FPAW 2016 Summer Meeting

3 August 2016

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Flight Efficiency Vision
Weather

2020

Automated
Flight
Planning

**Mobile and
Automated Flight
Efficiency
Advisories**

Airspace and
Flight Analytics
Tools

Paperless
Flight Deck

2010
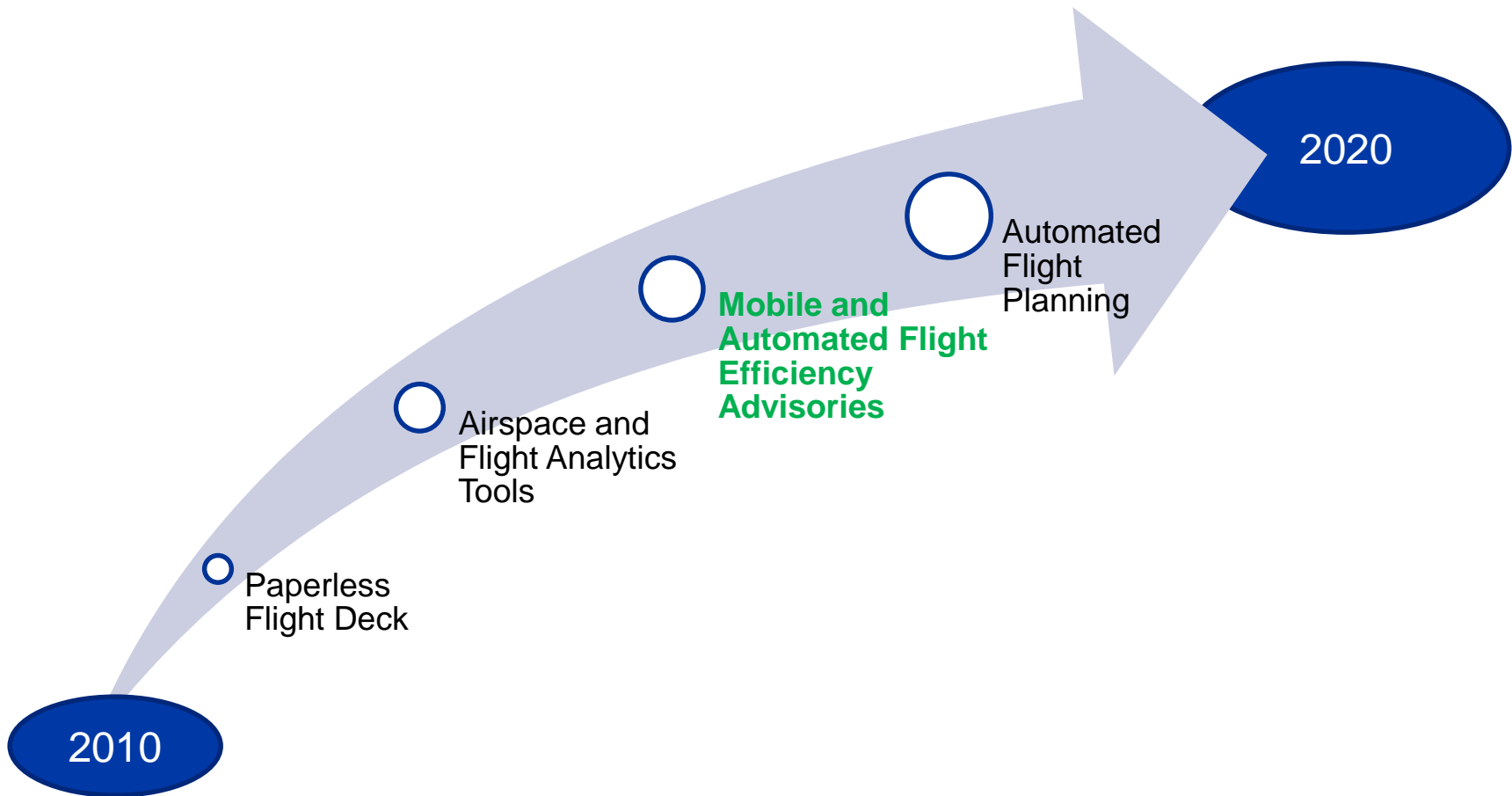
Guiding Principles
Efficiency Technology

- Partner with operators to gain immediate feedback to validate weather concepts and value.

- Full Flight Concepts – to include dispatch.

- Merge into current operational procedures and standards (won't require new standards or certs, etc.).

- Abbreviated/short projects with quick turn around to evaluate initial concepts, operational feasibility & benefit.

- Improve decision making with real-time flight and environment information.

- Provide a platform for networking and sharing of real-time weather information and advisories.

Inefficiencies in the System

- **Availability of real-time weather**

- **Accurate and timely delivery of need to know weather**

- **Integrated weather**

- **Recall specific <u>actual</u> weather conditions from historical data**

- **Ground trajectory prediction accuracy**

- **Coverage Gaps (In-situ)**

- **Workload (preflight, and enroute for weather advisories)**

Shortfalls

Key Issues:

› **Uplinking weather for the complete route (climb, cruise, descent, steps, alternate, etc.).**

› **Updates to EFB and FMC in flight.**

› **Applicable and pertinent weather selection for aircraft, AOC and ATC.**

› **Generic algorithms get created and applied to multiple aircraft types.**

› **Dynamic weather selection for off-route (direct, PDBs, offsets).**

› **The significance of temperature isn't understood.**

Gaps?

These are inefficiencies for both flight planning tools and FMCs.

- **Currently, weather along a flight plan is identified and evaluated at known flight plan waypoints. The flight plan waypoints are generally defined for purposes of navigation or communication.**

- **Flight plan tools only evaluate weather at waypoints and not a flight trajectory (offsets, pseudo waypoints).**

- **In between flight plan waypoints, weather is accounted for using linear interpolation of the entered winds and temperatures at the waypoint.**

- **What happens when weather doesn't follow linear interpolation?**

- **What happens when there is a thunderstorm, or other significant weather in between any 2 flight plan waypoints?**
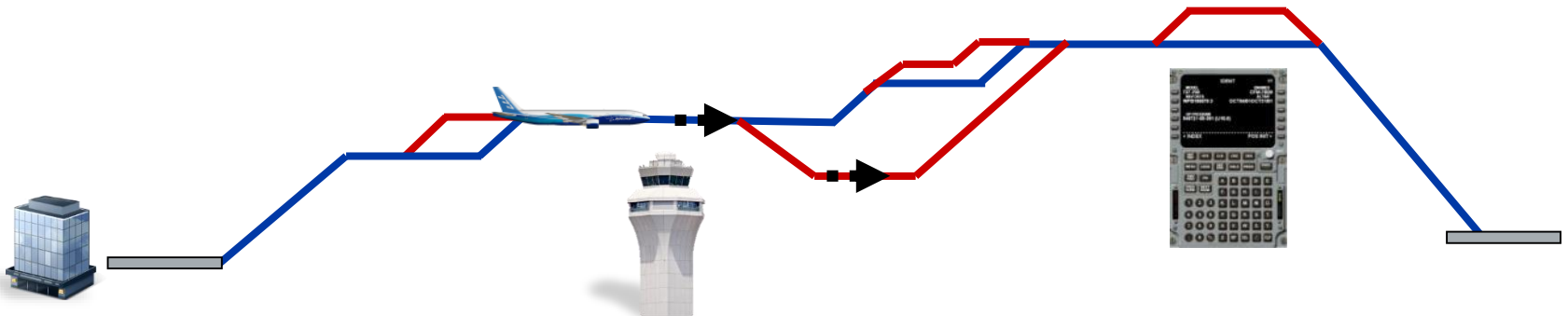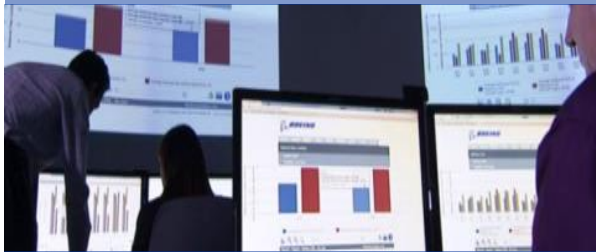
Needs

PRE-FLIGHT

FLIGHT

POST-FLIGHT

- **Assimilation of in-situ weather will require new quality validation.**

- **Standards documentation to ensure "weather" includes temperature.**

- **Integrated weather sources that provide forecast <u>and in-situ</u>.**

- **Weather for the flight plan, efficiency and schedule.**

- **Work together with ATC centers to connect them to the airline weather data.**

- **Weather to improve ground automation predictability. Enables efficiency rather that fixed traffic flows.**

A/C Observations
- **Increased AMDAR equipage**
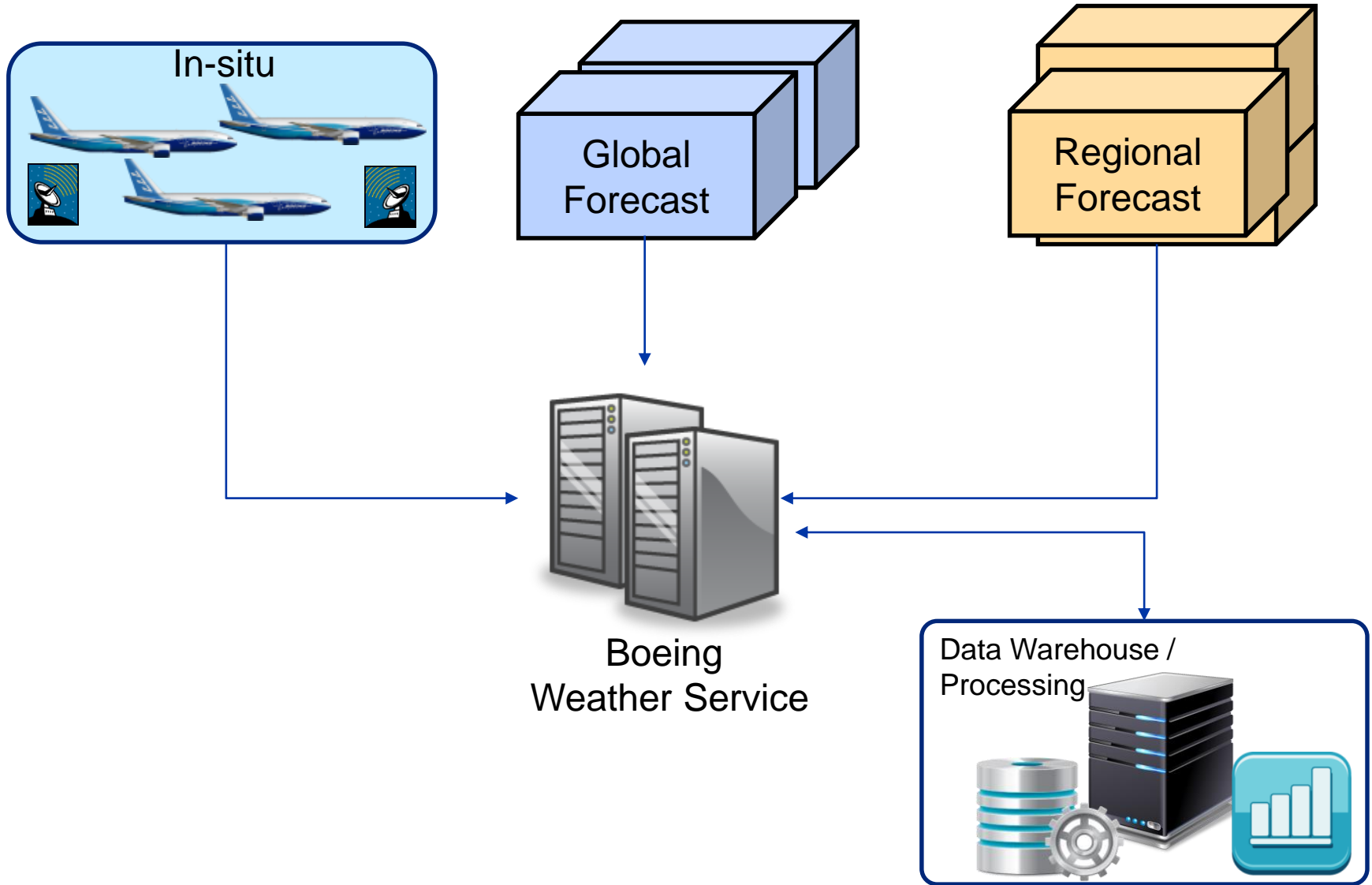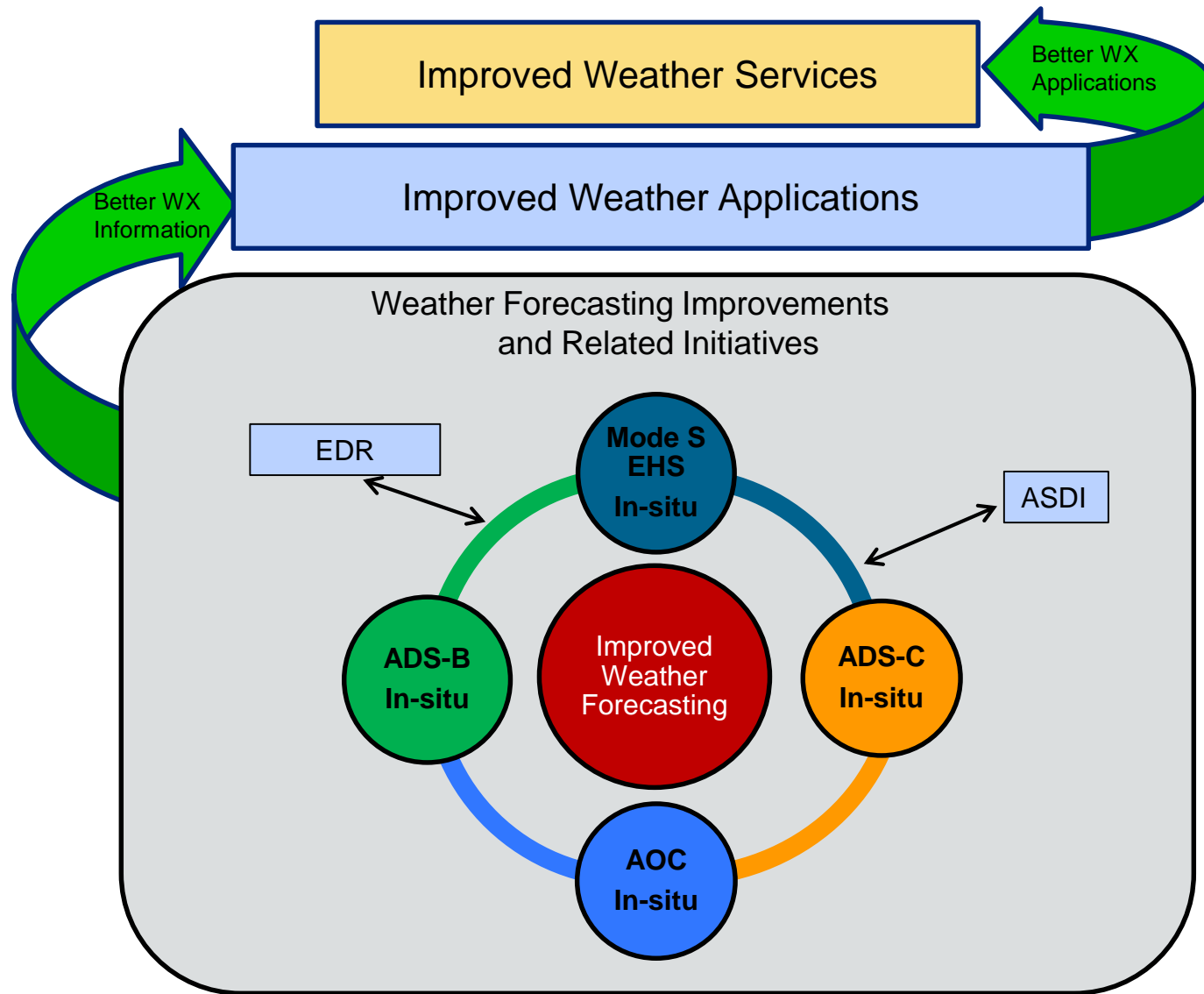- **New/improved Wx parameters**
- **AOC Downlinks**
- **ADS-C Downlinks**

ATC Needs
- **???**
- **???**

Flight Crew Needs
- **Turbulence awareness**
- **Flight optimization**
- **Real-time Weather**
- **Forecast Weather**

Integrating Weather
Weather Service

In-situ

Global Forecast

Regional Forecast

Boeing
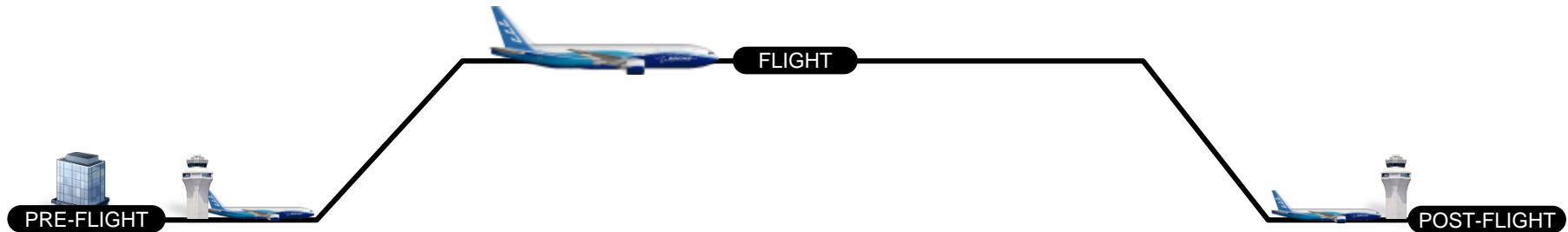Weather Service

Data Warehouse /
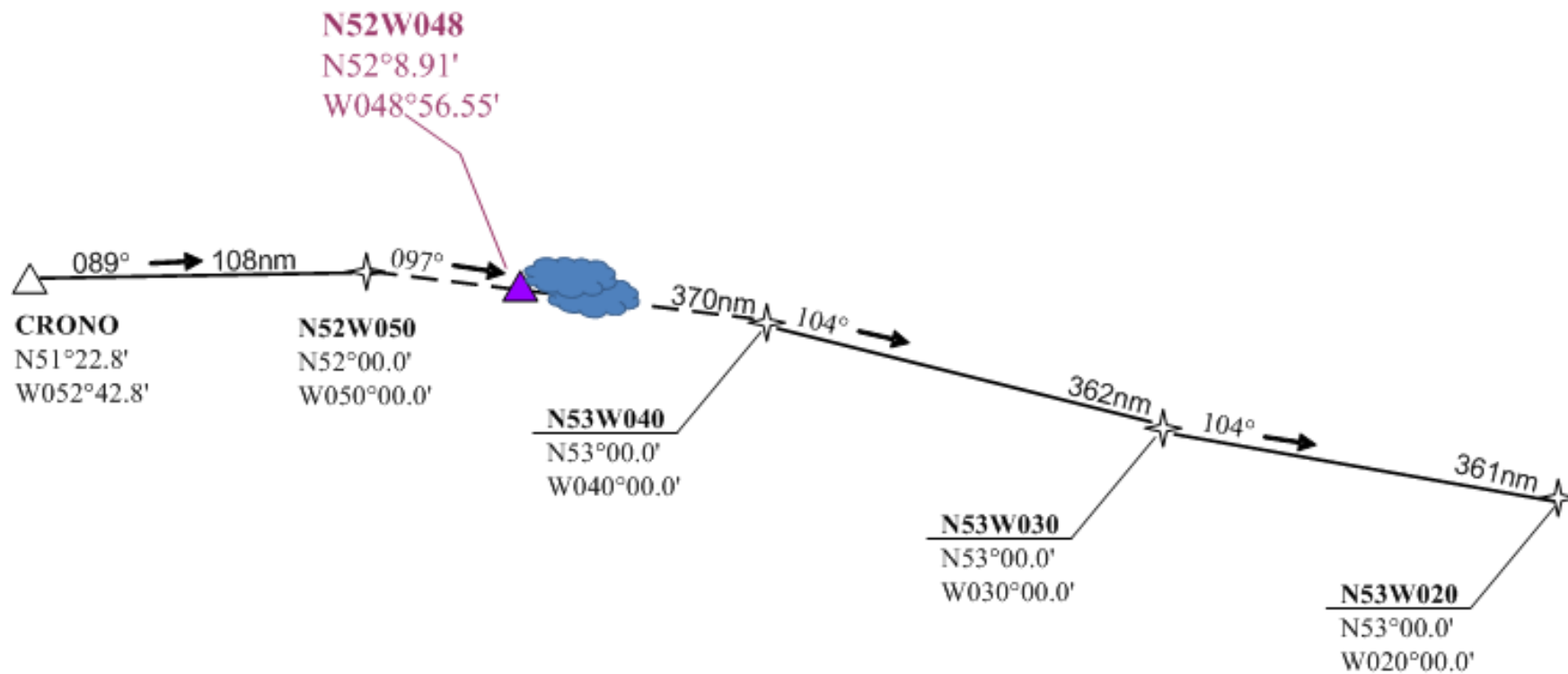Processing

Value of In-situ

Optimizing Flight Efficiency

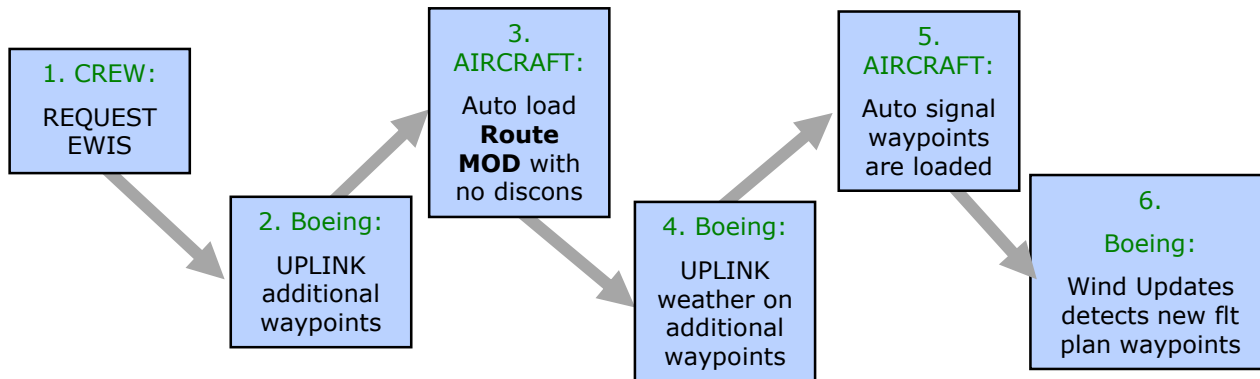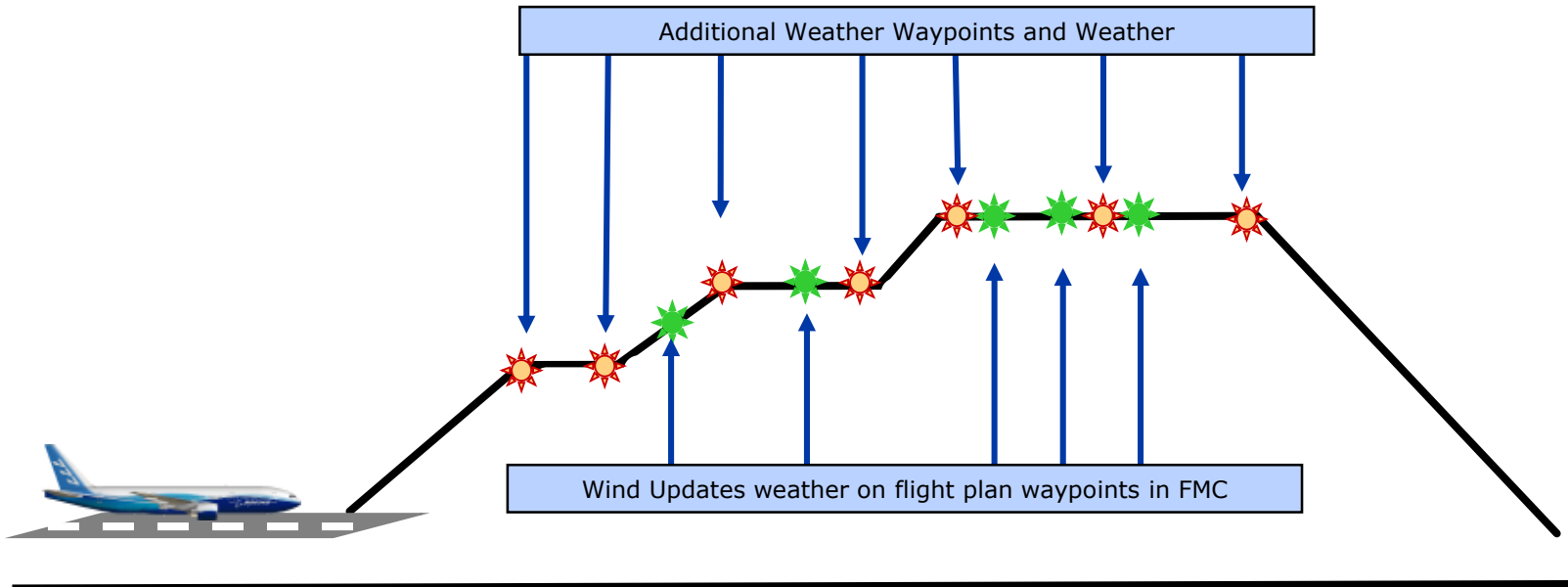**Increased weather and turbulence information sharing is needed for flight optimization.**

FLIGHT

PRE-FLIGHT

POST-FLIGHT

PRE-FLIGHT	FLIGHT	POST-FLIGHT
• Weather Advisories for ATC, Dispatch and Pilot • EFB: Wx OFP, NOTAM, SIGMET, NOTOC, etc. • FMC Uplinks: Perf, T/O, Wx, Flt Plan, Alternate FP, Secondary FP	• Weather Advisories • In-flight updates to EFB?? • FMC Advisory Uplinks: Wx, Alternate FP, Secondary FP • Transmitting in-situ • Recording wx actuals	• Recording and transmitting wx actuals and FP WX deviations

Predictability

N52W048
N52°8.91'
W048°56.55'

089° → 108nm   097°

CRONO
N51°22.8'
W052°42.8'

N52W050
N52°00.0'
W050°00.0'

370nm   104° →

N53W040
N53°00.0'
W040°00.0'

362nm   104° →

N53W030
N53°00.0'
W030°00.0'

361nm

N53W020
N53°00.0'
W020°00.0'

Improving predictability
Weather Advisories

Additional Weather Waypoints and Weather

Wind Updates weather on flight plan waypoints in FMC

1. CREW:

REQUEST EWIS

2. Boeing:

UPLINK additional waypoints

3. AIRCRAFT:

Auto load **Route MOD** with no discons

4. Boeing:

UPLINK weather on additional waypoints

5. AIRCRAFT:

Auto signal waypoints are loaded

6. Boeing:

Wind Updates detects new flt plan waypoints

Pertinent and Applicable Weather
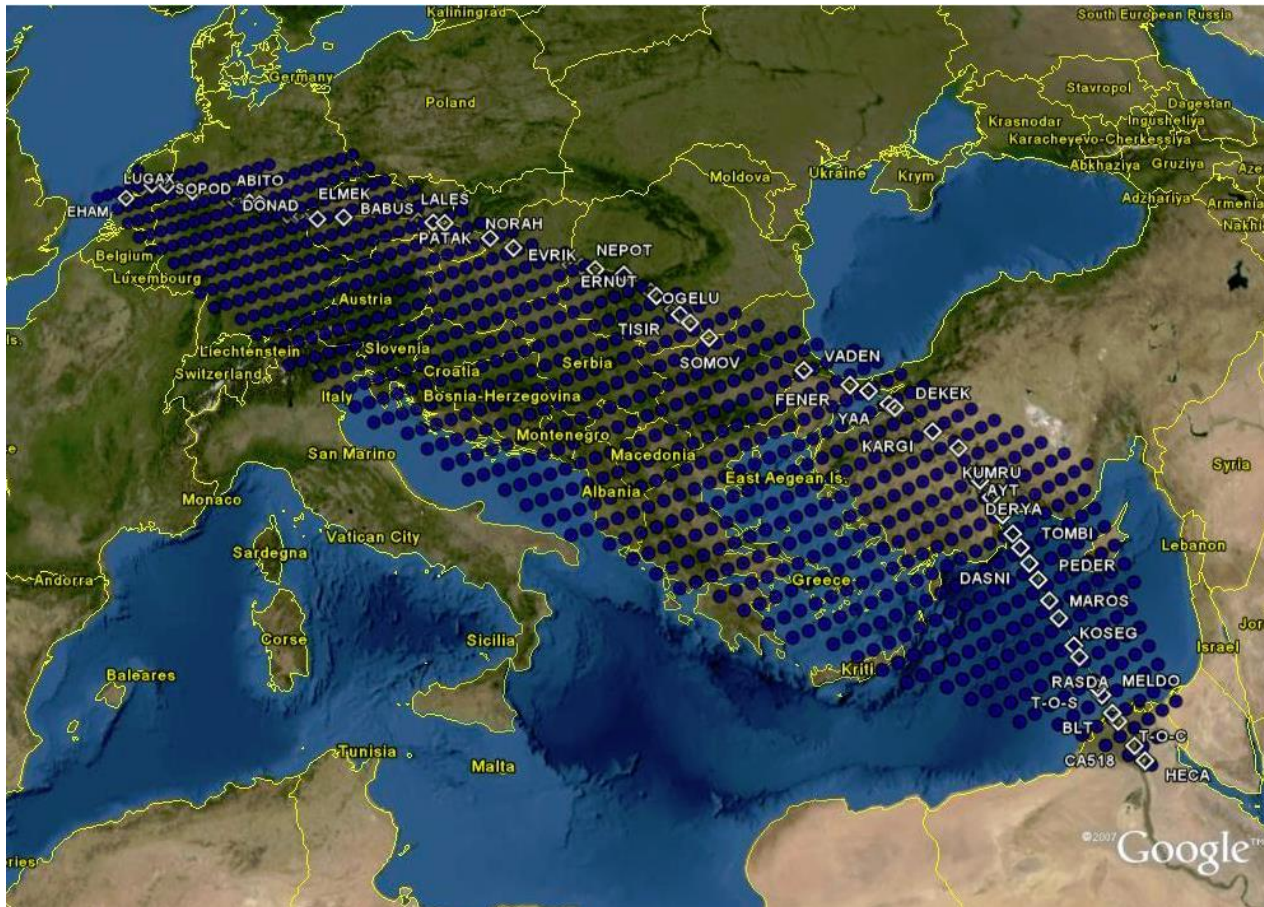
Crew will be advised of only those points that cause a loss
of efficiency along the planned and predicted trajectory.

Contact Info

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NEXRAD
FDA w/EWIS Overlays