# Air Force Integration of Weather In Mission Planning/Execution

## Friends and Partners in Aviation Meeting
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# Purpose

- **Discuss efficiencies gained when Air Mobility Command institutionalized weather risk management into airlift and tanker mission planning and execution processes**
- **Discuss how AF Weather would like to apply these lessons across the Air Force**

***Caveat: What the AF is doing, or can do, may not directly apply to NAS operations; but some concepts may apply***

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# What We Do Today

## A Combat Ops Force Multiplier

### Mission Timeline

- Long-range planning
- Troop deployments
- Course of action development

*Climatology, Seasonal Outlooks, long-range forecasts*

- Strategy Development
- AEF & Force Deployment

*5-day global / theater forecast*

- Commander's Guidance Letter
- Shape of the Battlefield
- Defensive / Offensive Planning

- Build Tasking Order; Weapon Selection
- AEF Employment

*Operational Area Forecast*

- Mission Planning

*Planning forecasts (mission-specific)*

- Tactic Selection
- Consider environmental effects

- Brief Crew

*Target forecasts (go / no-go)*

**Bombs on Target**

- BDA

H-30 days | H-120 Hrs | H-72 hrs | H-36 hrs | H-12 hrs | H-3 hrs | H-Hour | H+

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# What AFW Does Today

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**Recognized years ago we could do better factoring weather into planning to decrease crisis management during execution and increase effectiveness/efficiency—but required better tools/technology and a culture change**

*H-30 days* | *H-120 Hrs* | *H-72 hrs* | *H-36 hrs* | *H-12 hrs* | *H-3 hrs* | *H-Hour* | *H+*

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# Air Mobility Command's M2K Presents An Opportunity

- In late 1990's, AMC embarked on Mobility 2000 (M2K), an initiative to centralize planning and integrated flight management (IFM) for 300-400 airlift missions worldwide, daily
  - Opportunity to operationalize weather integration concepts previously tested during C-5 tail crack crisis
  - Opportunity to institutionalize business rules in Tanker Airlift Control Center (TACC) for integrating weather into planning
    - No longer personality dependent
    - Opportunity to leverage Command and Control (C2) technology during software development

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# TACC Weather Mission Under M2K

**Charged by the TACC Commander to ensure end-to-end fusion of weather and weather-driven hazard intelligence into C2 mission planning & execution in order to maximize the safety, survivability, and effective use of AMC assets executing missions globally in support of national objectives. Provides direct mission planning & execution products & services to the TACC & strategic airlift/tanker crews operating worldwide.**

**In past, except for exceptional events, weather was mainly only considered when crisis developed during execution**

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# Change Drivers

## Leadership and Culture

- **Major Organization Culture Shift In late 1990's (M2K)**
  - **Changed From Passive C2 During Execution Phase To Pro-Active, Anticipatory, "Co-Operation" To Prosecute Missions**
  - **Leadership Supportive Of ORM-Based "Business-Rules" To Manage Risk and Make Consistent Decisions**
- **Management of Such "Risks" Became An Organizational Goal and Responsibility**
  - **Ideal Environment For Wx Integration Into Planning and Execution……**
  - **But still fighting "Weather Guesser" mentality**
- **One significant event helped change that: Operation Anaconda**

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# Change Drivers

## Technology

- **Technology improved, advent of net-centricity**
  - **A Set of 1st/2nd generation tools allowed for:**
    - **Weather Data/Products, Risk Assessments, mission forecasts to be associated with each mission**
    - **Easy collaboration/communication with mission planners and decisionmakers within the new command and control domain**
    - **All command and control participants had a a "Common Picture" of weather related to each mission**
  - **For weather operators, process was still manpower intensive and the high number of missions required use of operational risk management processes**

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# TACC Approach to Reducing Weather Impacts

- **FIRST STEP: Identify missions "At RISK"**
  - **Those missions identified with a high degree of certainty that WILL NOT EXECUTE AS PLANNED (i.e. delay) DUE TO WEATHER**
    - **Annotated as "RED Missions"**
    - **About 5% Identified As RED**
    - **Weather operators ASSIGN A RISK CATEGORY to each Mission for inclusion in the C2 system**

- **SECOND STEP: Manage/mitigate RED risks, if possible "GREEN UP" the mission prior to execution**
  - **"RED Forecaster" Initiates The TACC ORM Actions**
    - **Develops Weather-based "Options" For Reduced Risk**
    - **Consults TACC Planners, Flight Managers, decisionamkers**
  - **TACC Planners, Flight Managers**
    - **Consult With RED Forecaster To Develop Mitigation Strategy**
    - **Mitigation Process "GREENS UP" About 80% Of The Missions**

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# TACC Approach to Reducing Weather Impacts

View: 15 OWS IN FLIGHT * Filter: 15 OWS IN FLIGHT * Layout: IN FLIGHT *

| Flight Mgr | Crew Paper | Mission | Flight Type | Call Sign | Tail | A/C Type | Wx ORM | Status | Dep Airfield | Dep Exc | Dep Dev | Off | Arr Airfield | Arr Exc | ETA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | PB 1-2 | AMYF310YT306 | CONTIN | RCH377 | 80054A | C017A | G | IN FLIGHT | OKBK | Notam | -00:10 | 5306/1005 | ORTF | Notam | 5306/11 |
| 10 | PB 1-1 | 7JH88CL1S305 | REFUEL | RCH311 | 80010S | KC135R | G | IN FLIGHT | KMEI | Notam | | 5306/0018 | SAZB | | 5306/11 |
| 10 | PB 1-1 | 7JH88CL2S305 | REFUEL | RCH320 | 72597S | KC135R | G | IN FLIGHT | KMEI | Notam | | 5306/0125 | SAZB | | 5306/13 |
| 13 | PB 1-2 | ABW20F5D5306 | CHANNE | RCH174 | 60004A | C017A | G | IN FLIGHT | LTAG | Notam | | 5306/1108 | ORAT | Notam | 5306/13 |
| 5 | PB 1-1 | 8MH47UG49304 | DEPLOY | RCH287 | 38885S | KC135R | Y | IN FLIGHT | EGUN | Notam | +00:10 | 5306/0640 | OTBH | Notam | 5306/13 |
| 5 | ACP 1-1 | 7JH88CL3S305 | REFUEL | RCH335 | 91478S | KC135R | G | IN FLIGHT | KMEI | Notam | | 5306/0152 | SAZB | | 5306/13 |
| 4 | PB 1-1 | JBBGKF50B306 | CHANNE | RCH3118 | 33118A | C017A | G | IN FLIGHT | KADW | Notam | +00:20 | 5306/0600 | ETAR | Notam | 5306/13 |
| 7 | PB 2-2 | 6QC52P50D305 | CHANNE | RCH114 | 30076S | KC010A | Y | IN FLIGHT | WSAP | Notam | -00:23 | 5306/0922 | FJDG | Notam | 5306/13 |
| 6 | ACP 1-2 | AMYF281YT303 | CONTIN | RCH372 | 80049A | C017A | G | IN FLIGHT | OTBH | Notam | +00:15 | 5306/1149 | ORBI | Notam | 5306/13 |
| 15 | PB 1-2 | ABW20N7D7306 | CHANNE | RCH180 | 90167A | C017A | Y | IN FLIGHT | LTAG | Notam | | 5306/1234 | ORQW | Notam | 5306/13 |
| 2 | PB 1-2 | PVZF114SD303 | CONTIN | RCH0175 | 00175A | C017A | Y | IN FLIGHT | KCHS | Notam | +20:12 | 5306/1047 | KCOS | Recut | 5306/14 |
| 12 | PB 1-1 | AVYF269YT306 | CONTIN | RCH340 | 00179A | C017A | G | IN FLIGHT | UAFM | | -00:46 | 5306/1014 | OTBH | Notam | 5306/15 |
| 10 | PB 2-2 | AVW2060D2306 | CHANNE | RCH198 | 80055A | C017A | Y | IN FLIGHT | ORBI | Notam | -00:20 | 5306/1250 | LTAG | Notam | 5306/15 |
| 9 | PB 2-2 | PAM752699306 | SAAM | RCH900 | 00184A | C017A | G | IN FLIGHT | MPTO | | +00:00 | 5306/1022 | KDOV | Notam | 5306/15 |
| 14 | PB 1-1 | 6JM319899306 | SAAM | RCH9947 | 91947S | KC010A | G | IN FLIGHT | KWRI | Notam | | 5306/1142 | MUGM | Notam | 5306/15 |
| 8 | PB 1-1 | AAM6238X1302 | SAAM | RCH6008 | 60008A | C017A | R | IN FLIGHT | ETAR | Notam | +00:05 | 5306/0535 | KLSF | Notam | 5306/16 |
| 9 | PB 1-1 | 6BC458200304 | CHANNE | RCH9711 | 91711S | KC010A | G | IN FLIGHT | RJTY | Notam | -16:19 | 5306/0814 | KSUU | Cig | 5306/16 |
| 12 | ACP 1-1 | PVRM70578304 | CONTIN | RCH389 | 90058A | C017A | G | IN FLIGHT | OTBH | Notam | +00:09 | 5306/1008 | ETAR | Recut * | 5306/16 |
| 5 | PB 1-1 | PMYN80391299 | CONTIN | RCH232 | 00185A | C017A | G | OFF | ETAR | Notam | +20:45 | 5306/1335 | LGSA | Notam * | 5306/17 |
| 8 | PB 1-2 | PLM101102306 | AIREVA | EVAC01 | 71473S | KC135R | Y | IN FLIGHT | FJDG | Notam | +01:26 | 5306/1226 | WSSS | Notam * | 5306/17 |
| 11 | ACP 1-1 | 8MH47UH49306 | DEPLOY | RCH282 | 80027S | KC135R | Y | IN FLIGHT | OTBH | Notam | | 5306/1035 | EGUN | Notam * | 5306/17 |
| 8 | PB 1-1 | ALM101128304 | SAAM | RCH027 | 00172A | C017A | G | IN FLIGHT | ETAR | Notam | +00:42 | 5306/1040 | UAFM | Vis * | 5306/18 |
| 8 | PB 1-1 | PAM163401302 | SAAM | RCH574T | 10187A | C017A | G | ARR DIVERT | KFFO | Notam | +31:33 | 5306/1018 | BIKF | Recut * | 5306/18 |
| 7 | PB 2-2 | PAM749001304 | SAAM | RCH929 | 21110A | C017A | G | IN FLIGHT | MROC | Notam | -00:30 | 5306/1127 | SADP | Notam | 5306/19 |
| 9 | PB 1-1 | GMYF36165305 | CONTIN | RCH186 | 21851T | C130E | G | IN FLIGHT | OKAS | Notam | | 5306/1325 | LGSA | Notam | 5306/19 |
| 4 | PB 1-1 | AJM130412305 | SAAM | RCH914 | 60015B | C005B | Y | IN FLIGHT | FJDG | Notam | +00:33 | 5306/0933 | RJTY | Notam * | 5306/20 |
| 4 | PB 1-1 | 6JH414D21304 | CORONE | PETRO01 | 40192S | KC010A | G | IN FLIGHT | KSUU | Notam | +04:15 | 5306/1010 | RJSM | Notam * | 5306/21 |
| 7 | PB 1-1 | AAM748301306 | SAAM | RCH930 | 44129A | C017A | Y | IN FLIGHT | KNYG | Notam | -00:10 | 5306/1150 | SBBR | TRW * | 5306/21 |
| 12 | PB 1-1 | JVBGOX40G306 | CHANNE | RCH1653 | 11653T | C130H | G | IN FLIGHT | KLFI | Notam | +00:13 | 5306/1313 | KBOI | Notam * | 5306/21 |
| 14 | PB 1-1 | PVM752399304 | SAAM | RCH989 | 10186A | C017A | G | IN FLIGHT | SAEZ | Notam | +00:10 | 5306/1325 | TJSJ | Notam * | 5306/21 |
| 10 | PB 1-1 | XBRRO360A306 | CHANNE | RCH210 | 80220B | C005A | G | IN FLIGHT | UAFM | | +01:40 | 5306/1210 | LEMO | Notam * | 5306/21 |
| 5 | PB 1-1 | ZVR66IH01306 | CONTIN | RCH037 | 80075S | KC135R | G | IN FLIGHT | LTAG | Notam | | 5306/1107 | KADW | Notam * | 5307/00 |

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# TACC Approach to Reducing Weather Impacts

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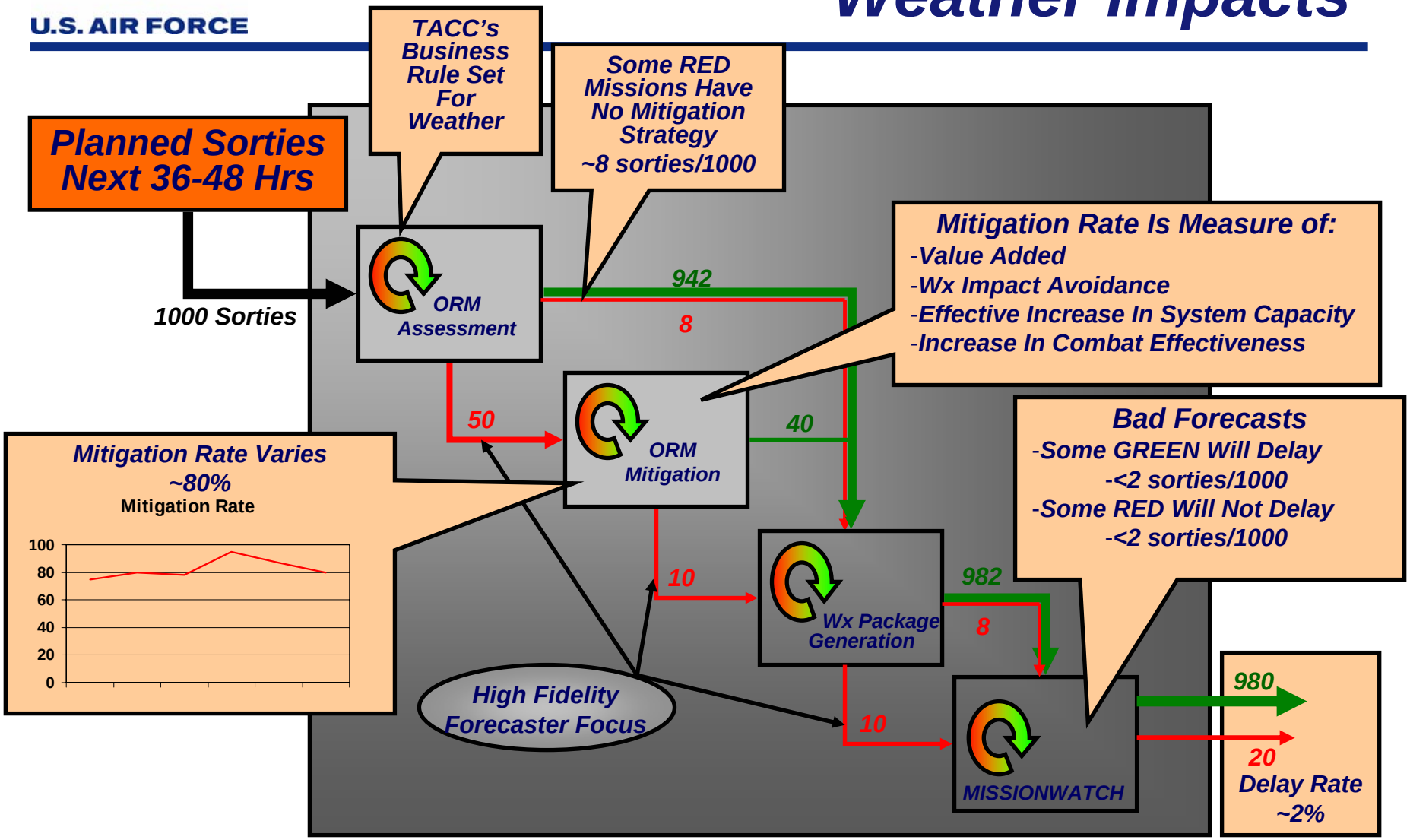

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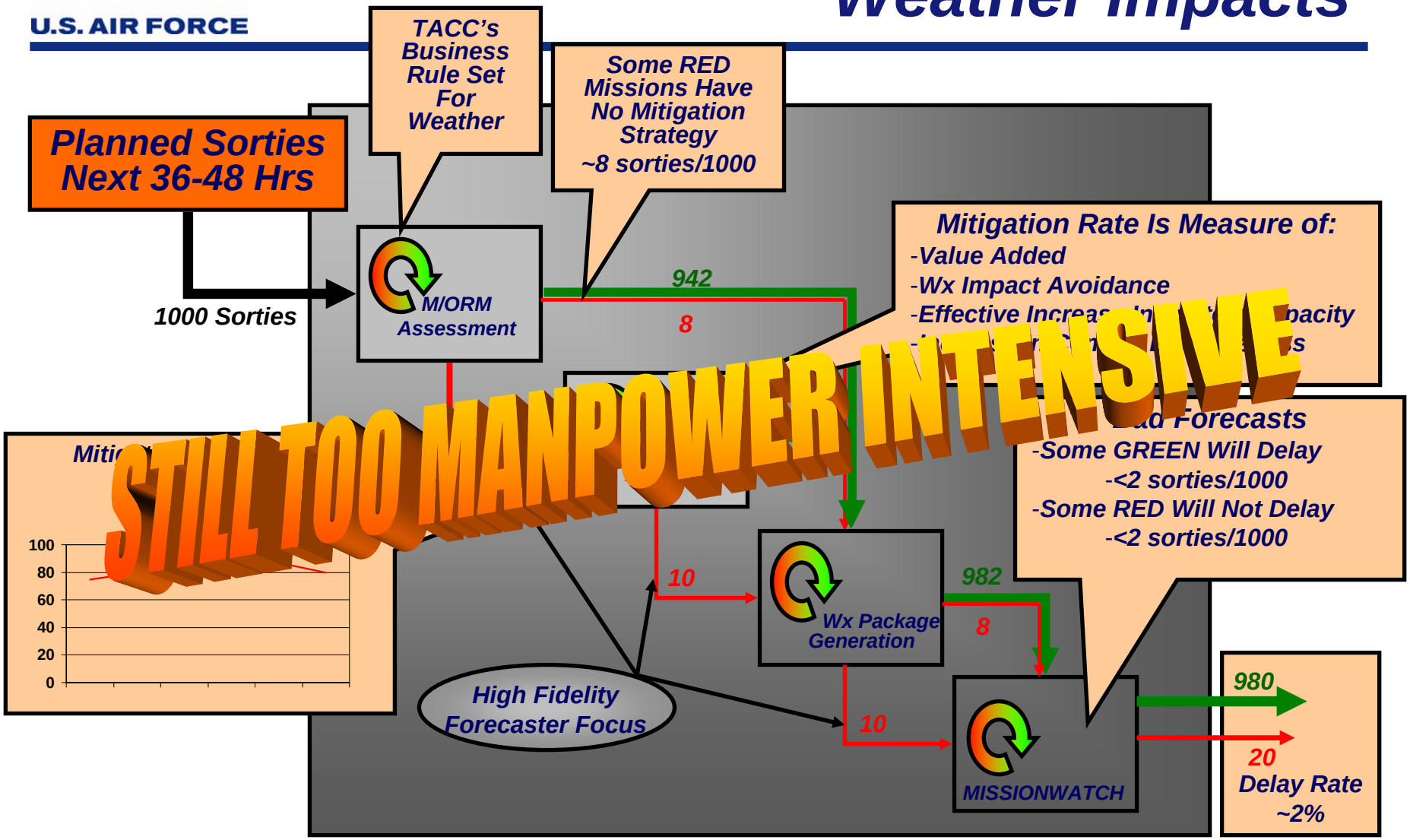

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# TACC Results

- Delay rate cut from 4.8% to 1.8% or from ~ 5,000 annually to 2,000 annually
- Results occurred:
  - Without any initiatives to increase forecast accuracy
  - Without changing mission profiles when forecast certainty was not “in the comfort zone”
  - With 1st and 2nd generation technology tools
    - Very rudimentary machine-to-machine weather transfers
    - No automated business rules
- Tremendous opportunities for improvement and implementation across the AF

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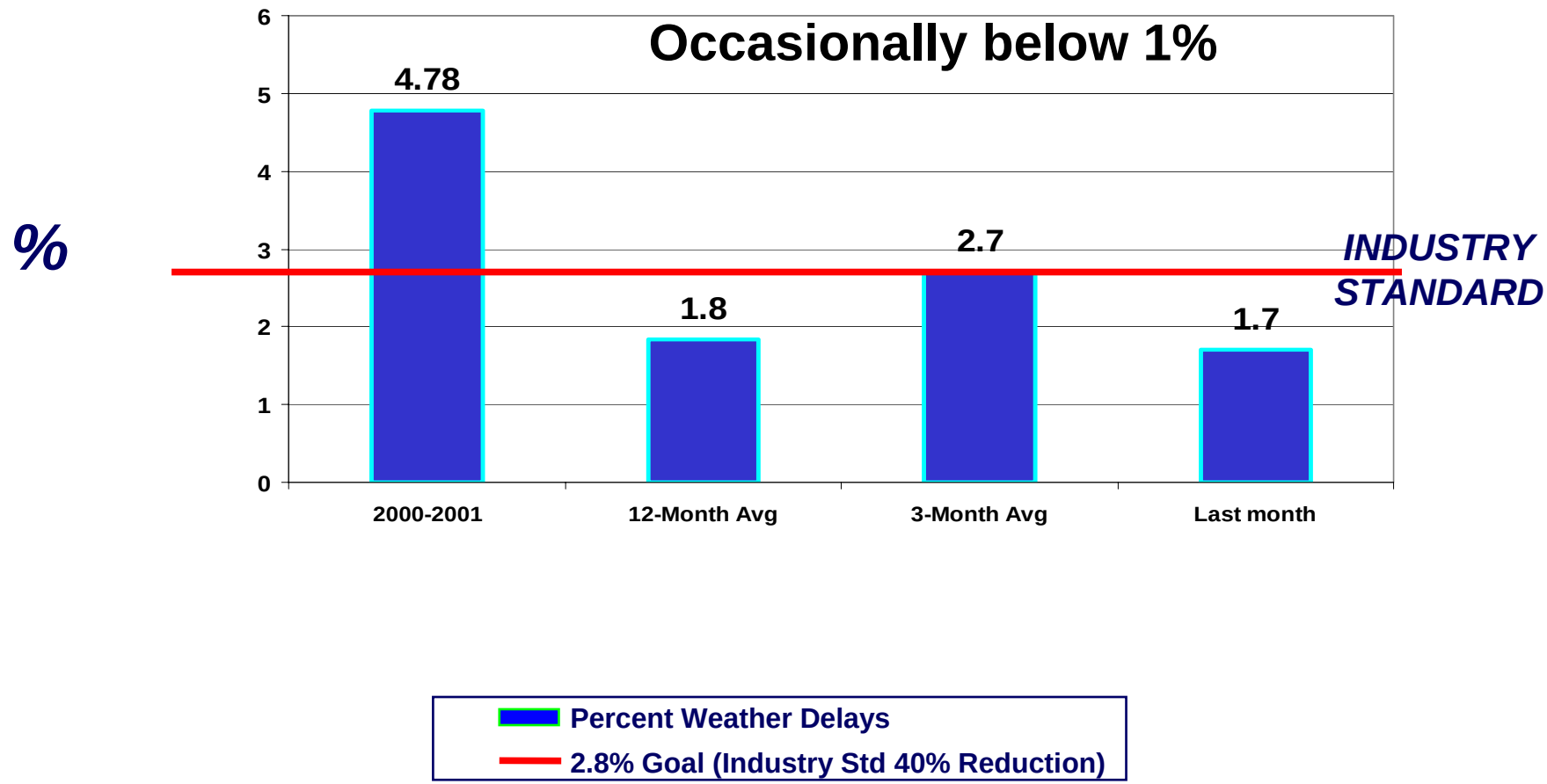
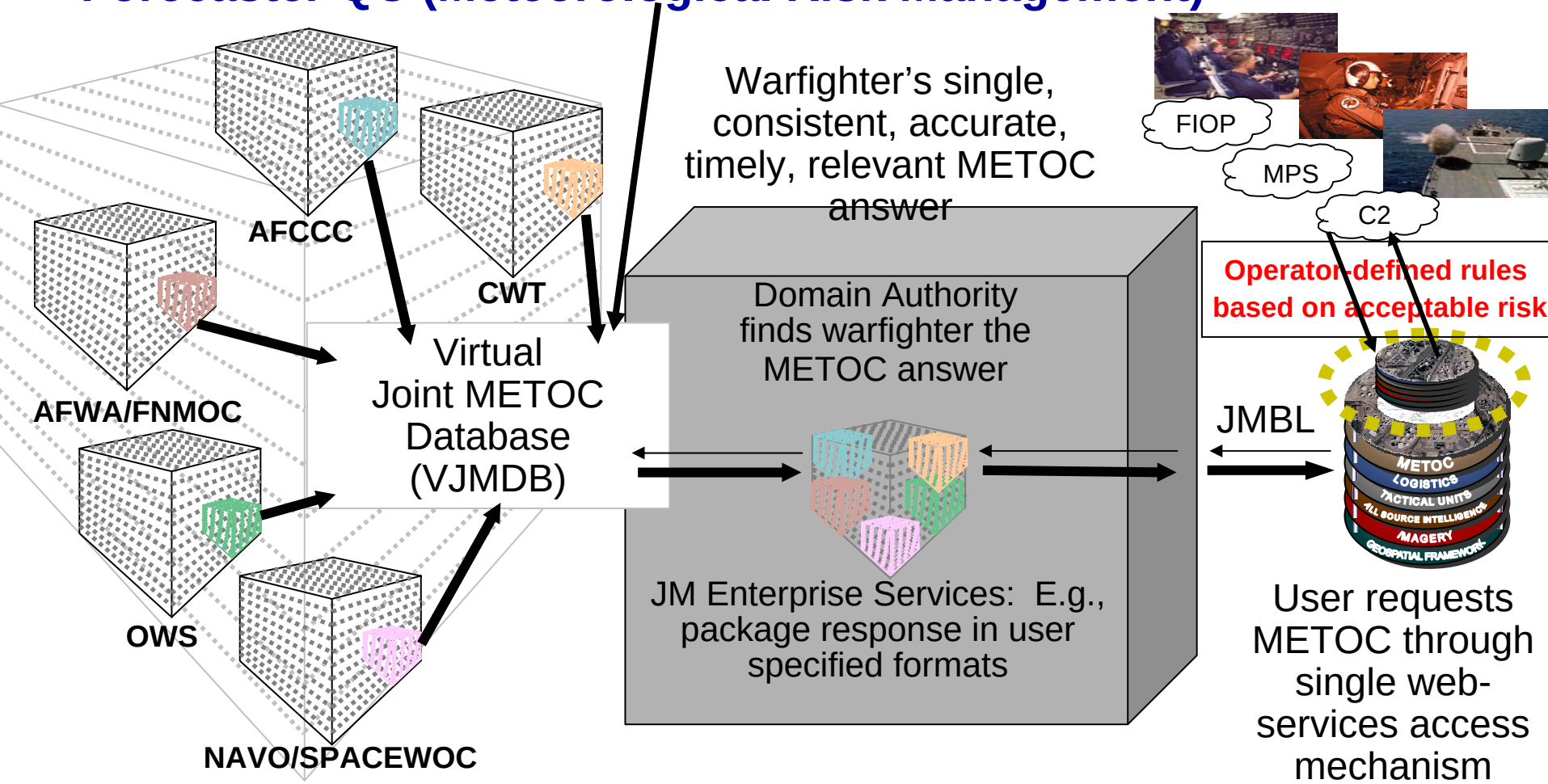
# TACC Results



# The Future—Across All Mission Areas

## Forecaster QC (Meteorological Risk Management)



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# The Future

- Machine to Machine weather directly into C2 decision systems
  - 4-D datacube of environmental info
  - Forecaster QC
  - Rapid updates for time-sensitive targeting
- Automated probabilistic information
- Quantify weather risk, identify options
- Operator-defined institutional business rules to mitigate or exploit the environmental impacts—operational or training missions
  - Fighter
  - Bomber
  - ISR
  - Airlift
  - Tanker
  - Airfield services
  - Army operations

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# Conclusion

- There are lessons here that apply to NGATs vision
- Will require cultural change in how weather is viewed and integrated today
- Will require consistent, repeatable processes
  - Ad hoc, personality-driven application and only using weather during crisis mode will not achieve benefits
- AF is ready to assist
  - Datacube design and development
  - Lessons learned WRT METOC Broker Language development
  - Lessons learned on improving system efficiency
  - Multi-level security

# Questions?