



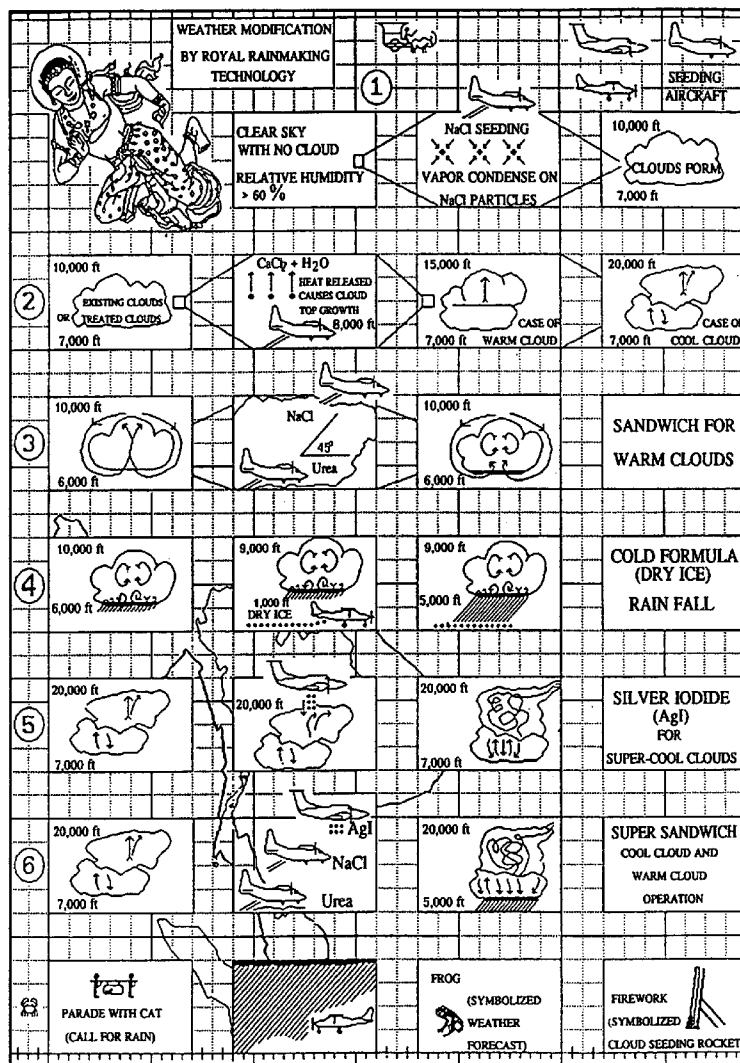
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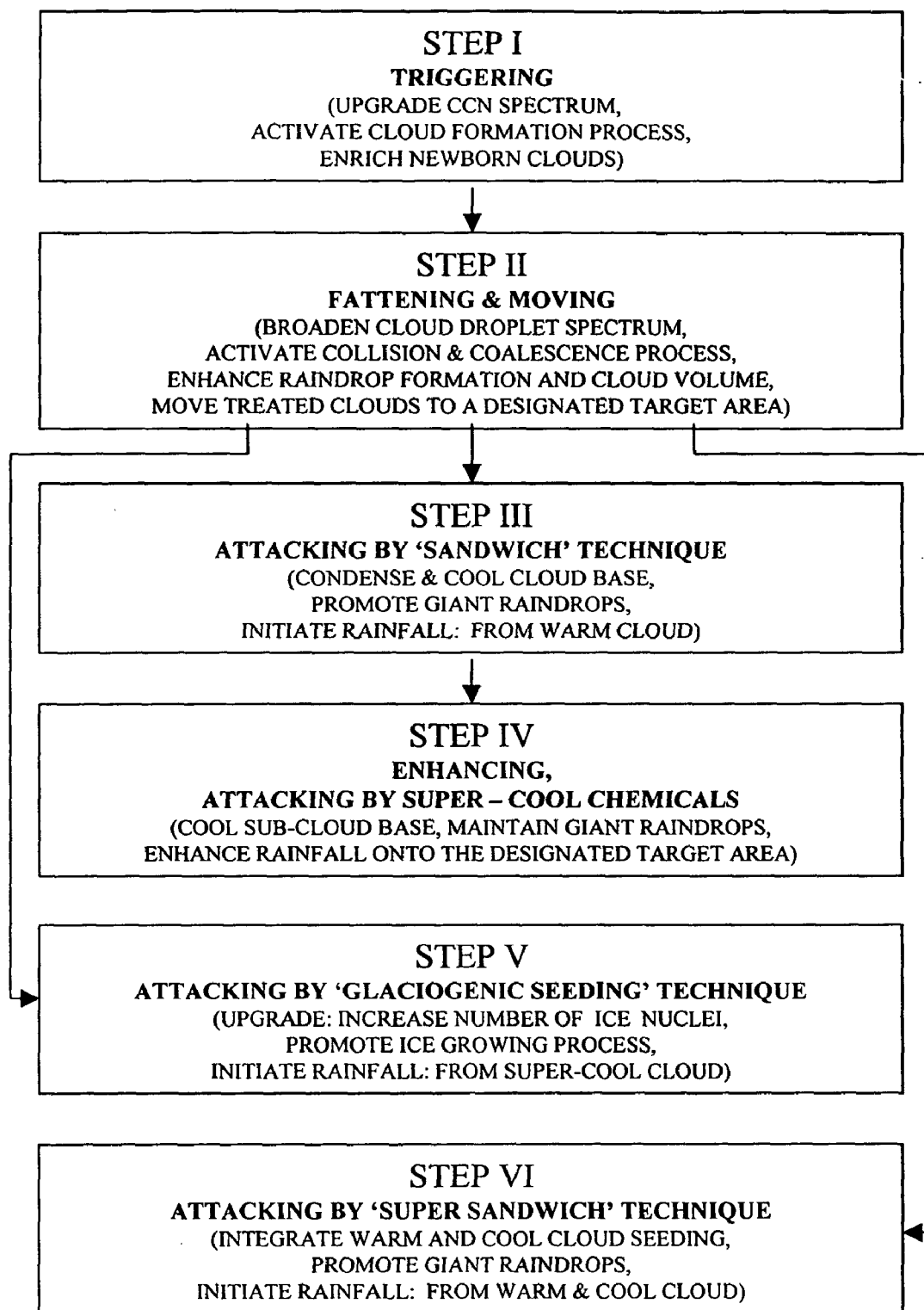
(19) **United States**(12) **Patent Application Publication**  
**Bhumibol Adulyadej**(10) **Pub. No.: US 2005/0056705 A1**(43) **Pub. Date: Mar. 17, 2005**(54) **WEATHER MODIFICATION BY ROYAL  
RAINMAKING TECHNOLOGY**(57) **ABSTRACT**(76) **Inventor: His Majesty King Bhumibol  
Adulyadej, Bangkok (TH)**

Correspondence Address:  
**The Office of His Majesty's Principal  
Private Secretary  
BANGKOK 10200 (TH)**

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Process of rainmaking and moving cloud using 'Royal Rainmaking Technology' is described for weather modification by means of chemical seeding comprises steps of "Triggering", to activate cloud formation; "Fattening", to promote cloud growth; "Moving", to move cloud to a designated area, and "Attacking" to initiate rainfall from cloud. Attacking can be done by at least 3 different techniques; by 'Sandwich Seeding Technique' for 'warm cloud', by 'Glaciogenic Seeding Technique' for 'cool cloud', or by 'Super Sandwich Seeding Technique' for mixed phase cloud. 'Enhancing' is for enhancing amount of rainfall and prolonging raining duration including increasing area coverage. Weather modification extends to dispersion of cloud into clear flight path, prevention of hail formation, and inducing rainfall from stratiform clouds onto a valley or any catchment areas. Seeding may be performed inside or outside a cloud or to the top or underneath any isolated cloud or cloud band.



**FIG. 1**

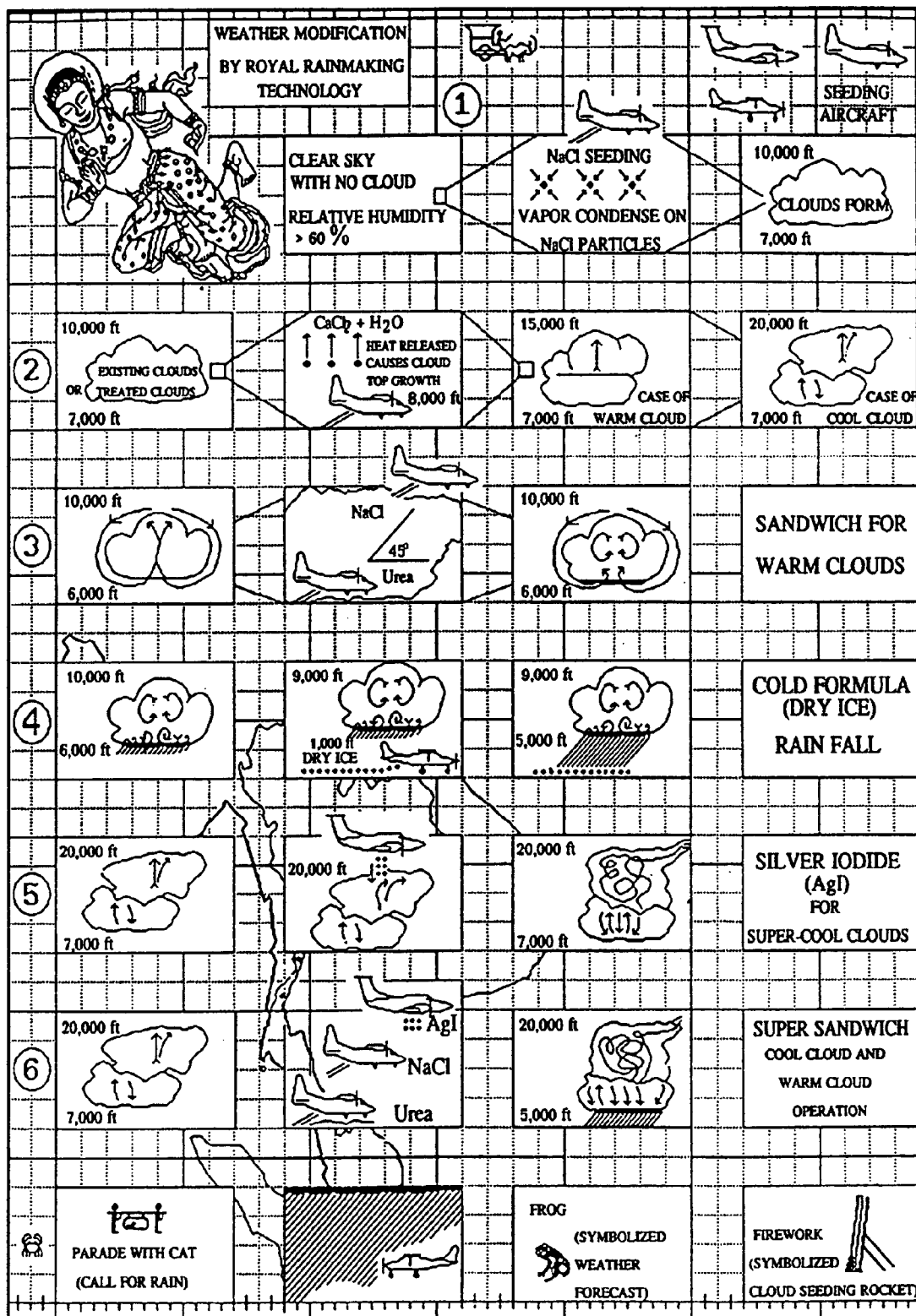


FIG. 2

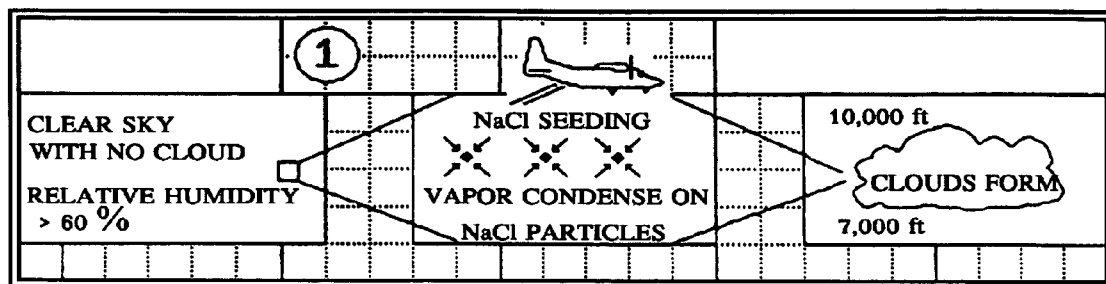


FIG. 3

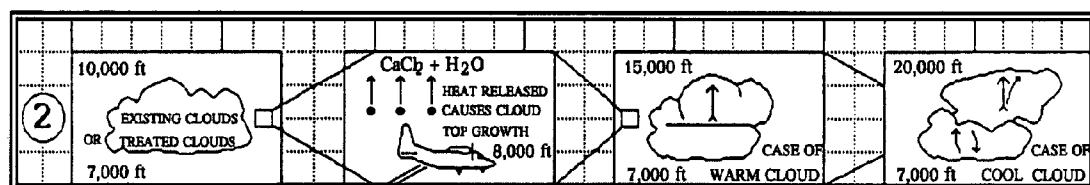


FIG. 4

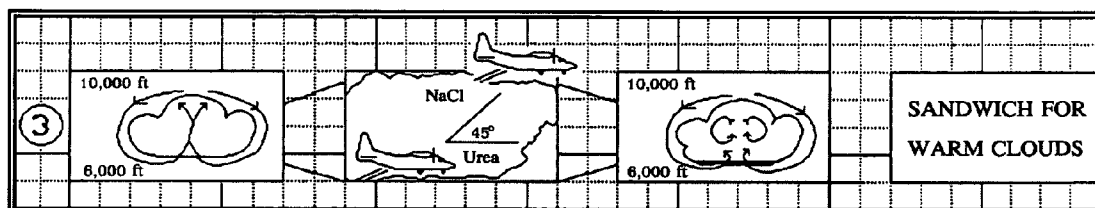


FIG.5

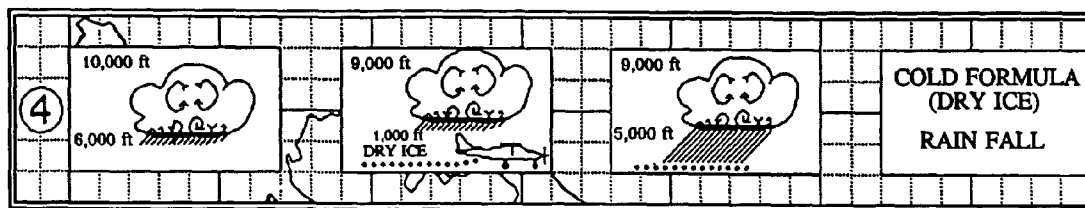


FIG. 6

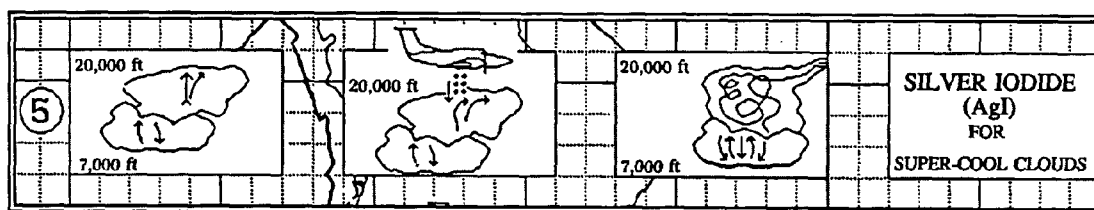


FIG. 7

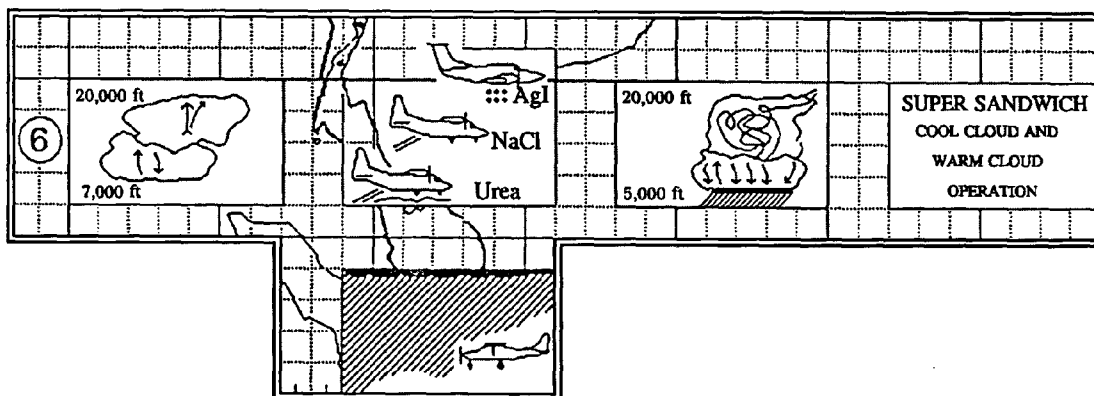


FIG. 8

## WEATHER MODIFICATION BY ROYAL RAINMAKING TECHNOLOGY

### FIELD OF THE INVENTION

[0001] This technology of rainmaking involves the knowledge of meteorology, climatology, cloud formation, cloud evolution, rain formation and cloud dispersion of various aspects.

### BACKGROUND OF THE INVENTION

[0002] This technology is termed the 'Royal Rainmaking Technology' as it is a unique technology invented by HIS MAJESTY KING BHUMIBOL ADULYADEJ OF THAILAND. The technology is developed to help people in Thailand and particularly those farmers who repeatedly face drought disasters due to variation and deviation of the seasons, and in addition as an attempt to solve a seemingly insoluble and paradoxical problem of water management in the North-East region of Thailand, i.e., when there is rain, the water is too much that it floods down the hills because there are not many trees to stop it and thus floods the area, but when water recedes it turns to drought. The solution to this problem is to build many small check dams along the creeks on the hills to regulate the flow of water. Small dams and reservoirs should be built which can take care of the drought. In the rainy season, water kept in the reservoirs can provide water for the dry season. Yet, one problem remains, as overall, the North-East region of Thailand is reputed to be a dry region. Despite the fact that there is lots of cloud in the sky, they are all blown past the arid land. The solution thus lies on how to make those clouds fall as rain in the designated locality.

[0003] In the old days, people in this North-East region cleverly launched a firework as shown in FIG. 2 to function as a traditional cloud seeding device to cause chemical burning underneath the cloud resulting in rainfall. They had to carefully observe behavior of the frogs in the locality as it is well-known that frogs are animal able to indicate the possibility of rainfall. When there was severe draught, people in the village would also perform a cat procession to beg for rain. These components are prior arts and are drawn at the lower part of FIG. 2. Statistically, the people would unpredictably get the rain they need due to the inefficiency of the procedure.

[0004] The 'Royal Rainmaking Technology' is therefore developed to make rain to fall onto a target area successfully by applying this invented technology and using aircraft. This technology provides sufficient fresh water supplies which may otherwise rapidly become inadequate to serve a growing water demand in each part of the country. It is now further developed to manage the weather especially cloud and rain formation in many different circumstances. The uppermost drawing of FIG. 2 shows a Thai prior belief of a 'Supreme God' named 'Pra Indhra' riding in his special vehicle, 'a flying cart', used for rainmaking operation in Thai legend. A goddess called 'Manimekhala', a computer-drawing by HIS MAJESTY THE KING at the upper left of FIG. 2, symbolizes the Meteorological Service performing one of the key roles in the rainmaking operation.

[0005] Experiments have been done by dispersing a hygroscopic substance such as sea salt powder from an airplane to catch the humidity in the air and then followed

by a cold substance (for instance, dry ice) to condense the humidity to form cloud. Yet problem exists, i.e., when there is no rain, while without enough dry ice it soon dissolves back to the blue sky right after a cloud is formed. If too much dry ice is used, the cloud becomes 'exploded' and thus also is destroyed; where at this stage even spraying the sea water does not help initiate rainfall as the sky remains blue. Therefore, so many factors must be concerned, i.e. humidity, temperature, speed and direction of the wind, and etc. Cloud physics must also be studied in much greater details to make rain efficiently although the basic principles and all the components for rain-making remain the same.

[0006] Many experiments have been done thereafter. In general, sea salt and dry ice are still in use while some other chemicals have been discontinued. Many other formulas have later been introduced in the 'Royal Rainmaking Technology', i.e. urea (moderately cold-formula 4), calcium chloride (warm—formula 6), and calcium carbide (very warm—formula 9). The latter formula 9 has now been discontinued as it is rather dangerous. At the first time when calcium chloride was used in the experiment, the prediction was that after building up a cloud with sea salt (formula 1), had calcium chloride (formula 6) been dispersed into the cloud, the cloud would become bigger and rise to a much higher altitude somewhat like a mushroom as of an atomic bomb. When the experiment has been done, the result was a heavy rain of 40 mm, although it rose up like a tall Christmas tree and not in a form of mushroom as expected.

[0007] Cloud Dispersion was first experimented as on a return trip from a religious ceremony at Ban Pong District in Thailand by a helicopter, ominous clouds had formed and threatened to impede the flying. An aircraft had been sent to fly preceding the flight path to disperse calcium chloride all the way to the destination which is Chitralada Villa, Dusit Palace, Thailand. As a result, cloud separated into a clear flight path where both sides along the path appeared as two gigantic walls made of cloud. Upon arriving at Chitralada Villa, the two walls began to close and there was a strong wind which made the return of the helicopter down to the base almost impossible. Soon after, there was then a torrential rain. The experience was thus a successful dispersion of cloud and at the same time it was also a successful operation of rainmaking.

[0008] The present invention describes modification of weather regarding rainmaking and moving cloud from one place to a designated target area to cause rainfall in many different circumstances. There has always been problem that water is plenty in some areas where in other areas in the vicinity perhaps only 30 miles away, drought may be a serious problem. Technology is now successfully developed to form cloud in an area where water is plenty, move the cloud formed and attack to cause rainfall in the area in need of water. This should be one of the most successful technology of mankind to overcome the natural disaster in term of developing a most cost-effective way to move such huge amount of water from place to place which may be otherwise impossible if the presently available method of transportation is used. Modification of weather by the 'Royal Rainmaking Technology' makes transportation of water in form of cloud possible. Flood is prevented, and at the same time, problem of drought can be solved. Rainmaking involves cloud formation, cloud evolution, rain initiation and rainfall to a target area as well as to increase the volume of rain and

to give a better uniformly distributed falling of rain over a target area than what would be if it occurs naturally. This technology can be applied in many various circumstances to manage rainfall such as lifting a cloud mass stuck to a mountain top upwind to pass over and fall as rain in the area downwind located on the other side of the mountain, or to induce rainfall onto a catchment area of a water reservoir or onto a valley located between hills and mountains, and more. The Royal Rainmaking Technology can also be applied to suppress hail formation to prevent damage to life and crops, or to provide clear view for aviation safety. Both warm cloud whose temperature is above water freezing point, and cool cloud whose temperature is below water freezing point, can be induced using various chemicals of different physical property and hygroscopic property. This technology involves the knowledge of meteorology, climatology, cloud formation, cloud evolution, rain formation and cloud dispersion of various aspects in each season. Many different kinds of chemicals have been experimented. Using the proper chemicals of exothermic or endothermic property when combined with water for cloud formation and cloud seeding is key management in the Royal Rainmaking Technology. The information on cloud statics and dynamics such as condensation to allow formation of cloud condensation nuclei, the loss or gain of latent heat during changing state of water from vapour to liquid and liquid to solid which may cause the updraft of air mass due to vertical heat convection and turbulence occurring either inside or outside the cloud mass, the direction of wind at the locality and on the radiating heat from the sun, must all be taken into account, compiled and applied to successfully achieve the best result of weather modification using this very high technology and very sophisticated procedure. The knowledge of aviation engineering, electrical and electronic engineering together with mechanical engineering must also be applied.

[0009] In general, the method of rainmaking comprises mainly 3 steps as follows:

[0010] 1. Triggering—modification of weather to stimulate or promote formation of cloud;

[0011] 2. Fattening—gathering and growing of cloud mass to make it sufficiently large and dense; and

[0012] 3. Attacking—manipulating the dense cloud mass to condense it as rain to fall onto a target area.

[0013] Modification may be done to make rain only from warm cloud, if the aircraft used is capable of flying not higher than 10,000 ft. above sea level where the part of a cloud being modified is of 'warm type' which has its temperature above 0° Celsius only. Modification of weather progresses to a point that growing or fattening of cloud can achieve an altitude of 25,000-30,000 ft. The temperature of such cloud at an altitude above 18,000 ft. is generally below 0° Celsius and thus belongs to a 'cool-type'. This technology is, therefore, developed to couple weather modification to make rainfall both from warm cloud and cool cloud simultaneously.

[0014] In the prior arts, where rainmaking is performed in temperate or cloud climate, modification of weather is used to form rain or snow from cool cloud by applying chemicals directly into the existing thick cloud. There has never been any technique used for triggering condensation to form a cloud nucleus from moderately humid air or moving a cloud

mass to a target area as presently disclosed. This process described is thus distinctly different than what have been disclosed in the prior arts in that, while in an invention (U.S. Pat. No. 5,357,865), there must exist certain small cloud formed and that the process they described is plainly precipitation enhancement not a whole process of rainmaking as presently described.

[0015] The process described in the present invention is a complete process of rainmaking which can be performed starting right from building a cloud in the sky from nothing except for a relative humidity of not less than 60%, growing such cloud to a cloud mass dense enough either as a warm cloud or a cool cloud, moving the cloud to a target area, then attacking the cloud mass to fall as rain and, in addition, enhancement is also described to increase amount of rainfall and to prolong the raining period as well as to increase area coverage. This is a successful management of weather to help providing water to the dry area as well as to prevent flood or to suppress hail formation. Thus, Thailand would be the first and the only country in the world to use this advanced technology of weather modification invented.

#### SUMMARY OF THE INVENTION

[0016] The present invention relates to technology for weather modification for rain making and moving water in form of cloud from an area to fall as rain onto a designated target area far away. The process comprises steps of 'Triggering' which is a technique to activate cloud formation using fine powder of hygroscopic materials such as sodium chloride; 'Fattening' which is a technique to encourage or promote cloud growth by dispersing giant nuclei of exothermic-hygroscopic materials such as calcium chloride to cause updraft by exothermic reaction and thereby activate collision and coalescence of the cloud droplets; 'Moving' which is a technique to move cloud mass to a designated target area; and 'Attacking' which is a technique to initiate rainfall from the cloud. Step of attacking can be done by at least 3 different techniques. Firstly, by 'Sandwich Seeding Technique' for 'warm cloud' whose cloud top does not grow beyond the freezing level, giant endothermic-hygroscopic nuclei such as sodium chloride are dispersed into the cloud top and urea at the cloud base simultaneously to increase number of big raindrops and decrease the in-cloud temperature due to endothermic reaction which further increase downdraft within the cloud mass and big raindrops thus start to fall from the cloud base. Secondly, by 'Glaciogenic Seeding Technique' for 'cool cloud' whose cloud top grows well beyond the freezing level where super-cool droplets and ice crystals appear in the cloud top portion, silver iodide flares are burnt into the cloud top to produce rapid glaciation of the super-cool cloud liquid water content in the updraft that the rest of the cloud water can be rimed into graupels which grow much faster than raindrops of the same mass and thus converted into ice precipitation falling through the freezing level and finally melt into raindrops. Thirdly, by 'Super Sandwich Seeding Technique' for mixed warm and cool cloud (mixed phase cloud), where the 'Sandwich Seeding' and 'Glaciogenic Seeding' techniques are combined to provide higher efficiency for process of rain enhancement. Dropping flakes of dry ice at about 1,000 feet below the cloud base results in increase in relative humidity of the air mass underneath the cloud base. The rainfall rate increases gradually and big raindrops can reach the ground. Strong downdraft increases feed back of moist air into the treated

and the neighboring cloud bases to cause continuation of rainfall, resulting in much more rainfall in terms of amount and area coverage as well as raining duration, thus called 'Enhancing'. Weather modification further extends to dispersion of heavy cloud into clear flight path, prevention of hail formation, and inducing of rainfall onto a valley or onto any catchment area of the water reservoirs in various circumstances. Seeding may be performed inside or outside a cloud or to the top or underneath any isolated cloud or cloud band.

#### BRIEF DESCRIPTION OF THE DRAWINGS

[0017] **FIG. 1** is a flow diagram illustrating the overall steps in the operation of the 'Royal Rainmaking Technology' with highlight information.

[0018] **FIG. 2** is a chart illustrating stepwise operation of the 'Royal Rainmaking Technology'.

[0019] **FIG. 3** is a blow-up part of **FIG. 2 (1)** illustrating Step I (Triggering) of the 'Royal Rainmaking Technology'.

[0020] **FIG. 4** is a blow-up part of **FIG. 2 (2)** illustrating Step II (Fattening & Moving) of the 'Royal Rainmaking Technology'.

[0021] **FIG. 5** is a blow-up part of **FIG. 2 (3)** illustrating Step III (Attacking) which is 'SANDWICH SEEDING' of the 'Royal Rainmaking Technology'.

[0022] **FIG. 6** is a blow-up part of **FIG. 2 (4)** illustrating Step IV (Enhancing) of the 'Royal Rainmaking Technology'.

[0023] **FIG. 7** is a blow-up part of **FIG. 2 (5)** showing Step V (Glaciogenic or AgI seeding) of the 'Royal Rainmaking Technology'.

[0024] **FIG. 8** is a blow-up part of **FIG. 2 (6)** showing Step VI which is "SUPER SANDWICH SEEDING" of the 'Royal Rainmaking Technology'.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] The present invention describes a technology for weather modification to make rain and to move water in form of cloud from one area to fall as rain onto a designated target area far away using the 'Royal Rainmaking Technology'. The 'Royal Rainmaking Technology' is chemical seeding technique for rainmaking, rain stimulation and rain enhancement for modification of weather in various circumstances. The chemical seeding technique involves warm cloud seeding, cool cloud seeding or a combination of the two categories. The technology in general comprises main steps as follows:

[0026] Step I: Triggering:—to activate cloud formation;

[0027] Step II: Fattening & Moving:—to stimulate cloud growth and to move cloud mass to a designated target area;

[0028] Step III: Attacking:—to initiate rainfall from the cloud by 'Sandwich Technique' (attacking warm cloud);

[0029] Step IV: Enhancing:—to enhance rainfall onto the ground;

[0030] Step V: AgI Seeding:—attacking cool cloud when cool cloud seeding aircraft is available;

[0031] Step VI: Super Sandwich Technique:—attacking the cloud formed when both warm and cool cloud seeding aircraft are available. This is a combination of steps III, IV and V.

[0032] Details in each procedure and the explanation of the reasons and the result of each step, as shown in **FIGS. 1 and 2**, are as follows:

[0033] STEP I: "Triggering"

[0034] The aim of this step, as shown in **FIG. 3**, is to activate cloud formation or condensation process and enrich the newborn clouds by upgrading the Cloud Condensation Nuclei (CCN) property and broadening its spectrum in the convective air plumes. So, Step I begins when the sky is clear or only a few cumulus clouds have just formed in the morning and the average relative humidity up to an altitude of 7,000 feet is not less than 60% in the locality.

[0035] This step is done by dispersing tons of powder of various size spectrum of low critical relative humidity and hygroscopic chemicals, sodium chloride in this case, into the volume of air at or a few thousand feet above the level of cloud formation or convective condensation level (CCL), at a distance upwind of the designated target area and at a time before natural cloud forming.

[0036] After seeding, the condensation to form cloud droplets is more active and a lot more clouds are formed in the treated area. Then clouds will be able to grow by themselves due to continuation of condensation and support by the local convection.

[0037] STEP II: "Fattening" & "Moving"

[0038] The aim of "Fattening", as shown in **FIG. 4**, is to increase raindrop formation and to build up cloud volume by promoting Collision and Coalescence Process of the cloud droplets (i.e. to cause broadening of cloud droplet spectrum) and increasing in-clouds updraft due to the energy released from the exothermic reaction. This step begins when the cloud tops of the cumulus clouds formed from Step I reach 10,000 feet.

[0039] This step is done by dispersing tons of powder of a few hundred microns of exothermic-hygroscopic chemicals, calcium chloride ( $\text{CaCl}_2$ ), into the updraft portion of clouds at a level of about 8,000 feet.

[0040] After seeding, the rate of cloud growth increases due to increasing of the updraft and inducing of moist air into the cloud base. The numbers of big raindrops increase continuously due to active collision and coalescence of cloud droplets.

[0041] Clouds grow from this step can be classified into two categories depends on the temperature of the cloud top and the rain producing mechanisms. The two categories of clouds are the 'warm cloud' and the 'cool cloud'. In brief, if the top of the cloud reaches above freezing level in the sky (higher than about 18,000 feet), it is defined as 'cool cloud', otherwise, it is 'warm cloud'.

[0042] The aim of "Moving" is to move cloud from one area to cause rainfall in any designated target area far away.



[0043] This can be done in many different situations as follows:

[0044] Case 1: Moving cloud from a plain area to a neighboring designated target area downwind.

[0045] This is done by dispersing exothermic-hygroscopic chemicals, such as calcium chloride from a dense cloud mass formed by "Fattening" located upwind to a target area at a level not less than 1,000 feet above said cloud base, where dispersion may be drawn as a linear or a coil shape within a cloud mass depending on the circumstances and to the spaces between cloud masses. This causes lifting up and the cloud mass starts moving along the wind to a target locality, then the "Sandwich Technique" (as of Step III) is applied, while simultaneously super-cool chemical such as dry ice is dispersed at a level about 1,000 feet below the cloud base to enhance rainfall.

[0046] Case 2: Moving a cloud mass stuck to the windward side of a mountain to pass over and fall as rain in the area downwind located on the other side of the mountain.

[0047] This is done by dispersing exothermic-hygroscopic chemicals, such as calcium chloride at a level not less than 1,000 feet above said cloud base. This causes lifting up of the treated cloud and the cloud mass starts moving along the wind passing over the mountain top to a target locality on the other side of the mountain which is a rain-shadow area, then the "Sandwich Technique" (as of Step III) is applied, while simultaneously super-cool chemical such as dry ice is dispersed at a level about 1,000 feet below the cloud base to cause rainfall. This is one of the most useful technique. The designated target area is quite dry despite there are plenty of water in the area upwind on the opposite side of a mountain as the mountain itself is the main obstacle to stop moving of cloud to the area in need of water. By using this technique, problem of drought in the rain-shadow area downwind of a mountain can be solved.

[0048] Case 3: Causing rainfall to expand against direction of wind onto a designated target area from a dense cloud resting on the windward side of a mountain.

[0049] In an area in need of water, cloud forms but is blown away yet is stuck to the windward side of a mountain. To retain such cloud and cause it to fall back as rain onto the locality is possible by fattening cluster of small clouds in the designated target area upwind to the dense cloud mass to cause merging of growing small cloud masses into the dense cloud mass and attacking the growing small cloud masses using 'Sandwich Technique' (as of Step III) to initiate rainfall in the locality and thus cause drawing the dense cloud mass to expand back and fall as rain against direction of the wind onto the designated target area.

[0050] Omitting this step of 'Moving', rain can be induced to fall in situ at a place where the cloud is built up by step of 'Attacking' either by the 'Sandwich Technique' or 'Glaciogenic Seeding' or 'Super Sandwich Technique' of the Royal Rainmaking Technology.

[0051] STEP III: "Attacking"

[0052] The aim of this step, as shown in FIG. 5, is to initiate rainfall from warm clouds by cloud seeding technique called 'Sandwich Technique'. This is the case for warm cloud seeding. The aim of this technique is to initiate rainfall by promoting the giant raindrops to increase in-

cloud loading factor and cooling the cloud base due to endothermic reaction. This step begins when the cumulus clouds formed from Step II move along the wind approaching the target area and the cloud tops reach 10,000 feet or higher but can not grow further to reach the freezing level or about 18,000 feet (i.e. the 'warm cloud' type).

[0053] This is done by dispersing tons of hygroscopic chemicals at two levels, at the cloud top and at the cloud base, at the same time. Powder of the cloud condensation nuclei which is sodium chloride and powder of endothermic-hygroscopic chemicals which is urea in this case are dispersed into the clouds at the top and the base, respectively and simultaneous. The two seeding aircraft fly on the opposite side of the clouds making an angle of 45 degrees to each other.

[0054] After seeding, the height of the treated cloud base levels down by about 1,000 feet due to the cooling of cloud base temperature and heavy loading of bigger raindrops of the cloud volume. The cloud becomes mature and starts to fall as rain.

[0055] STEP IV: "Enhancing"

[0056] The aims of this step, as shown in FIG. 6, are to maintain Step III and to enhance rainfall onto the ground, and in addition, to prolong raining duration by cooling the sub-cloud base air mass resulting in cut off buoyancy, increase the downdraft, increase the relative humidity and reducing the evaporation of the raindrops. This step can be applied after step III which may begin when the treated clouds from step III move along the wind to cover the target area.

[0057] This is done by dropping dry ice flakes at about 1,000 feet below the cloud base. The rainfall rate increases gradually, much greater number of giant raindrops reach the ground, strong downdraft increases and feeds back the moisture into the neighboring cloud bases and causes the continuation of rainfall, resulting rain enhancement in terms of the amount, rain duration and area coverage.

[0058] STEP V: "Glaciogenic Seeding or AgI Seeding"

[0059] This is the case of 'Attacking' by cool cloud seeding, as shown in FIG. 7, when only the cool cloud seeding aircraft is available. A cool cloud seeding aircraft must have the internal pressure control thus capable of operating at an altitude of 30,000 ft. and must be equipped with all the scientific instruments necessary for measuring and recording the meteorological data. The seeding criteria are that when the cumulus clouds formed from Step II move along the wind approaching a target area and the cloud tops grow above the freezing level and reach 20,000 feet. The qualified clouds must have 0.5 gm/m<sup>3</sup> of super-cool liquid water content or higher and 5 m/sec in updraft or higher at the level of 21,500 feet.

[0060] The aim of this step is to initiate rainfall from cool clouds by supplying the artificial ice nuclei into a cool-cloud top to produce rapid glaciation of the super-cool cloud liquid water content (SLWC) in the updraft by freezing the super-cool droplets so they can rime the rest of the cloud water into graupels. Freezing of droplets enhances the release of latent heat, increases cloud buoyancy, increases the updraft, and induces more moist air into the cloud base. Those seeding-induced graupels grow much faster than raindrops of the

same mass so that a larger fraction of the cloud water is converted into ice precipitation before falling through the freezing level and finally melt to be raindrops.

[0061] This process is done by ejecting 5 to 15 flares each of 20-gram of silver iodide into the cloud top at the seeding flight altitude of normally about 21,500 feet. Each flare normally burns for about 40 seconds and falls 1 to 1.5 kilometers in the cloud and produces a lot of silver iodide particles to cause freezing of the super-cooled droplets.

[0062] STEP VI: Attacking Mixed (warm and cool) cloud by cloud seeding technique called 'Super Sandwich Technique'

[0063] This is the case of 'Attacking' by mixed phase cloud seeding, as shown in FIG. 8, when both cool cloud seeding aircraft and warm cloud seeding aircraft are available. The seeding criteria for this case is when cumulus clouds formed from Step II move along the wind and reach the target area and the cloud tops develop above the freezing level and reach over 20,000 feet. The qualified clouds must have 1.0 gm/m<sup>3</sup> or higher of super-cool liquid water content and 8 m/sec or higher in updraft at the level of 21,500 feet.

[0064] The aim of this Super Sandwich Technique is to initiate rainfall from either cool cloud or mixed phase cloud (in which both warm rain process and ice process are dominant in the same cloud mass) by integration of the Step III, IV, and V. While Step III (the Sandwich Seeding Technique) promotes bigger drops in the strong current of the updraft resulting in much greater super-cool droplets in the cloud top, step V (the AgI Seeding or so-called Glaciogenic Seeding Technique) preferentially freezes the larger super-cool drops so they can rime the rest of the cloud water into graupel much faster. This faster conversion of cloud water into ice precipitation enhances release of latent heat, thus increases cloud buoyancy, increases the updraft, and induces more moist air into the cloud base. A larger fraction of the cloud water is then converted into ice precipitation before falling through the freezing level and finally melts as rain.

[0065] Thus, step VI is done by combining warm and cool cloud attacking techniques together simultaneously; in this case by dispersing the endothermic-hygroscopic chemicals such as sodium chloride particles at the mid-cloud level (about 10,000 feet), and urea particles at the cloud base level (Sandwich), ejecting 5 to 15 of 20-gram flares of Silver Iodide into the cloud top at the altitude of about 21,500 feet, and dry ice seeding at 1,000 ft below the cloud base of the same treated clouds, simultaneously.

[0066] After seeding by the Super Sandwich Attacking Technique, the treated clouds, in most cases, start to rain right after or shortly after seeding onto the designated target area.

[0067] The 'Royal Rainmaking Technology' can be further applied to prevent hail formation. By applying the 'Super Sandwich Technique' to cause rainfall at a time point before hail starts to form. Such operation can suppress hail formation and alleviate the damage to life or properties and especially the agriculture crops. Furthermore, to provide clear view of the flight path for aviation safety, over-seeding is done by dispersing excess amount of exothermic-hygroscopic chemicals, such as powder of calcium chloride into a cloud mass. The dense cloud mass will separate into a clear flight path.

[0068] Causing rainfall from stratiform clouds in a valley or any catchment areas between hills and mountains where access to the area is quite difficult, can be done by dropping alternately exothermic-hygroscopic chemicals such as calcium chloride and endothermic-hygroscopic chemicals such as urea to cover the clouds while dispersing hygroscopic chemicals such as sodium chloride on top of the developing clouds. This can successfully cause sufficient amount of rainfall.

[0069] The technology can be used to augment water for reservoir storage and to provide additional water for rainfed agriculture. More rain in the catchment areas of major reservoirs would provide more water storage for irrigation in all seasons. More water in the reservoirs would help enhance agriculture in the ever-expanding irrigated areas in the case that the existing water supplies may otherwise be insufficient. The hydropower generation can meet base and peak loads by the water production from the 'Royal Rainmaking Technology' and minimize the national dependence on fossil fuel to generate power. This additional fresh water, at the same time, helps alleviate salinity and pollution problems downstream.

[0070] It is thus quite obvious that the advantages of the present invention using the Royal Rainmaking Technology described above is immense and is a great progress invented in modification of weather.

[0071] The present invention and many of its attendant advantages will be understood from the foregoing description that modification can be made without departing from the scope of this invention by one of ordinary skill in the art. It is accordingly intended that all matter contained in the above description or shown in the accompanying drawings be interpreted as illustrative rather than in a limiting sense.

[0072] It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention as described herein, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim:

1. A process of rainmaking using 'Royal Rainmaking Technology' by means of chemical seeding for cloud formation, cloud growth, rain initiation, and rain enhancement comprising steps of "Triggering", to activate cloud formation and enrich newborn cloud;

"Fattening", to promote raindrop formation and building up of cloud volume;

"Attacking", to initiate rainfall from said cloud; and

"Enhancing", to enhance volume of rainfall onto said designated target area, area coverage, and to prolong rain duration.

2. A process of activating cloud formation (Triggering) as of claim 1 wherein, cloud condensation nuclei (CCN) of one or more hygroscopic chemicals are dispersed into volume of air at a level of cloud formation or a few thousand feet above said level of cloud formation or convective condensation level (CCL), at a distance upwind to said designated target area.

3. The process of claim 2 wherein said hygroscopic chemical is, preferably, sodium chloride.

4. A process of promoting raindrop formation and building up of cloud volume (Fattening) as of claim 1 wherein powder of exothermic-hygroscopic chemicals are dispersed into the updraft portion of clouds at a level above said cloud base.

5. The process of claim 4 wherein said exothermic-hygroscopic chemical is, preferably, calcium chloride.

6. A process of initiating rainfall (Attacking) as of claim 1 from warm cloud by "Sandwich Technique" wherein, first and second endothermic-hygroscopic chemicals are dispersed upwind of said cloud shoulder and at said cloud base, respectively and simultaneously.

7. The process of claim 6 wherein said first endothermic-hygroscopic chemicals to be dispersed upwind of said cloud shoulder is, preferably, powder of sodium chloride.

8. The process of claim 7 wherein said second endothermic-hygroscopic chemicals to be dispersed at said cloud base is, preferably, urea.

9. A process of enhancing rainfall onto the ground (Enhancing) as of claim 1 wherein, super-cool chemical(s) are dispersed below said cloud base.

10. The process of claim 9 wherein said super-cool chemicals to be dispersed below said cloud base is, preferably, dry ice.

11. A process of initiating rainfall (Attacking) as of claim 1 from mixed phase (warm and cool) clouds by "Super Sandwich Technique" wherein, first endothermic-hygroscopic chemical(s) and second endothermic-hygroscopic chemical(s) are dispersed upwind of said cloud shoulder and at said cloud base level, respectively and simultaneously, where glaciogenic chemical(s) are seeded into the top of said cloud, and where super-cool chemical(s) are dispersed below said cloud base simultaneously.

12. The process of claim 11 wherein said first endothermic-hygroscopic chemical(s) to be dispersed upwind of said cloud shoulder is, preferably, powder of sodium chloride, said second endothermic-hygroscopic chemical(s) to be dispersed at said cloud base is, preferably, urea, said glaciogenic chemical(s) is, preferably, silver iodide flare(s) and said super-cool chemical(s) to be dispersed below said cloud base is, preferably, dry ice.

13. A process of moving cloud using 'Royal Rainmaking Technology' by means of chemical seeding for cloud formation, cloud growth, moving of cloud, rain initiation, and rain enhancement comprising steps of

"Triggering", to activate cloud formation and enrich newborn cloud by dispersing CCN of hygroscopic chemicals into volume of air at or a few thousand feet above the level of cloud formation or CCL at a distance upwind of a designated target area;

"Fattening", to promote raindrop formation and building up of cloud volume by dispersing exothermic-hygroscopic chemical(s) into the updraft portion of cloud at a level above the cloud base;

"Moving" to move said cloud to a designated target area;

"Attacking", to initiate rainfall from said cloud by 'Sandwich Technique' using endothermic-hygroscopic chemicals dispersed upwind of said cloud shoulder and at said cloud base, or by 'Super Sandwich Technique' using endothermic-hygroscopic chemical(s) dispersed upwind of said cloud shoulder and at said cloud base level, and using glaciogenic chemical(s) seeded into the top of said cloud, and super-cool chemical(s) dispersed below said cloud base; and

"Enhancing", to enhance volume of rainfall onto said designated target area, area coverage, and in addition, to prolong rain duration using super-cool chemicals further dispersed below said cloud base.

14. A process of moving said cloud formed (Moving) as of claim 13, wherein exothermic-hygroscopic chemical(s) are dispersed into said cloud mass and to the spaces between the cloud masses to cause lifting up and moving of said cloud mass along the wind either to a target area on a plain or passing over a mountain top to be attacked and to fall as rain onto a target locality.

15. The process of claim 14 wherein said exothermic-hygroscopic chemical is, preferably, calcium chloride.

16. A process of expanding rainfall against wind direction from a dense cloud resting on windward side of a mountain, using two steps of chemical seeding as of claim 13; comprising steps of:

fattening preexisting small clouds upwind to merge with said dense cloud mass, and attacking growing clouds to cause expansion of area of rainfall from said dense cloud to a designated target area upwind.

17. A process of rain making using Royal Rainmaking Technology as of claim 1 wherein said chemical seeding can be performed inside or outside a cloud or to the top or underneath said cloud either of an isolated cloud or any cloud band.

18. A process for preventing hail formation comprising steps used in "Super Sandwich Technique" of Royal Rainmaking Technology of claim 11 operating at a stage prior to formation of hail.

19. A process for providing clear view of flight path for aviation safety comprising over-seeding exothermic-hygroscopic chemical(s) into a cloud mass to cause separation of said cloud mass into a clear path.

20. A process to cause rainfall from stratiform clouds covering an area using chemical seeding as of claim 1 modified by dropping alternately, exothermic-hygroscopic chemicals, and endothermic-hygroscopic chemicals, to cover said clouds and dispersing hygroscopic chemicals, on top of developing clouds.

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