Infrared Rotary Dryer

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Heat transfer fundamentals: radiant versus convection heat

- Heat Transfer methods:

Conduction, Convection and Radiant heat.

- ➢ Convection is the transfer of heat by movement of liquids or gases
- ➢ Conduction is the transfer of heat by object.
- ➢ Radiant heat is the transfer of heat by radiation.

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Convection Heat

- This air movement cannot be controlled and heat transfer always works from hot to cold which you cannot control in the air.
- Air absorbs heat poorly and transfers it back out to other objects poorly
- Air is not “zoneable” and rapidly cools when the thermostat switches off

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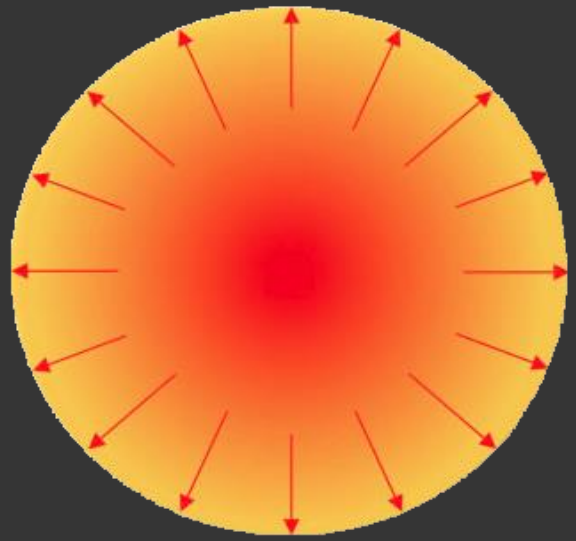
Radiant Heat:



- Radiant heat has considerable advantages over convection heat for comfort heating because:
- A Radiant heater directly heats objects in an environment, not the air in between.
- Radiant heater has a better penetrating ability heating, therefore it's able to heat the material inside out.
- Radiant heater has a lowest energy lost, and easy to control temperature.

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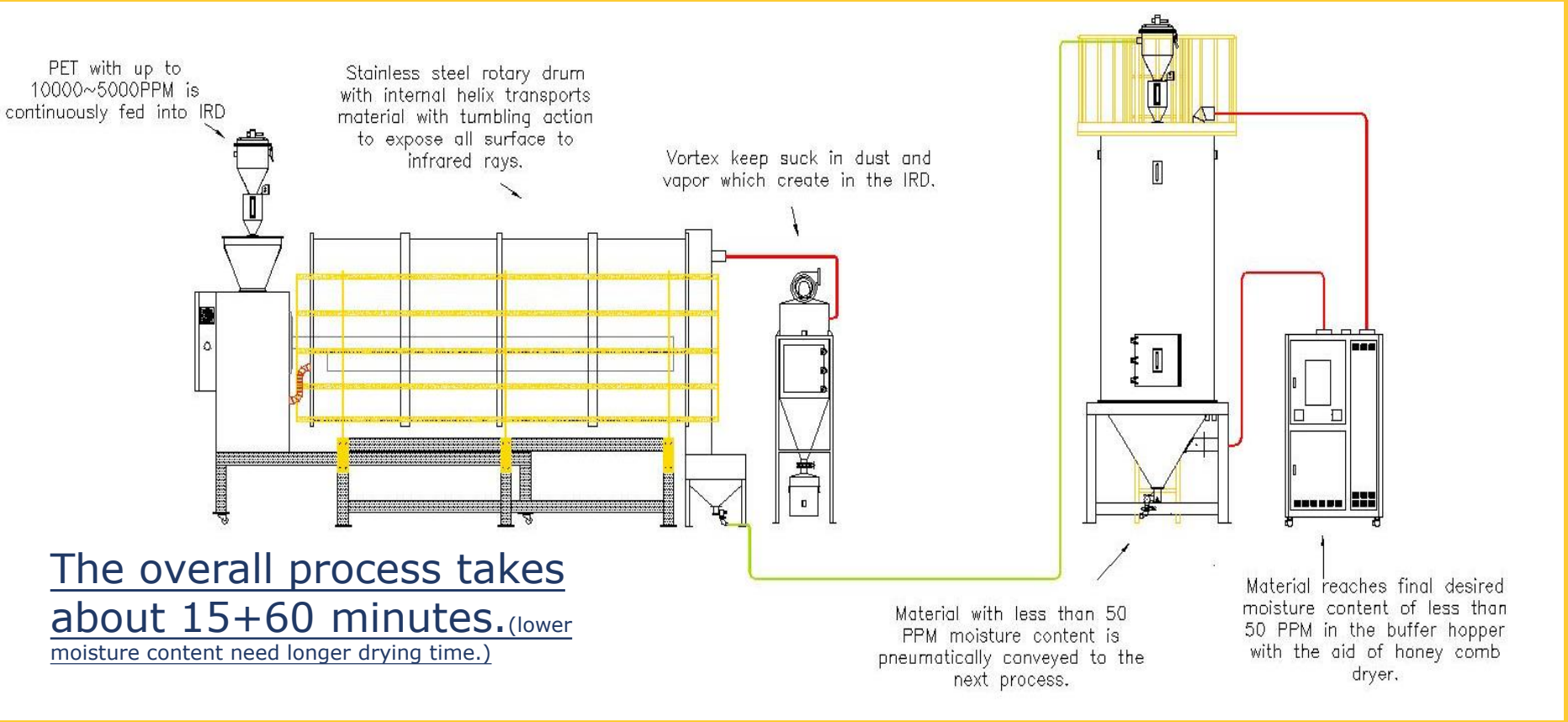

The overall process takes about 15+60 minutes.(lower moisture content need longer drying time.)

Working Flow of IRD

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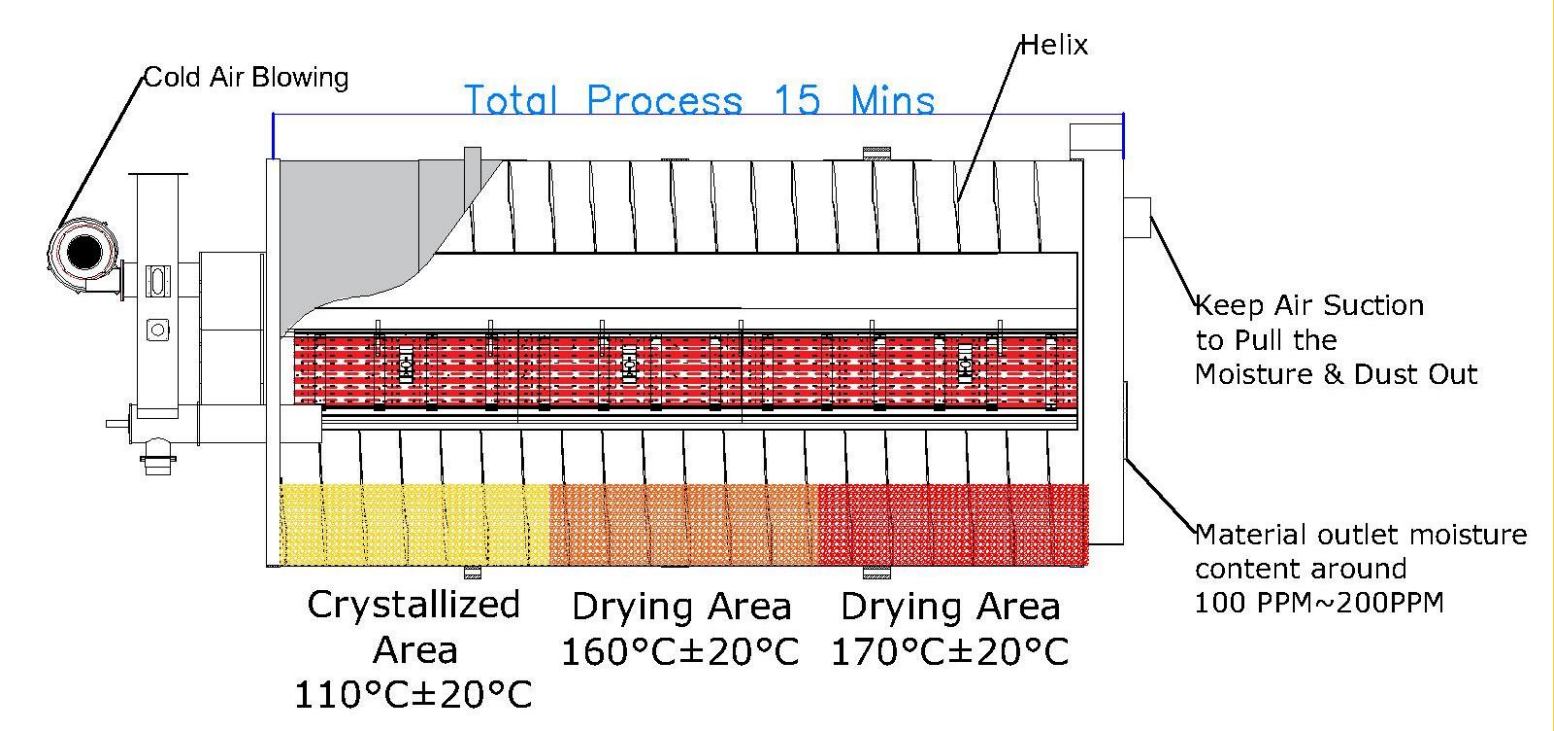
Inside the IRD



- IRD uses 1/3 of the energy compare to conventional type to crystallized and dry the PET.
- PET virgin/flake moisture content up-to 10000~5000 ppm is feed continuously into IRD.
- Helix inside the IRD move the resin and rotation of the drum exposes all surface of the particles to IR rays.
- Infrared heat the particles directly inside out.
- Moisture inside the particle is rapidly heated and vaporized.
- A stream of air removes the vaporized moisture from the process.
- Crystallized PET is transported to ta buffer tank for further reduce the moisture to desired level.

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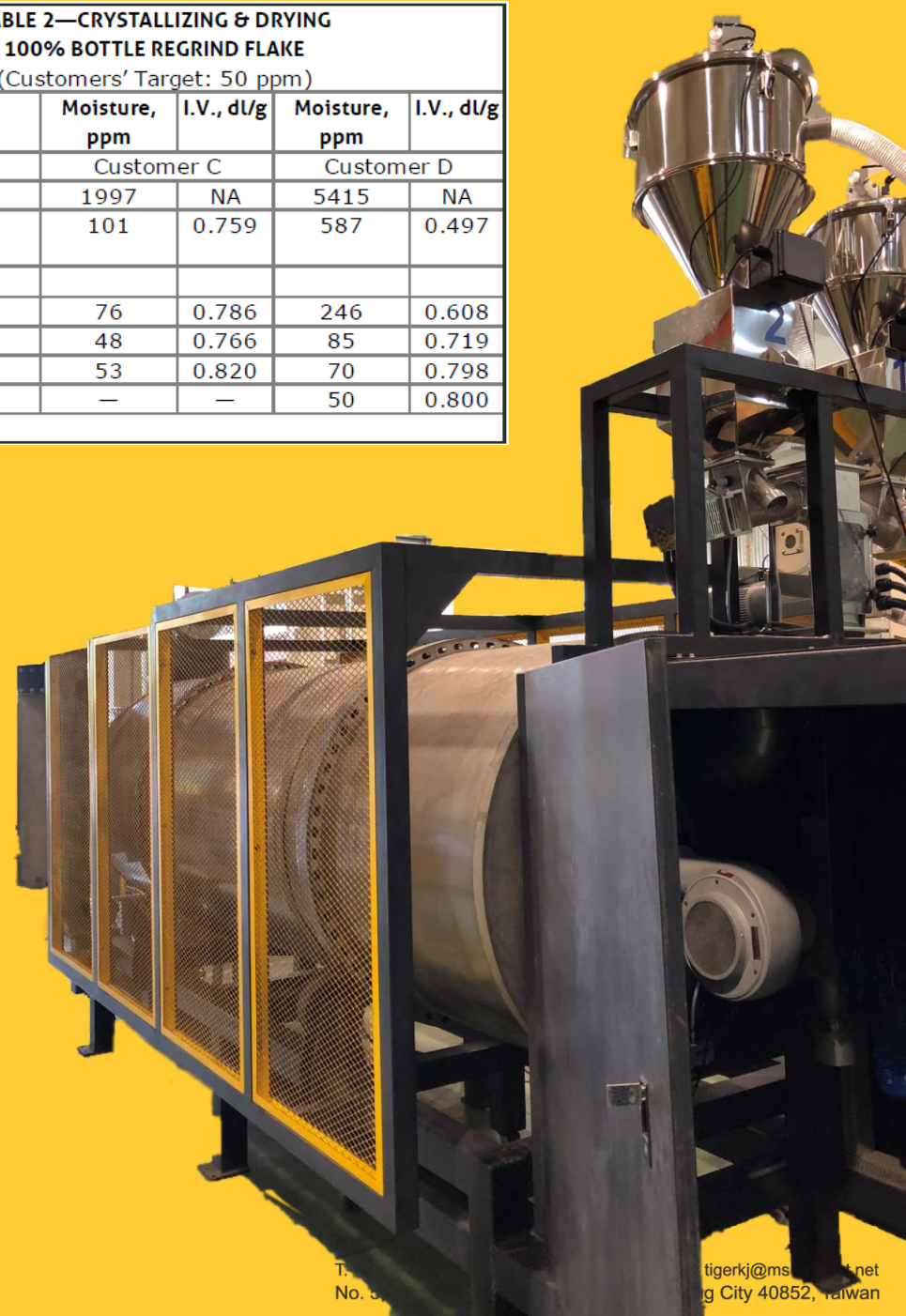
Benefits of IRD

TABLE 2—CRYSTALLIZING & DRYING 100% BOTTLE REGRIND FLAKE (Customers' Target: 50 ppm)				
	Moisture, ppm	I.V., dl/g	Moisture, ppm	I.V., dl/g
	Customer C		Customer D	
Initial	1997	NA	5415	NA
After IRD Crystallizationa	101	0.759	587	0.497
In Buffer Hopper				
15 min	76	0.786	246	0.608
30 min	48	0.766	85	0.719
45 min	53	0.820	70	0.798
60 min	—	—	50	0.800
aAbout 14 min.				

- ✓One Step Process(from 10000~5000 ppm to <50 ppm)
  - The IRD system crystallized and dries up to 2000 KG/hr.
- ✓Energy Saving up to 50%
- ✓Quick Change-Over Time and Shutdown Time.
- ✓Faster Start Up
- ✓Maintains Critical Resin Properties.



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IRD Energy Comparison of PET Drying Methods :

IRD Energy Comparison:										
Type	Description	Drying Method	Material	KW Power Consumption	Dt Drying time	TKW Total Power Consumption		STKW Energy Saving	TKW+ With Margin Energy	MSTKW With Margin Energy Saving
				KW	Hr.	KW		KW	KW	KW
CRYSTALLIZD and DRYING A-PET 300Kg/Hr.	LEAD TIME	IRD + 2.5 Hr. Small DRYER	A-PET(Flake)	19		19	41	-126	53	-164
			C-PET	9	2.5	22		-75.51%		-75.51%
		Crystallizer + 4 Hr. DRYER	A-PET(Flake)	36	1.0	36	167		217	
			C-PET	33	4.0	131				
	PER HOUR	IRD + 2.5 Hr. Small DRYER	A-PET(Flake)	19		19	28	-41	36	-53
			C-PET	9	1.0	9		-59.42%		-59.42%
		Crystallizer + 4 Hr. DRYER	A-PET(Flake)	36	1.0	36	69		90	
			C-PET	33	1.0	33				
DRYING C-PET 300Kg/Hr.	LEAD TIME	IRD + 2.5 Hr. Small DRYER	C-PET	19		19	41	-156	53	-202
			C-PET	9	2.5	22		-79.33%		-79.33%
		4-6 Hr. DRYER	C-PET	33	6.0	196	196		255	
	PER HOUR	IRD + 2.5 Hr. Small DRYER	C-PET	19		19	28	-5	36	-7
			C-PET	9	1.0	9		-15.46%		-15.46%
		4-6Hr. DRYER	C-PET	33	1.0	33	33		42	

A-PET(AMORPHOUS PET) / C-PET (CRYSTALLIZED PET)

A、IRD Power Consumption Analysis (From Material View) :

NO.	Material Type	M Material Consumption	S Material Specific Heat	T_1 Material Temp. Before Drying	T IRD Drying temp.	T_2 Material Temp. After Drying	W_1 Material Moistu Before Drying	W_2 Material Moistu After Drying	Q Total Energy Required	KW Energy Consumption	KW^+ Margin Energy Consumption
		Kg/Hr.	Kcal/Kg℃	℃	℃	℃	%	%	Kcal/Hr.	KW	KW
1	A-PET	300	0.50	25	160	130	0.60	0.020	16,690	19	25
2	PET FLAKE	300	0.50	25	160	130	0.60	0.020	16,690	19	25
3	C-PET	300	0.50	25	160	130	0.40	0.020	16,366	19	25
4	C-PET FLAKE	300	0.50	25	160	130	0.40	0.020	16,366	19	25

Remarks:

T2 = T - 30 (It means material has dried , the temp. of material will less than drying air about 30℃.)

Q (Total heat required) = Qs (Sensible heat) + Ql (Latent heat)

Qs (Sensible heat required) = M * S * (T2 - T1)

Ql (Latent heat required) = M * (W2 - W1)

Qw (Water Latent heat required) = 540 Kcal / Kg

KW = Q / 860 Kcal / Hr.

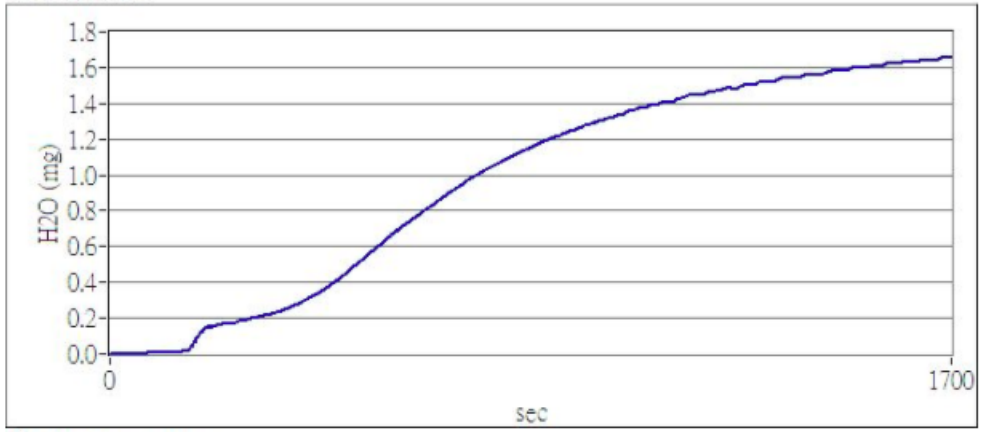
KW^+ =KW*1.3(margin)

FMX HydroTracer

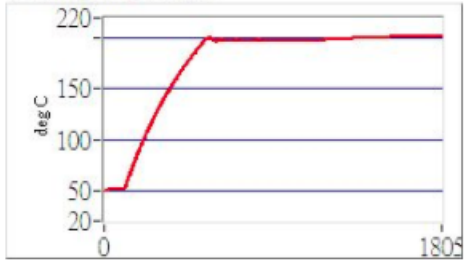
Date 02.01.01 Start of program 05:19
Name of operator N.N.
comments
Material PET Polyethylenterephtalat
Sample weight in grams 11.50
Density 1.30
Heating temperature 200
Measuring time 0 : 28 : 20
Ambient air temperature 鈖 21.7
Relative humidity of ambient air % 56.7
air pressure hPa 996.3
Water content [%] 0.0116
Water content [ppm] 116
Water content [mg] 1.33

Device status: 21602
Program: 4.00i
the data was saved at: d:\FMX\FMX\Data\FMX020101-0519

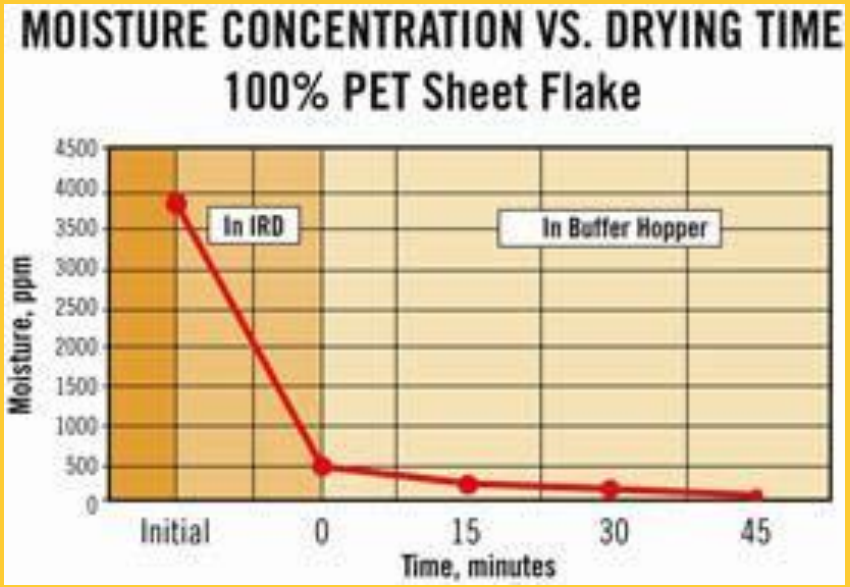
H2O in reactor



Heating temperature



Moisture content after IRD



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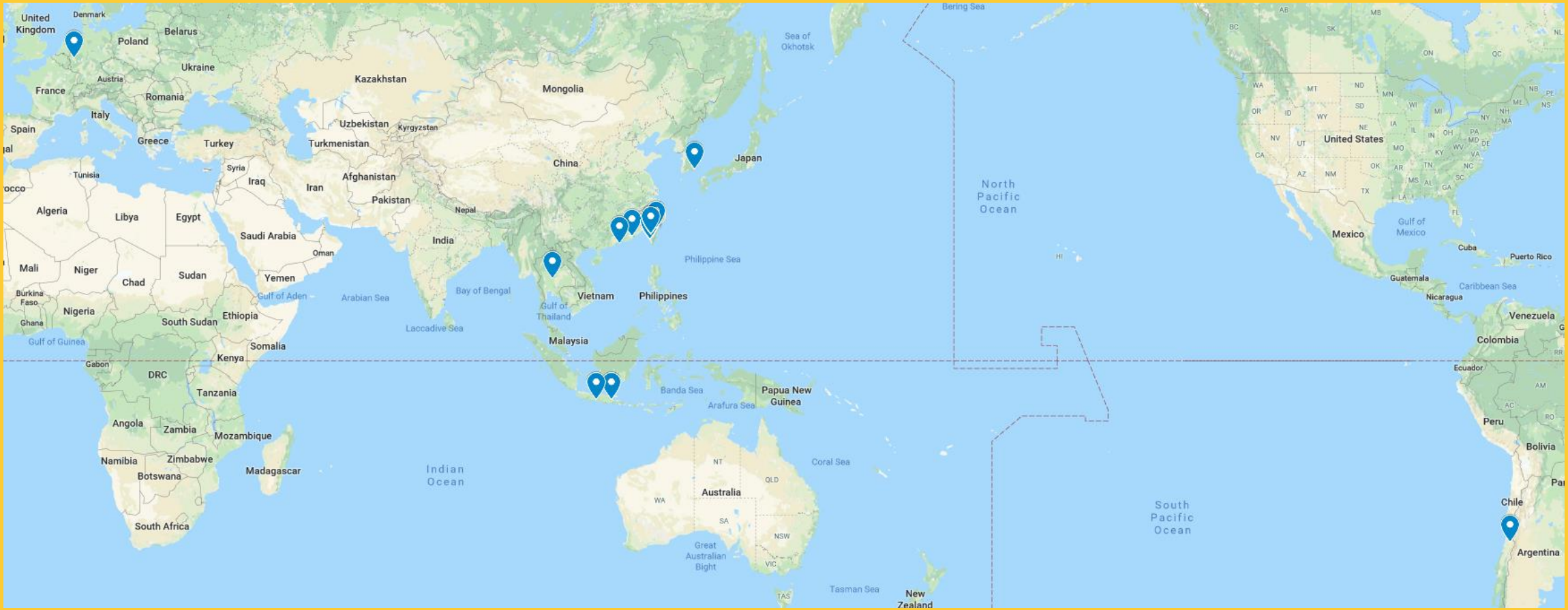
Flying Tiger IRD System In The World



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