Clarifications on Super-turbo charger failure

1. The description is vague when it says ***For any turbo-supercharger out, treat as "One Engine Out"*** but earlier says ***All turbo-superchargers out.*** I am inclined to believe the intent was to have all of the turbo-superchargers fail at the same time.
The intent was for each supercharger to have possible failure, and the reference really should be that for EACH supercharger out to treat it as an engine out. This is a simplification that will be addressed in a moment.

2. I am also confused by what the turbo-superchargers did for the engines. It was my belief they allowed the engines to perform more efficiently when at high altitude. When the fail would the engine fail or would they not be able to sustain power when above 10,000 feet?
You are correct. The superchargers allowed the engines to operate at bombing altitude since without them the reduced atmospheric pressure would not allow enough engine power to be applied to fly a laden bomber at service ceiling.

3. Finally Section 5.10 states that landing with all engines out would results in a -7 Landing Modifier. Table 7-1 [landing on land] is -7, but Table 7-2 [landing on Water] lists a -4 Landing Modifier for B-17's with no engines operating and -5 when a B-24 attempts the same landing.
I would use the table modifiers. As for the difference between water and land, it's the difference between crashing or ditching and so the modifiers reflect the surface landed on causing more or less possible damage to the plane and its occupants. However, loss of all superchargers should not cause the same result as a full engine failure or loss of all engines (although again, there is more to it than that--more in a moment).

Looking for confirmation that in fact all engines fail simultaneously and that I must Ditch or Bail Out in the current zone?
No landing or ditching should be required.

Second, should the related (B-24) Landing Modifier be -7 as stated rule 5.10 or -5 as listed in Table 7-2?
For loss of all engines I would use the Table modifiers.

Now--for the **long answers**:
The superchargers deal with engine manifold pressure. At sea level normal atmospheric pressure will be sufficient to maintain the desired manifold pressure. As altitude increases, and full throttle fails to give sufficient manifold pressure, boost is added with the turbo-superchargers. This generally applies for effect about 10,000 feet when booster pumps are also switched on to support the fuel pumps.

Loss of a supercharger generally happens at one of two times and for one of two causes. The two times are during take-off and when at altitude, when they are fully engaged and operating.

The two main reasons are regulator failure and mechanical failure. The first is the more prevalent reason, that causes overspeed issues in the turbo portion of the supercharger.

The second is less likely to happen but can cause significant problems to the engine and anyone or anything in the path of parts that may come off (think of a turbine that sheds a piece--and these are lined up with the wings and the pilots (B-17) and top turret/radio (B-24) crewmen.

The Before Starting Engines checklist shows "Superchargers" as OFF. This is because if the waste gates are closed when the engines are started that the exhaust or the turbo may be damaged by excessive exhaust pressure. If electronic turbo control is present it is set to zero (this is a little dial that controls all four superchargers at once on a 0-10 scale). When taxiing it is sent to "0,"to "8" before takeoff, as desired to maintain manifold pressure when climbing, and as desired (keeping minimum 4" of turbo boost) at altitude.

Note that (related to possible failure) at altitude there is a tendency for the turbo wheel in the supercharger to overspeed. The critical altitude at maximum climb settings will vary with the type of fuel (30,000 feet at 91 Octane and 27,000 for 100 Octane). Therefore, manifold pressure is reduced for every 1000 feet of climb above these critical altitudes.

Once cruising at low altitude there may be sufficient manifold pressure with the superchargers completely off . However, they are usually kept on to prevent carburetor icing. Above 20,000 feet they have to maintain at least 1800 rpm (this is the turbo impeller speed) due to the lower air density.

There is also a flight rule related to engine power change sequencing: always increase manifold pressure (using superchargers) before increasing engine rpm to maintain the BMEP (brake mean effective pressure) in a safe range and minimize undue cylinder pressure that generates heat. So when increasing power the sequence is adjust Mixture Controls, the Propellor rpm, then the Throttles, then the Superchargers one at a time. Reducing power takes a reverse sequence with Superchargers first retarded slowly to prevent back pressure in the induction system that would cause increase engine temperature increases. This shows some of how superchargers are used in flight.

An overspeeding turbo on the supercharger is a possible failure: one of the two I mentioned before. This is infrequent but usually on takeoff. A turbo can also transient overspeed during takeoff and settle down immediately afterward, then continue to operate normally. If you have electronic supercharger controls, the throttle is used to reduce manifold pressure. Using the electronic control dial to do so would result in all four engines losing manifold pressure: not good. Now, usually the overspeed failure is not a mechanical issue but rather due to an amplifier or electric power issue. There are amplifier tubes that control the waste gates (the exhaust of the supercharger) and if the control amplifier is burned out the supercharger will overspeed. There is usually a spare amplifier onboard and it can be changed once a safe altitude is reached.

In level flight loss of a supercharger may be a "Concealed Engine Failure." If the superchargers are operating and an engine fails, the manifold pressure will immediately drop to approximate atmospheric pressure for the present altitude. If the superchargers are not engaged manifold pressure will show no substantial drop when an engine fails.

Mechanical parts that may fail include the compressor (with the impeller--the only major moving part), nozzle box, intercoolers, bearings, and waste gates. The waste gate is the exhaust of the engine, and narrowing it controls the pressure of the exhaust against the impellers). There is a control box, a governor, an amplifier, and as waste gate motor that may also fail.

So now...application to the game:
1.At takeoff, loss of a supercharger is factored into Table 3-2, result "1" engine malfunction.
2. Since there are basically two altitudes in the game, these can be correlated to needing superchargers and not.

3. If forced to 10,000 feet or below due to oxygen or heat issues, this would correspond roughly to superchargers having an effect.
4. At "Low" altitude, loss of a supercharger really would have effect only on a laden plane.
5. At "Low" altitude loss of a supercharger really would have no appreciable effect on an unladen plane.
6. At altitude (in formation) loss of a supercharger mimics the loss of an engine.
7. The engine itself may continue to work but its power output is reduced.
8. So in the game either we add on a set of extended "Supercharger Loss" rules, or take the shortest route to just calling it a loss of an engine for its overall effect.
9. Having said that, to more accurately reflect the effects of supercharger malfunction, I offer up the following as a revision to Note "c" of Tables 4-3B and 4-4C:

c). Roll 1D10 to determine type of failure: 1-2 = mechanical failure; 3-10 = regulator failure. For mechanical failure, then roll 1D10 to determine engine affected: 1 = #1 turbo-supercharger out; 2 = #2 turbo-supercharger out; 3 = #3 turbo-supercharger out; 4 = #4 turbo-supercharger out; 5-10 = no engine affected. For mechanical failure, treat as "Engine Out" for that engine for remainder of mission (See Section 5.10). Pilot may abort mission. This failure result may occur again on any remaining operating engine; there is no effect if a previously failed engine is affected. For regulator failure, then roll 1D10 to determine engine affected: 1-2 = #1 turbo-supercharger out; 3-4 = #2 turbo-supercharger out; 5-6 = #3 turbo-supercharger out; 7-8 = #4 turbo-supercharger out; 9-10 = all turbo-superchargers out. For regulator failure, to remain in formation must follow effects of "One Engine Out" per Section 5.10. If choose to leave formation and reduce altitude below 10,000 feet, once at the lower altitude the affected engine functions normally (is not considered "Out"). If remain in formation, the flight engineer may repair the regulator, by spending one turn taking no other action in the Pilot Compartment (B-17)/Flight Deck Pilot Compartment (B-24). Roll 1D6: 1-5 = successful, affected turbo-supercharger is repaired and engine functions normally; 6 = unsuccessful, if bomber remains in formation engine is considered "Out." If bomber descends to 10,000 feet engine is no longer considered "Out." There is only one (total) repair attempt per mission. Pilot may abort mission. This failure result may occur again on any remaining operating engine; there is no effect if a previously failed engine is affected.

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