The ATM-Weather Integration Model: An Updated Perspective

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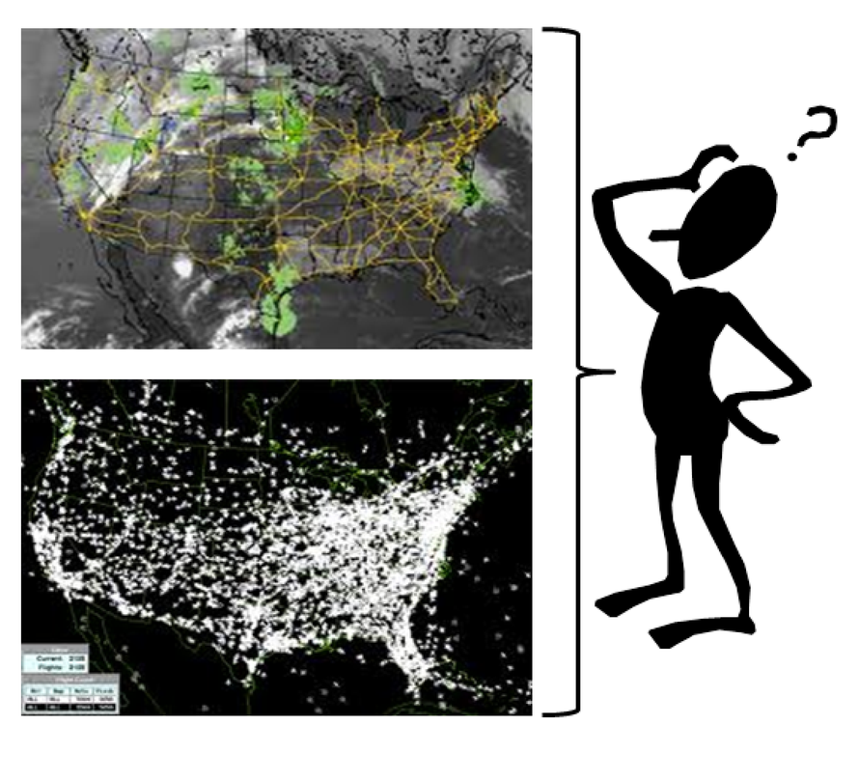
1 The ATM-Weather Integration Model

Why Weather Integration?



- Estimated 70% of delays are caused by weather and cost approximately \$28B annually[1]
- Imperfect weather forecasts pose a challenge to ATM decision makers
- Weather integration into decision support systems will:
  - Standardize the decision process, providing greater predictability
  - Allow full and continued use of automated tools during weather events
  - Provide consistent, efficient system solutions to local weather constraints
  - Increase efficiency across the NAS

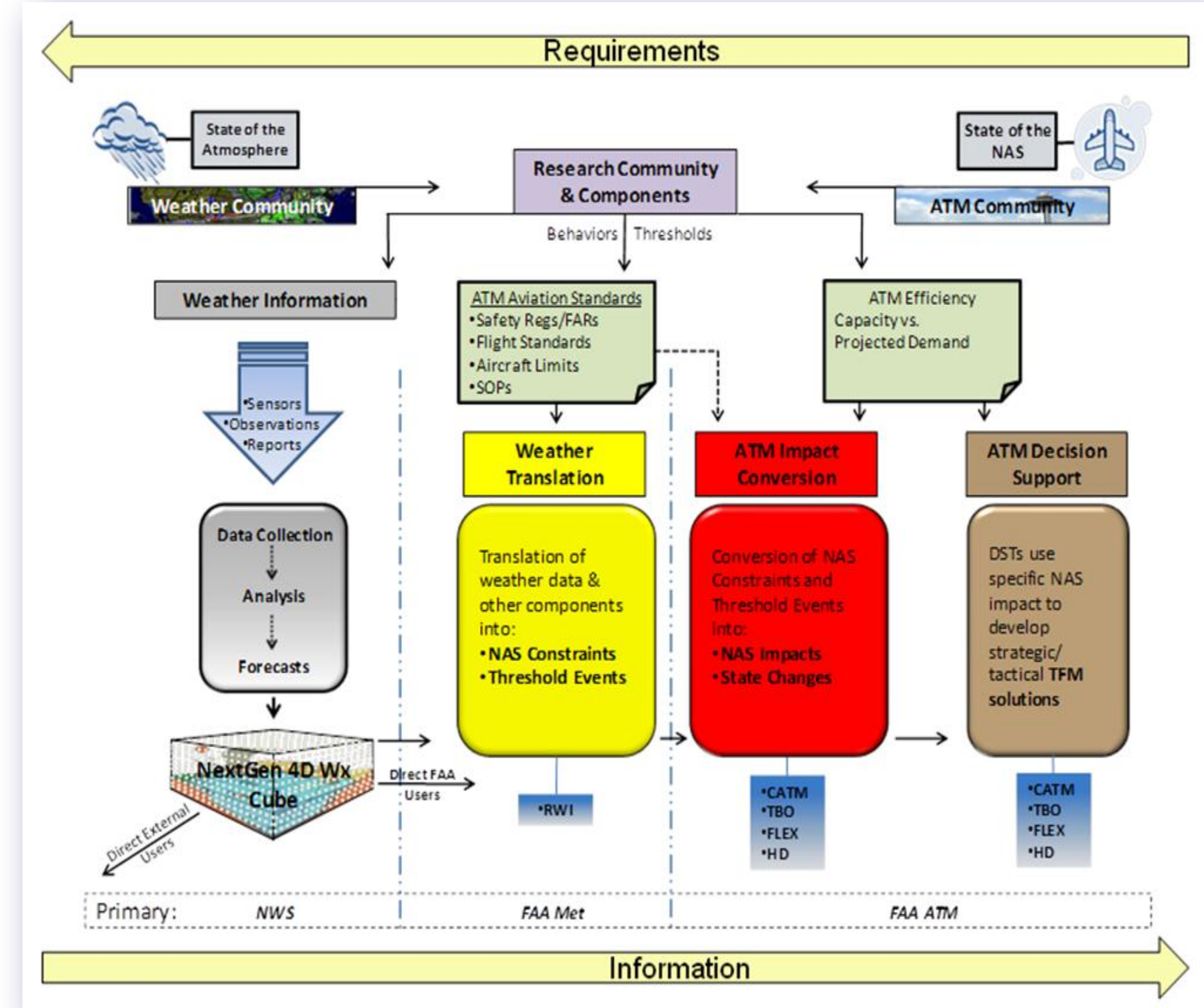
[1]Federal Aviation Administration, 2010, *ATM Weather Integration Plan Overview and Weather Translation Description*, Washington, D.C.

Current ATM-Weather Integration Diagram

The ATM-Weather Integration Diagram was originally described in the Federal Aviation Administration's ATM-Weather Integration Plan V2.0 published in September 2010.

The diagram shows the flow of information, starting as pure weather data on the left and continuing through Translation (yellow box) where it is output as either a NAS Constraint or Threshold Event, onto Conversion (red box) where traffic is applied and NAS Impacts and State Changes are derived, and finally onto Decision Support (brown box) where TFM solutions are developed.

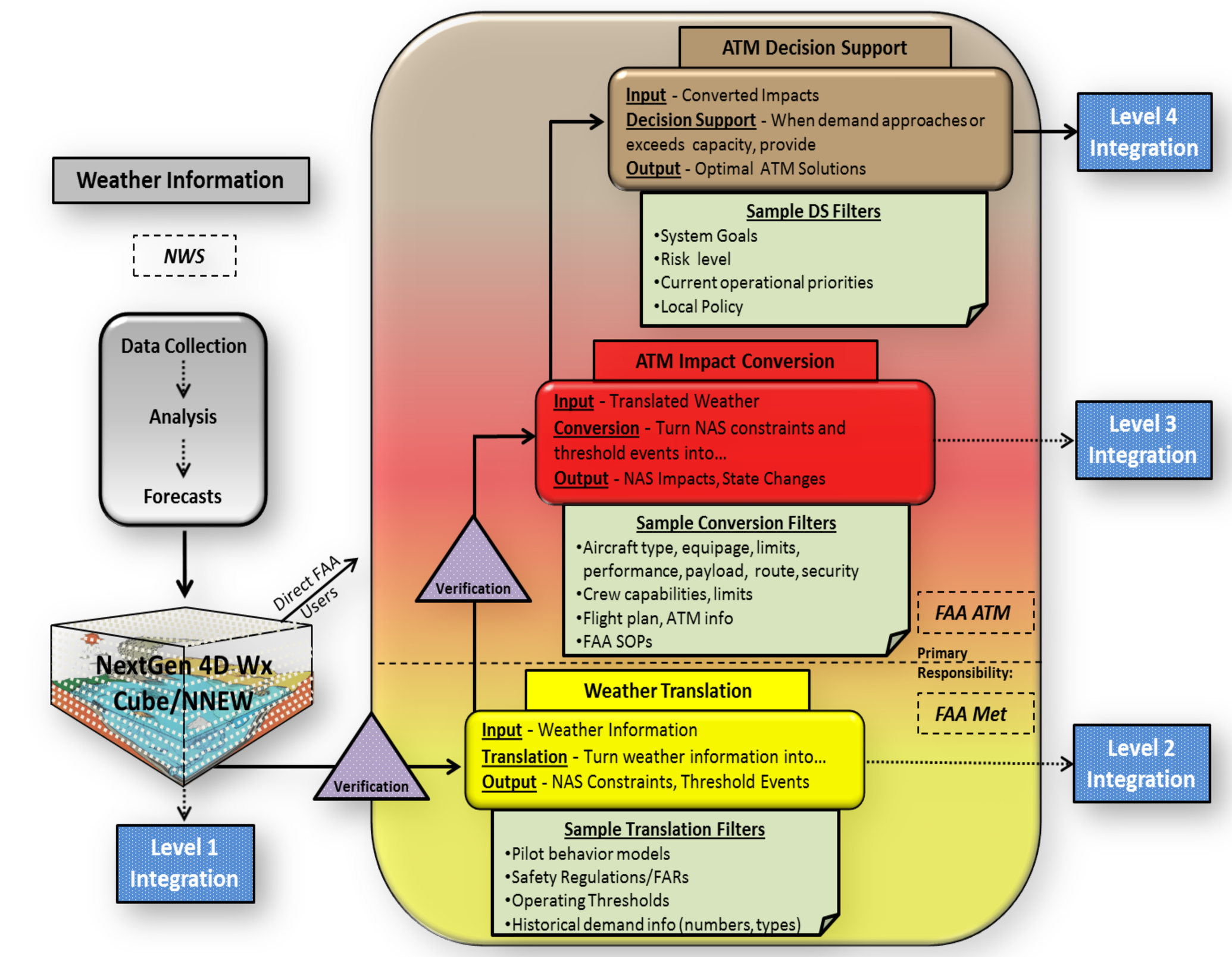
The dashed vertical lines are meant to represent the permeable lines of responsibility (between NWS, FAA Met, and FAA ATM) and the blue labels hanging off of each box show which NextGen solution set is associated with each area. Lastly, the green boxes are a first cut at what information filters will be needed to complete Translation, Conversion, and Decision Support. Unlike information, requirements necessarily flow from right to left.



Proposed ATM-Weather Integration Diagram Update

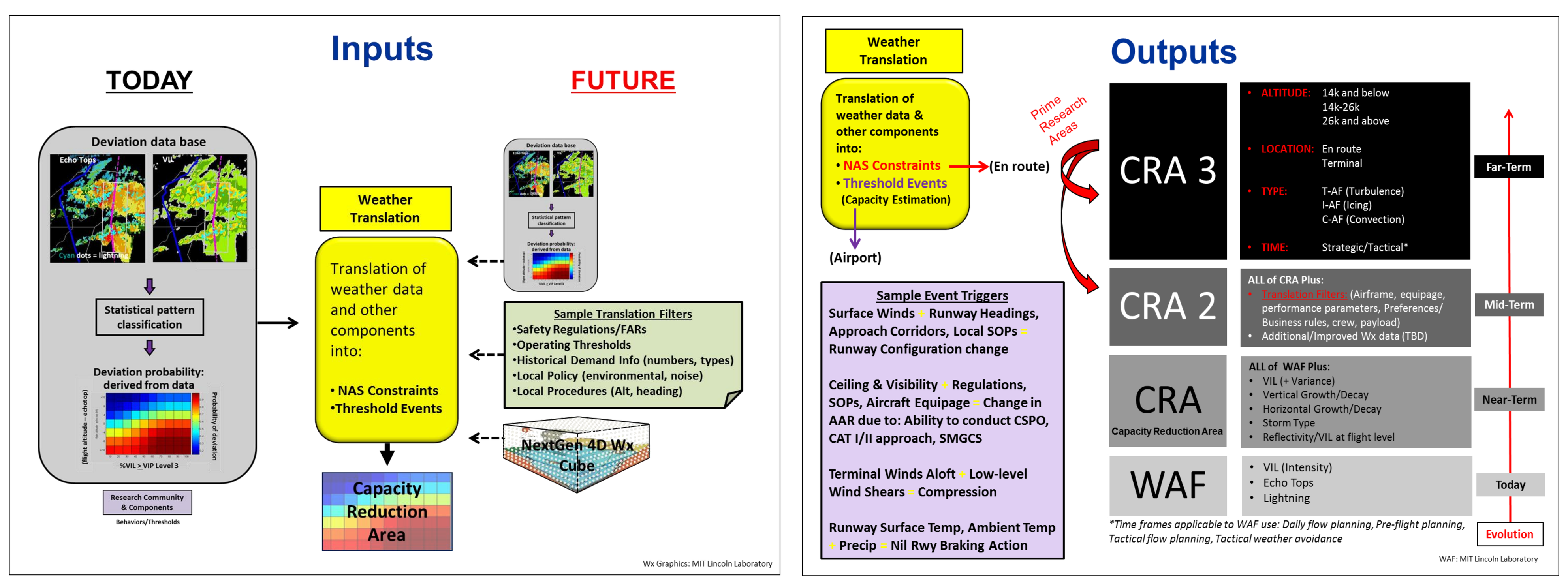
The Proposed Update to the diagram does not change any of the fundamental concepts of weather integration. It primarily seeks to clarify certain aspects (the very permeable and ill-defined areas of responsibility, shown here as shades of yellow, red, and brown) and better define the likely data "filters" used in each step of the process (samples shown in the associated green boxes).

Each Level of ATM-Weather Integration is referenced by the associated blue boxes, and verification of weather and translation was added to indicate what is likely to be a very important, but as yet undeveloped process. The respective flows of information and requirements, and associated solution sets remain the same.

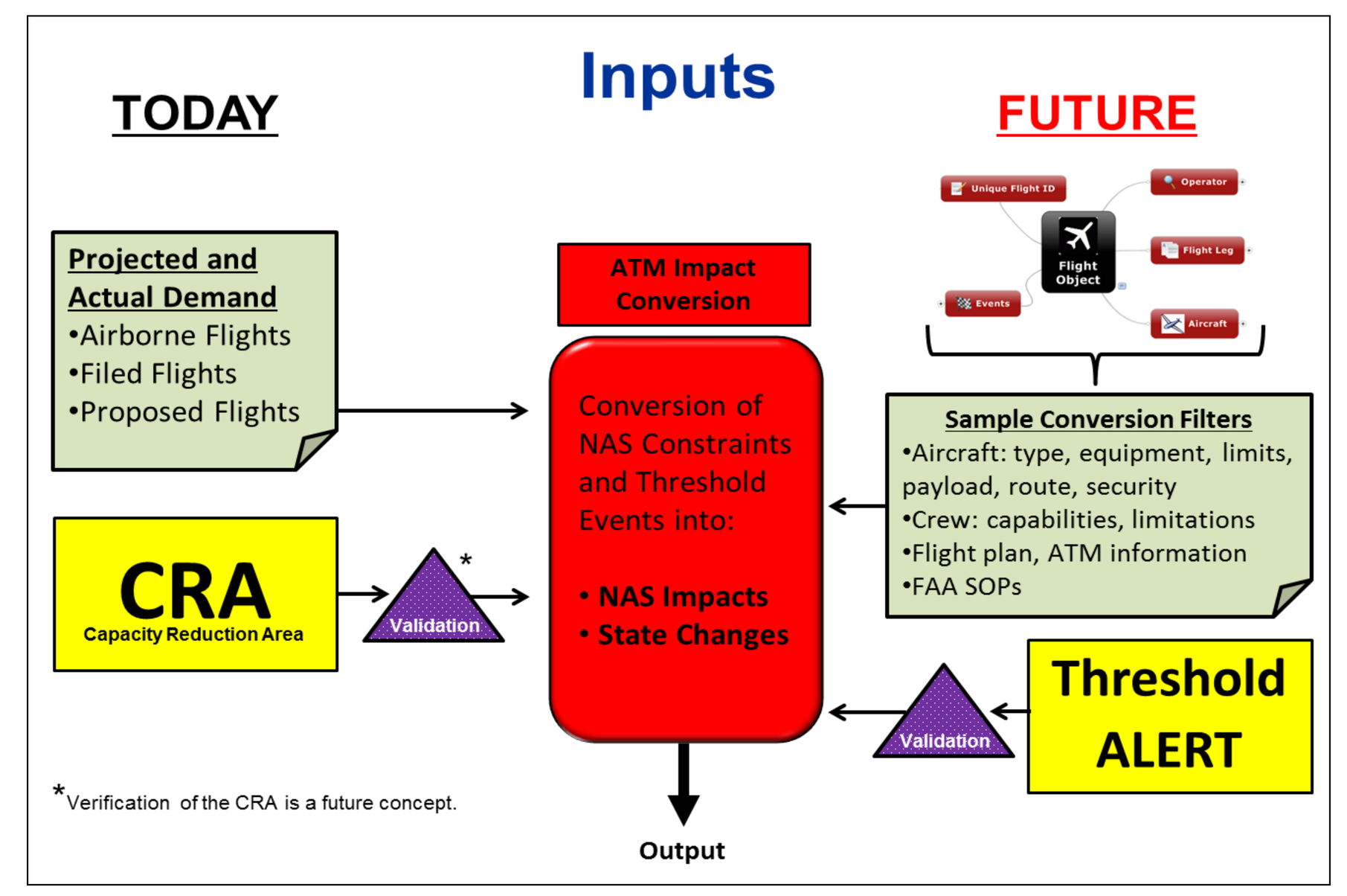


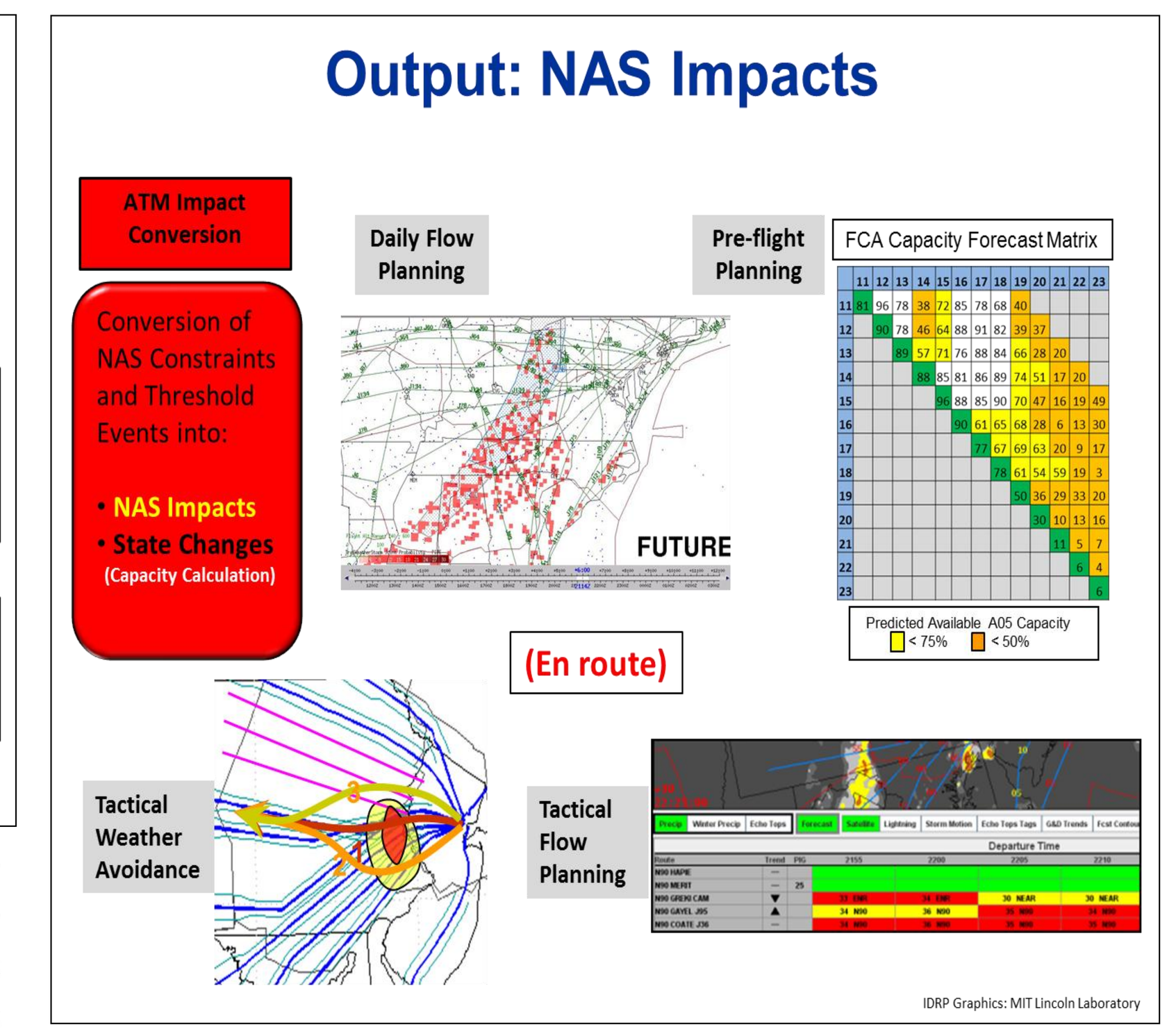
2 A Closer Look

Translation

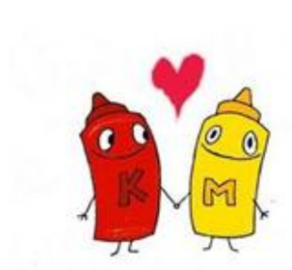


Conversion

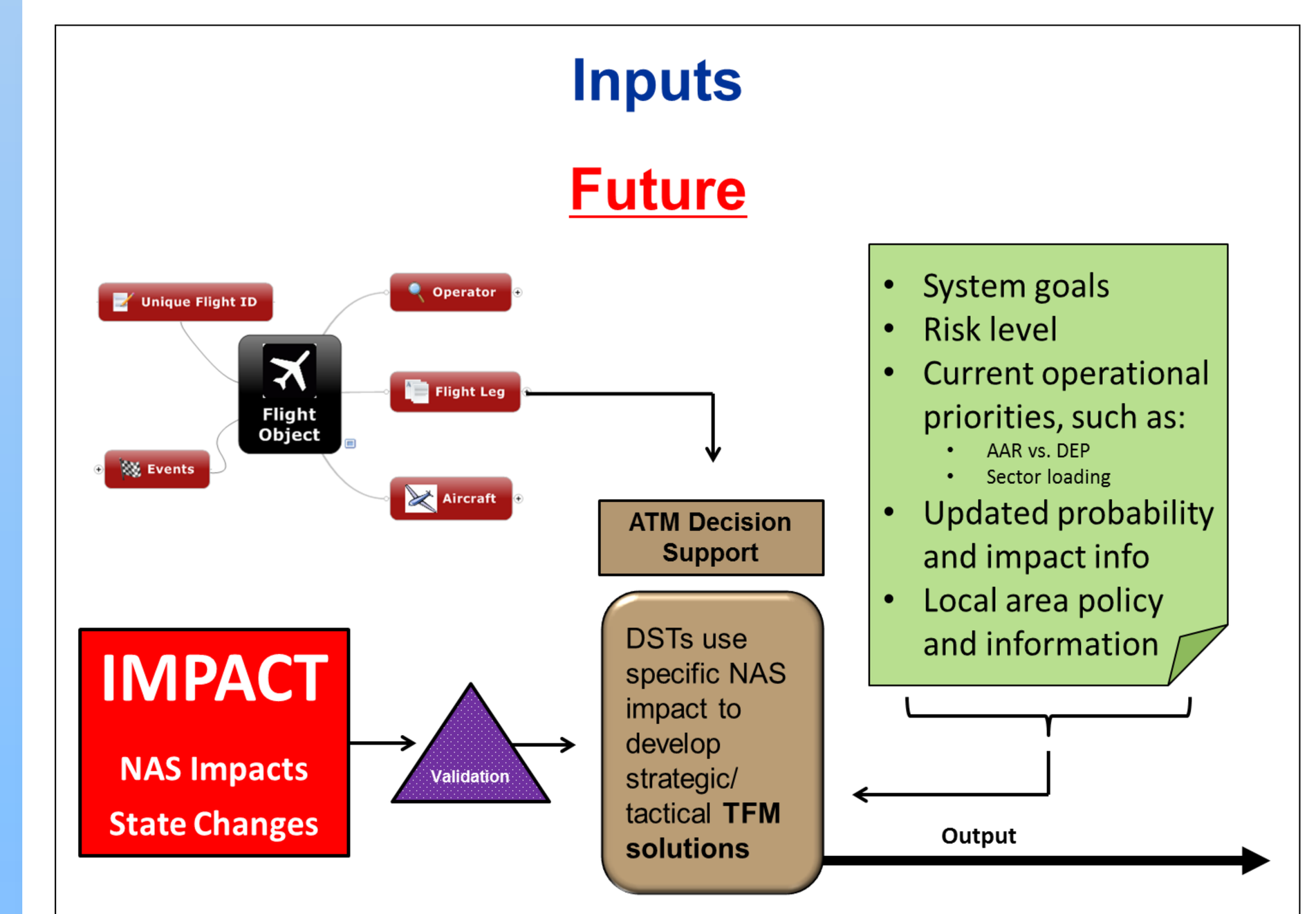


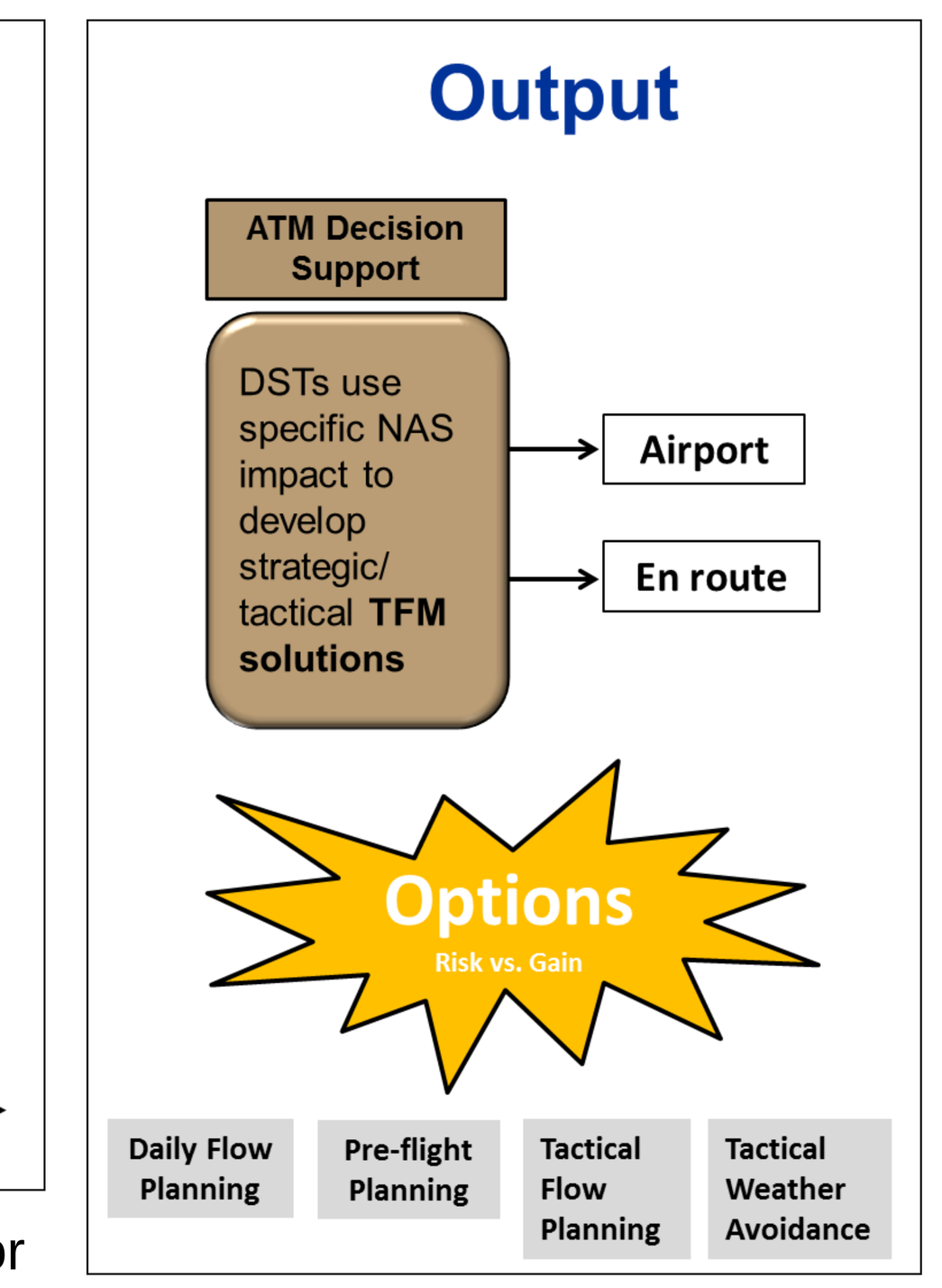


The current focus of translation is, and has been, the departure and en route domains. The Integrated Departure Route Planning (IDRP) concept being tested in the New York area is a good example of ATM impact conversion. The WAF/CRA is being considered for other en route concepts as well. In the area of threshold alerts and state changes there has been little development. The Flight Object concept is thought to be a good potential source of additional conversion data/filters.



Decision Support



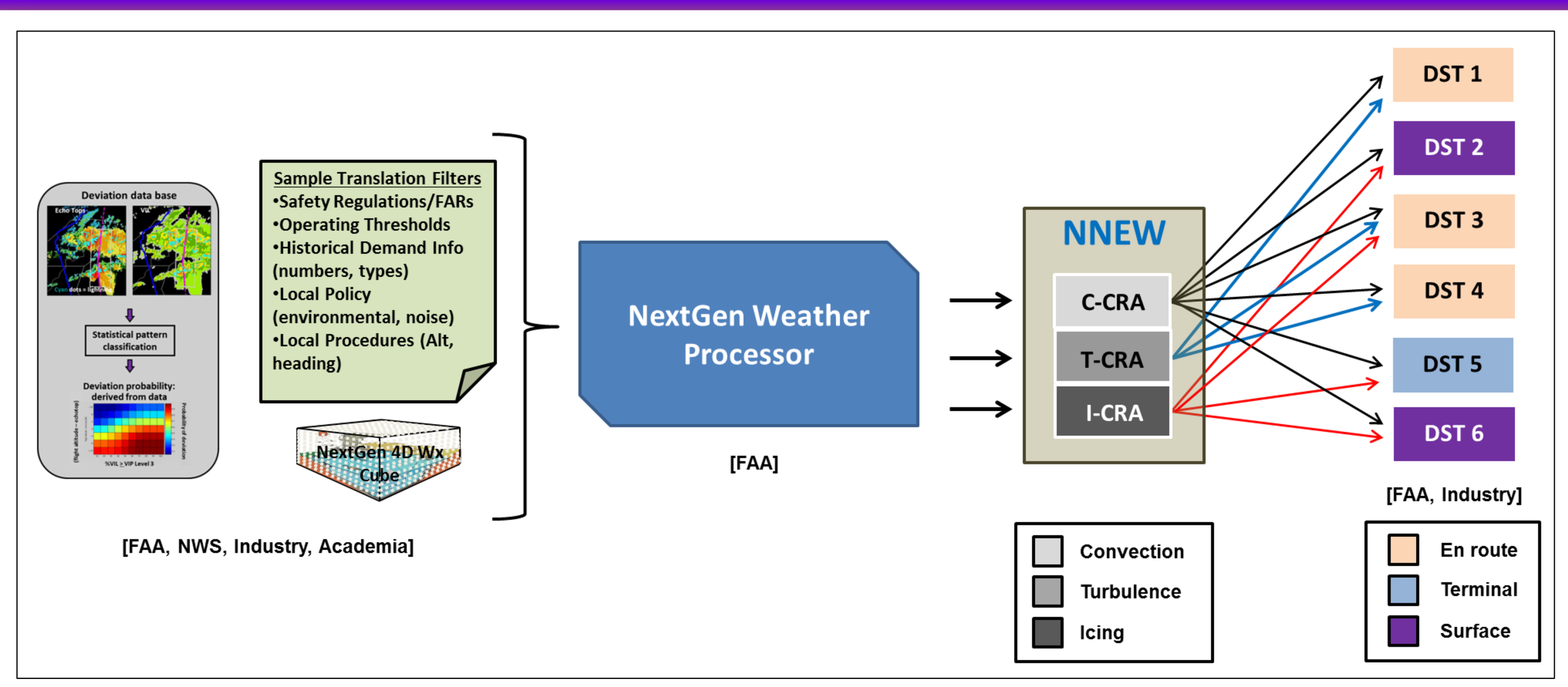


Flight Object, or a similar capability, may be a good source for aircraft, crew, operator, and event data. That information, combined with items in the green "filter" box above, can be used as amplifying information with which to develop optimum TFM solutions and recommendations tailored to specific locations and events.

Weather integration is an iterative process, constantly updating and revalidating original weather, translation, and conversion information.

3 Getting to the Next Level – Issues to Resolve

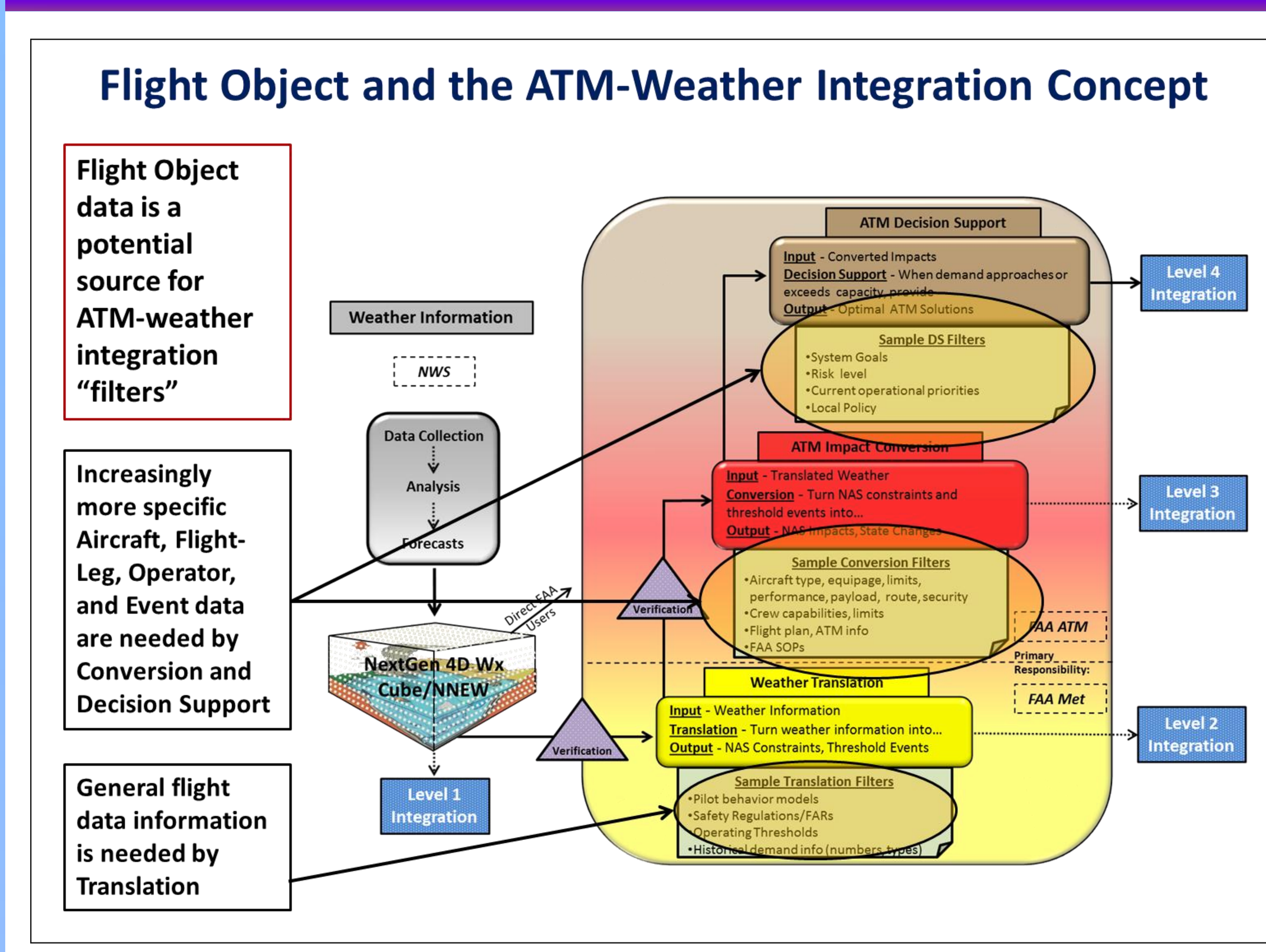
Notional View – The Evolution of Translation



The diagram at left is a notional view that addresses some of the following ***Translation issues*** needing further discussion.

- **Where will translation take place (e.g., the NextGen Weather Processor)?**
- **Will there be a "single authoritative source" for Capacity Reduction Areas?**
- **Should there be a separate CRA for different weather phenomena, time frames, altitudes, or location (en route vs. terminal)?**

Evolution of Conversion and Decision Support

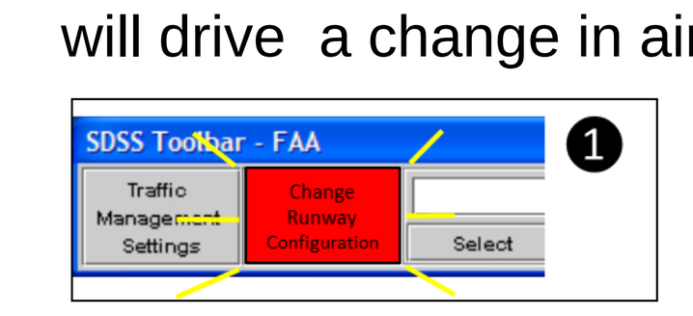


The first step in Conversion is to add known and proposed traffic to translated weather in order to determine NAS impact and state changes. However, in addition to traffic information, there is a variety of data or "filters" (many of which may be available through a Flight Object or similar capability) that will provide the next step in identifying the true nature of the impending impact, allowing more surgical ATM capability.

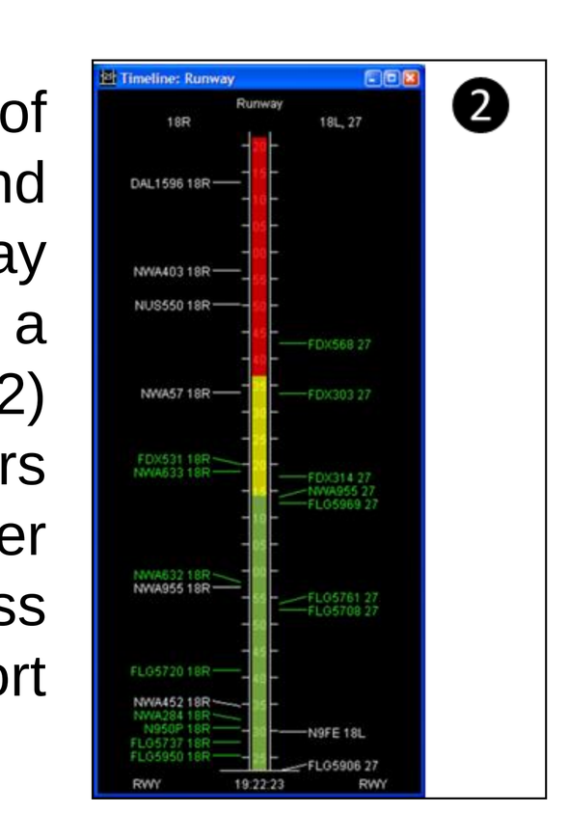
This enhanced rendering of impact can then be passed to decision support systems which can in turn apply additional filters, further enhancing the ability to develop more effective solutions.

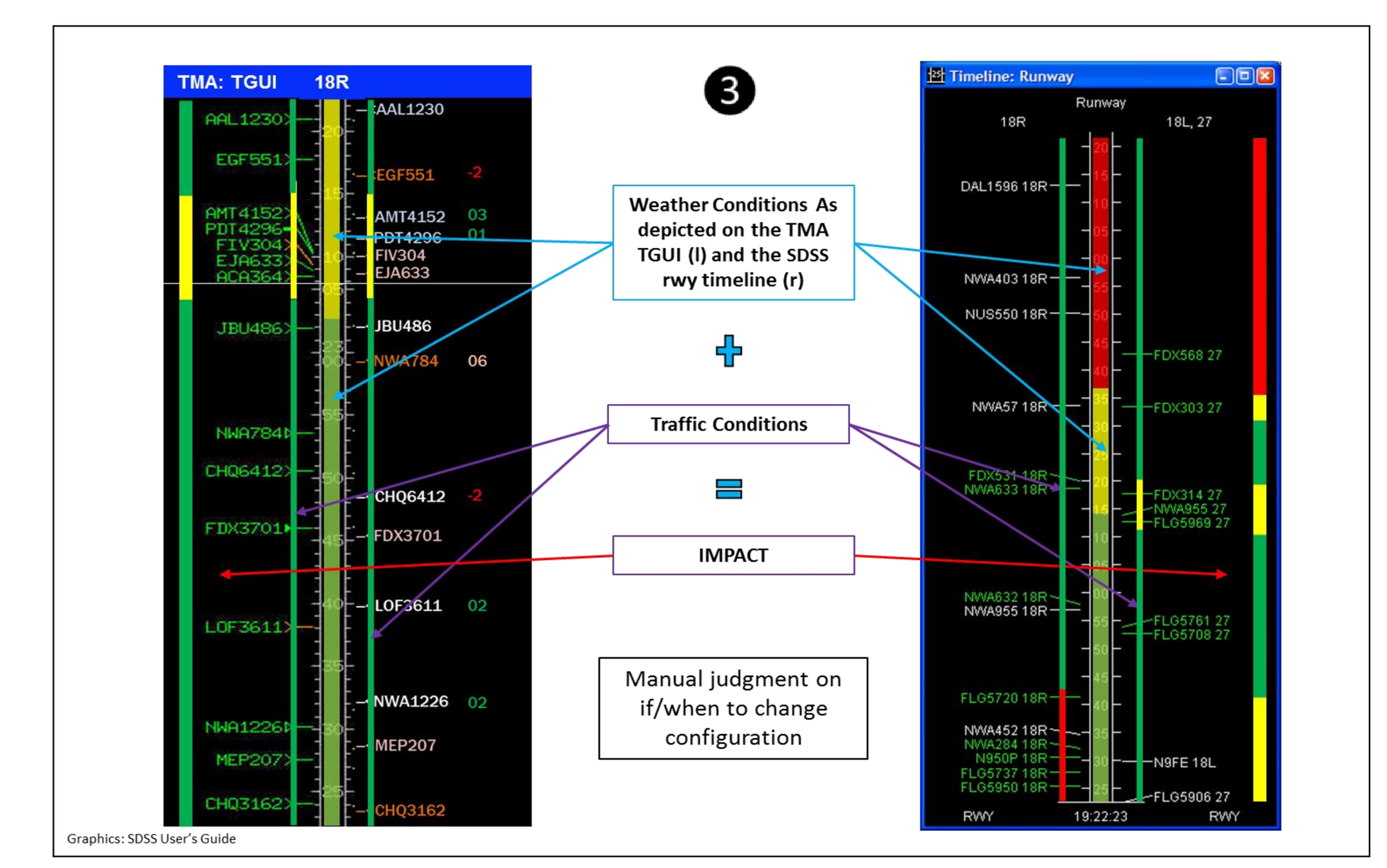
Application in the Surface Environment

There has been little to no application of weather integration in the surface environment. The first step will likely be automated indications or alerts (in the tower and TRACON) of impending conditions that will drive a change in airport configuration (1).



The indication (possibly of desirable, allowable, and out-of-limit conditions) may also be depicted on a runway load graph (2) allowing traffic managers and controllers better situational awareness when managing airport configuration.





The next step (3) will be the application of known and proposed traffic to determine impact. Traffic managers will be able to use this information for "what-if" decision making. Eventually, this information will be combined with additional filters (as indicated earlier) to develop solutions to individual airport surface conditions, which often have ramifications across the NAS.

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