visualize base distance.

Real pilots do it with canopy cues, but that really doesn't work very well in the sim ☺ .I tried but I can't decide which one to use, the real cockpit canopy of the 3D canopy …

- Base airspeed is self explanatory it's the calibrated airspeed you need to be at base.
- PRA is Planned Release altitude. You drop your weapon when you pass through that altitude
- MRA is Minimum Release Altitude. Don't drop below that altitude
- Release airspeed is self explanatory as well: your calibrated drop airspeed.
- %BFL is the distance between the FPM and the target expressed as a percentage of the total CCIP line (from FPM to pipper) 25% BFL means that the FPM is placed 25% of the length of bomb fall line above the target. This info is needed to determine your aim off point.(AOP)
- Fuse Arm is the Arming delay for your weapon, which should be set at ramp.
- Bomb Time of flight is self explanatory – if you release at PRA within all settings
- Foul Altitude is your safety floor. Strikers can not go lower than foul altitude without risking flight safety. Any pilot going under that Foul altitude will be sent RTB directly.

A typical range mission is usually made of 3 different events each having 3 passes. With the first spacer pass (dry) it makes a total of 10 patterns per range mission.

For instance a typical range training mission could be 3 events 30°DB, 3 events 10°LALD and 3 events STRAFE.
All this happens on a very short time lapse and range operations are very intense. Pilots need to keep the tempo, set their avionics, maintain visual with other flight members and with the target and stay safe from the ground. Needless to say, it requires careful planning and preparation before actually getting there.

(change 2.2)

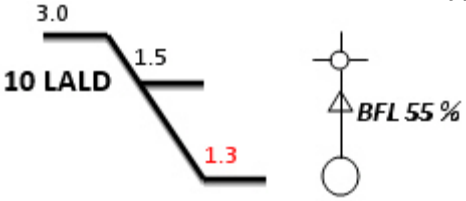
Events are schematized and properly briefed. Mission Datacard will display the event symbol like the one pictured below:

30 DB means that this symbol is for a 30° Dive bomb event.
8.0 is Base altitude in thousand of feet (AGL)
3.1 is Planned release altitude in AGL (PRA)
2.8 is Minimum release altitude in AGL (MRA)

Bomb fall line will be at 39%

It is VERY good practice so set MSL ALOW at event MRA. Doing so will give the pilot a Betty call when reaching MRA and hearing this the pilot should immediately starts his climbing safe escape manoeuvre to avoid flying lower than foul altitude.
Obviously, MSL ALOW needs to be reset for each event!
Please note that we don't use the CARA ALOW as it depends on the radar altimeter and might be in a blanked condition (attitude). If that happens, you may not have the advisory altitude call from Betty.

A 10° LALD event will have the same type of schematic; the data will be different though:



A Low angle strafe is a Gun pass. This kind of event is where we loose experienced pilots because of target fixation and non respect of the FOUL altitude!!!
KOTAR has two lines of specific vertical targets for gun strafe.
Base altitude is 2.1 (4.9) and Foul altitude is 500feet AGL. It is strongly advised to set MSL ALOW at 1000 feet AGL start your CSEM as soon as Betty calls altitude. Target fixation is a real risk here and although we're flying for fun, you don't want to miss the fun of the overhead recovery after a successful range training mission!

2. Airborne Range controller

When an airborne range controller is available - different aircraft can be used for this purpose: OV-10D, A-10, F-16. Be aware that any 3D cockpit different than default F-16 cockpit might create problem for tuning the radio.

The role of the airborne range controller has to be standardised. So that each pilot going to the range with a different range controller follow the same procedures.
The responsibilities of the range controller are:
1. Ensure flight safety for all aircraft within the range airspace.
2. Coordinating range entry/exit with inbound flights.
3. Clear weapon drops.
4. Call BDA
5. After the flight, Range controller should be able to debrief each flight Range operations.

1. Ensuring flight safety within the range airspace.
Since the range controller is not on the ground but airborne, he needs to ensure deconfliction and at the same time be able to maintain the range targets and the strikers in visual. Normally a ranger cannot be cleared in hot unless he confirms having visual on its target and on the airborne range controller!
Deconfliction can be made using different altitude blocks, depending on the strike events flown. For instance the airborne range controller can assign GROUND to FL150 to Strikers and circle the range above FL150. That may make his life difficult spotting the strikers visually but it will make the strikers easily spot him at higher altitude.
Deconfliction can also be made laterally with the airborne range controller flying on one side of the range and making that area a no fly zone for the strikers. BDA might be harder for the range controller in that case.
Another aspect of flight safety, and since BMS 4.30.2, is the altimeter setting. The local altimeter setting is available on Kotar UHF radio (306.8) but range controller can pass that information to rangers as well.

2. Coordinating range entry/exit with inbound flights
The airborne range controller should also coordinate with inbounds flights and make them hold as long as the range airspace is occupied by another flight. Neighbours MOA can be used as holding areas.
Range slots are normally briefed before the flight and should be around 30 minutes for a 4 ship.
When an airborne range controller mans the range, Range entry is prohibited as long as two way radio communications is not initiated between parties.
Any flight leaving the range should get clearance from the airborne range controller who will also pass on exit procedure to ensure deconfliction with inbound flights.

3. Clear weapon drops
As with the use of live weapons in a friendly area, tight control must be enforced. Outside the range lies a city and we don't want to inadvertently drop practise rounds there. Within the range grounds, we have South Korean personnel manning the facilities we don't want to bomb either. As a consequence, each weapon drops, missile firing or gun strafing has to be cleared hot by the present airborne range controller. (when not present, the flight leads assumes responsibility).
Clearing in hot can only be done pending the following conditions:
A. Bomber is on attack heading and has called which target he aims for
B. Range controller has the bomber and the target in sight

The strikers need to tell the range controller which target is selected for each pass. They are cleared to that target only and the BDA will be called in respect to that target. When targeting the vehicles or the airframes, it is not always possible to call the exact target; in that case, the pilots should use the North, centre and South Junkyard and type of target (Mig-15, F-4, Huey, M2A3). See range charts

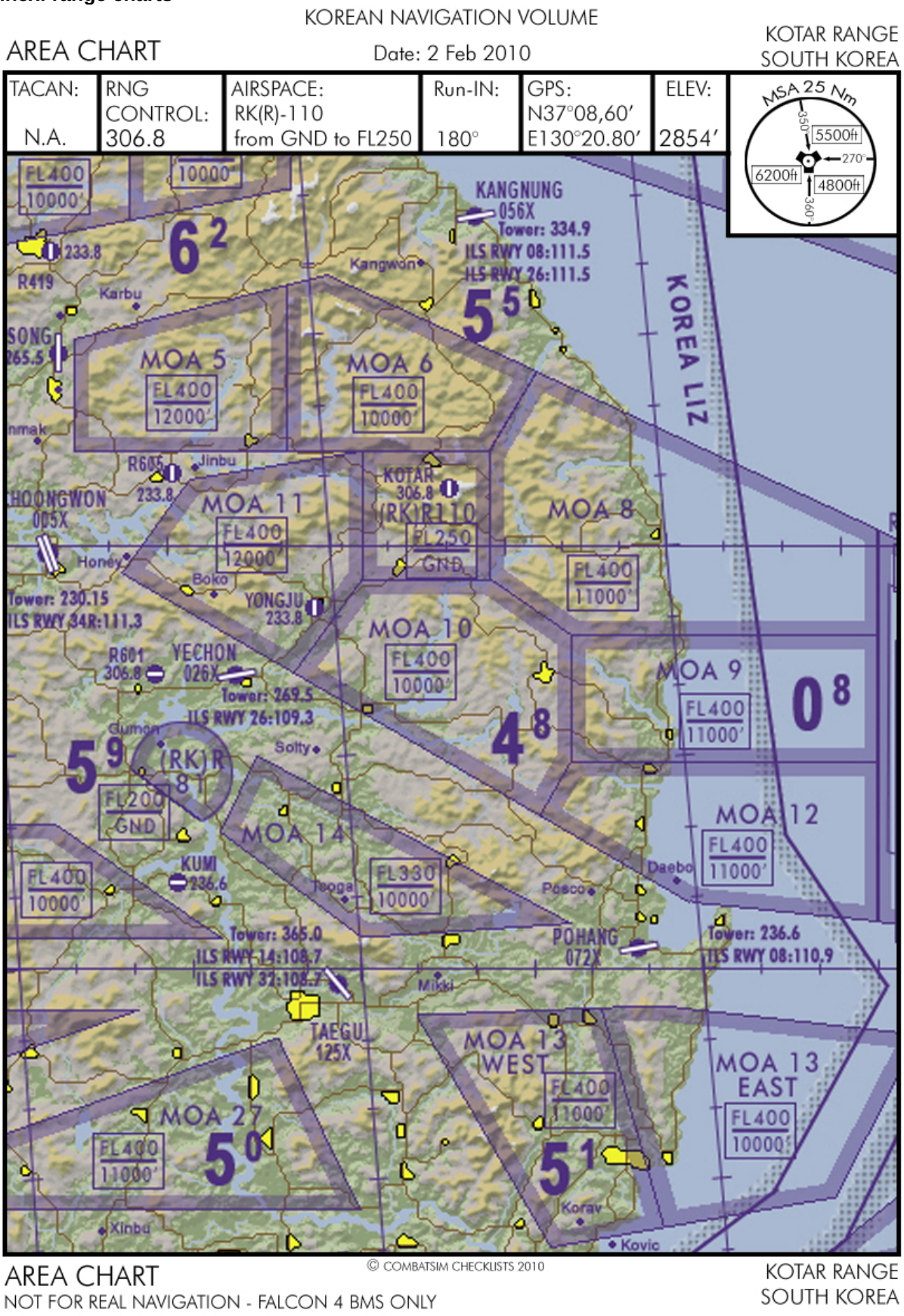
4. Calling BDA (Bomb Damage Assessment)
After each pass, the range controller will call the score to the dropping pilot in a standardized manner: Distance/direction from assigned/declared target.

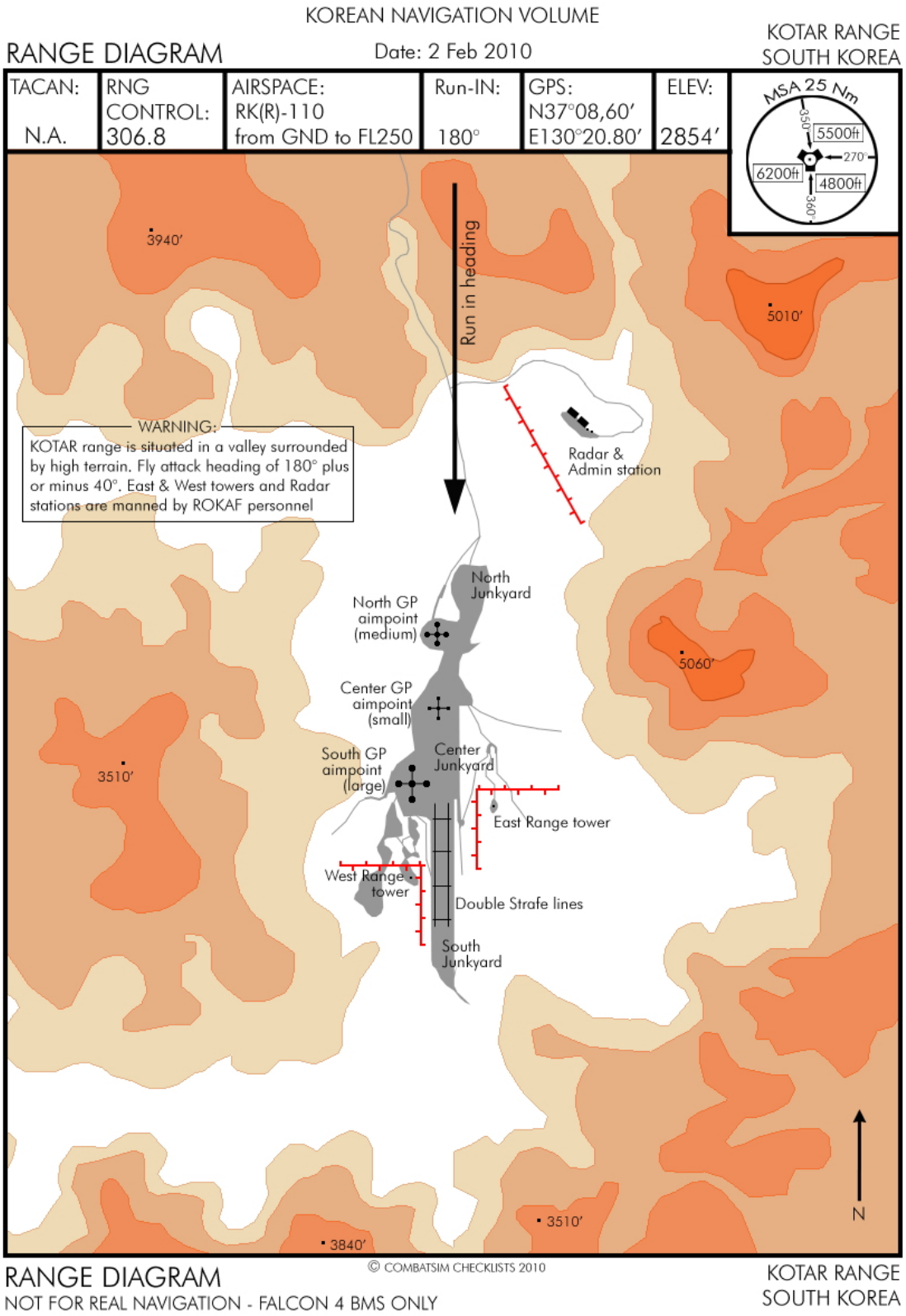
Distance is given in feet – range controller should use the scale on the map for accurate distance calls. A good rule is to use the southern GP target as a distance reference. They are square and measure 55x55 feet (18x18m).

Direction is given in the usual clock system with the target at the centre of the clock:
Example: Falcon2, BDA – 50 at 3. Means the bomb hit 50 feet at 3 o'clock of target.
Direct hit are reported as Delta Hotel.

5. Debrief.
A good airborne range controller should write a table of BDA so he can give proper BDA for all pilots at debriefing. The role of the airborne range controller is not a side role, it is similar to the role of mission commander and as such should lead debrief and ensure that Range SOP was maintained.
Any deviation should be discussed at debrief.

Annex: range charts





As you can see on the above chart, east and west of the range main area are two observation towers. Those are manned by ROKAF & USAF personnel and utmost care should be taken NOT to drop weapons on those towers. Same notice about the Northern radar station which are the admin building and facilities of the range ground crew.

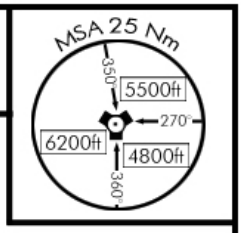
KOREAN NAVIGATION VOLUME

TARGET LIST

Date: 2 Feb 2010

KOTAR RANGE
SOUTH KOREA

TACAN:	RNG CONTROL:	AIRSPACE:	Run-IN:	GPS:	ELEV:
N.A.	306.8	RK(R)-110 from GND to FL250	180°	N37°08,60′ E130°20.80′	2854′



North Junkyard:
Mig-15 #1: N37°08.651′ - E130°20.790′
Mig-15 #2: N37°08.651′ - E130°20.866′
Mig-15 #3: N37°08.627′ - E130°20.829′
Mig-15 #4: N37°08.605′ - E130°20.781′
Mig-15 #5: N37°08.579′ - E130°20.806′
Mig-15 #6: N37°08.603′ - E130°20.844′
Mig-15 #7: N37°08.575′ - E130°20.827′
Mig-15 #8: N37°08.551′ - E130°20.796′

North GP aimpoints (medium):
Crater North : N37°08.526′ - E130°20.702′
Crater Center: N37°08.503′ - E130°20.698′
Crater East: N37°08.503′ - E130°20.728′
Crater West: N37°08.503′ - E130°20.668′
Crater South: N37°08.484′ - E130°20.696′

Center Junkyard:
F-4 #1: N37°08.400′ - E130°20.696′
F-4 #2: N37°08.398′ - E130°20.718′
F-4 #3: N37°08.392′ - E130°20.739′
F-4 #4: N37°08.271′ - E130°20.712′
F-4 #5: N37°08.260′ - E130°20.712′
F-4 #6: N37°08.250′ - E130°20.711′
Mig-15 #1: N37°08.219′ - E130°20.663′
Mig-15 #2: N37°08.204′ - E130°20.656′
Mig-15 #3: N37°08.192′ - E130°20.663′
Mig-15 #3: N37°08.192′ - E130°20.663′
Mig-15 #4: N37°08.157′ - E130°20.665′
Mig-15 #5: N37°08.161′ - E130°20.677′
Mig-15 #6: N37°08.135′ - E130°20.682′
Mig-15 #7: N37°08.119′ - E130°20.676′
Mig-15 #8: N37°08.098′ - E130°20.674′
Huey #1: N37°08.110′ - E130°20.657′
Huey #2: N37°08.099′ - E130°20.651′
Huey #3: N37°08.088′ - E130°20.652′
M2A3 #1: N37°08.188′ - E130°20.713′
M2A3 #2: N37°08.173′ - E130°20.715′
M2A3 #3: N37°08.158′ - E130°20.729′
M2A3 #4: N37°08.144′ - E130°20.709′
M2A3 #5: N37°08.126′ - E130°20.720′
M2A3 #6: N37°08.093′ - E130°20.718′

South GP aimpoints (large targets):
Target North : N37°08.166′ - E130°20.595′
Target Center: N37°08.128′ - E130°20.588′
Target East: N37°08.127′ - E130°20.640′
Target West: N37°08.129′ - E130°20.541′
Target South: N37°08.086′ - E130°20.584′

Center GP aimpoints (small):
Crater North : N37°08.342′ - E130°20.695′
Crater Center: N37°08.317′ - E130°20.689′
Crater East: N37°08.314′ - E130°20.720′
Crater West: N37°08.319′ - E130°20.657′
Crater South: N37°08.293′ - E130°20.684′

Double Strafe Line targets:
West Row #1: N37°08.025′ - E130°20.652′
West Row #2: N37°07.961′ - E130°20.649′
West Row #3: N37°07.895′ - E130°20.645′
West Row #4: N37°07.839′ - E130°20.641′
East Row #1: N37°08.025′ - E130°20.684′
East Row #2: N37°07.961′ - E130°20.681′
East Row #3: N37°07.895′ - E130°20.677′
East Row #4: N37°07.839′ - E130°20.674′

South Junkyard:
M2A3 #1: N37°07.746′ - E130°20.624′
M2A3 #2: N37°07.732′ - E130°20.621′
M2A3 #3: N37°07.717′ - E130°20.631′
M2A3 #4: N37°07.738′ - E130°20.650′
M2A3 #5: N37°07.715′ - E130°20.668′

TARGET LIST
NOT FOR REAL NAVIGATION - FALCON 4 BMS ONLY

KOTAR RANGE
SOUTH KOREA