

# NextGen benefits evaluation: Air carrier perspective



## Federal Aviation Administration

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# Airline-specific NextGen benefits assessment and equipage investment decision methodology

## Methodology

- 1 Calculate full NextGen benefit for all stakeholders
- 2 Using FAA SWAC model, calculate direct benefits for specific carriers
- 3 Calculate equipage-dependent benefits
- 4 Run NPV analysis based on equipage costs, fleet retirements, and ramp up of NextGen benefits

## NEXTGEN BENEFITS NextGen delivers three categories of benefits—direct airline/operator benefits, industry benefits, societal benefits

Type of benefit	Description	Example metrics
Direct airline/ operator benefits	<ul> <li>Direct OpEx savings from reduced flight times (direct routings, ascent/descent)</li> <li>Direct OpEx savings from reduced delay/congestion</li> <li>Savings from network reoptimization</li> <li>Improved predictability (i.e., reduced variance)</li> <li>Flight cancellations</li> </ul>	<ul> <li>Reduced average flight time</li> <li>Reduced average delay per flight</li> <li>Reduced flight operating costs, including fuel (e.g., ADOC)</li> <li>Increased fleet utilization</li> <li>Reduced flight cancellations</li> <li>Reduced block times</li> </ul>
Industry benefits	<ul> <li>Additional capacity for new flights, particularly at busy airports</li> <li>Increased system resiliency, including, faster recovery from irregular operations (e.g., recovery from weather events)</li> </ul>	<ul> <li>Additional industry revenue</li> <li>Additional available flights/seats</li> <li>Additional airport passengers</li> <li>Reduced overall delay during irregular operations</li> </ul>
Societal benefits	<ul> <li>Societal benefits for passengers, airports</li> <li>Environmental benefits</li> <li>Safety benefits</li> </ul>	<ul> <li>Reduction in CO<sub>2</sub> emissions per flight</li> <li>Elimination of lost passenger value of time</li> </ul>

## NEXTGEN BENEFITS FAA annually assesses NextGen benefits; current estimates show the program will deliver ~\$134B of benefits to NAS through 2030



1 Based on FAA's 2014 Business Case for NextGen, plus additional estimates of benefits, based on team analysis

2 Assumed SWAC fuel price = \$2.45/gal (constant); internal benefits (fixed costs) to airlines not calculated in direct OpEx benefits, as well as small program benefit estimates that may include some PVT and safety value also included in airline cost savings

3 Benefits from SWIM considered FAA efficiencies



#### Integrated Flight Planning

Operators and traffic managers have immediate access to identical weather, aeronautical, and flight information through one data source.

### Streamlined Departure Management

**RNAV** and **RNP** precision allows multiple departure paths from each runway. Departure capacity increased.

#### **Efficient Cruise**

**RNAV, RNP** and **RVSM** utilize reduced separation requirements increasing airspace capacity. Aircraft fly most optimal path using trajectory-based operations considering wind, destination, weather and traffic. Re-routes determined with weather fused into decision-making tools are tailored to each aircraft. **Data Communications** reduce frequency congestion and errors. **ADS-B** supported routes available for equipped aircraft.



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### **Streamlined Arrival Management**

Arrival sequence is planned hundreds of miles in advance. **RNAV** and **RNP** allow multiple precision paths to runway. Equipped aircraft fly precise horizontal and vertical paths at reduced power from descent point to final approach in almost all types of weather. Time and fuel are saved. Emissions and holding are reduced.

Domestic / Oceanic Cruise

Flight Planning Push

Push Back / Taxi / Takeoff

### Surface Traffic Management

Automation optimizes taxi routing. Provides controllers and pilots all equipped aircraft and vehicle positions on airport. Real-time surface traffic picture visible to airlines and controllers. Surface movement management linked to departure and arrival sequencing. **ADS-B** and **SWIM** contribute to this function. Taxi times reduced and safety enhanced.

### **Enhanced Predeparture Clearances**

Pilots and controllers talk less by radio. **Data Communications** expedite clearances, reduce communication errors. Pilot and controller workloads reduced.

#### Descent / Final Approach / Landing

#### Surface Traffic Management

Runway exit point, assigned gate and taxi route are sent by **Data Communications** to pilots prior to approach. Pilot and controller workload reduced and safety improved.

## **NextGen PHASES OF FLIGHT**

www.faa.gov/nextgen

## NEXTGEN BENEFITS Implemented improvements have generated >\$1.5B in benefits from 2010-2014; future benefits from implemented changes may reach ~\$11B

NAC priorities **Bold = large benefits** 

Benefits from implemented operational NextGen portfolio improvements in 2010-2014 (\$M FY2014)		Improvements included in 2010-2014 benefit	
Time-Based Flow Management	635	<ul> <li>Traffic Management Advisor (TMA) system at ATL, EWR, FLL, SFO, DTW, LAS, LGA, PHL (implemented, not evaluated at IAH, SAN)</li> <li>Adjacent Center Metering (ACM) at IAD, ATL, SAN, LAX, SFO, TEB, HPN, DCA, BWI, CLE</li> </ul>	
Performance Based Navigation	580	<ul> <li>RNP &amp; RNP Authorization Required approaches</li> <li>Transition to PBN routing for cruise operations</li> <li>RNAV Standard Instrument Departures (SIDs) and Standard Terminal</li> </ul>	
Improved Multiple Runway Ops	46	Arrivals (STARs) at Single Sites: Equivalent Lateral Spacing Operations (ELSOs)	
Improved Surface Ops	35	<ul> <li>Dependent approaches at SFO</li> <li>Use Converging Runway Display Aid</li> </ul>	
Improved Approach & Low-Vis Ops	27	<ul> <li>Airport Surface Detection Equipment (ASDE-X) at 35 large airports</li> <li>Initial tailored arrivals</li> <li>Expanded low visibility ops using lower RVR minima (incl. SA-Cat I, SA-Cat II)</li> </ul>	
Separation management	Approx. \$534M accrues to carriers 188	• Optimized Profile Descents (OPDs)	
		<ul> <li>Wake Re-Cat</li> <li>Alaska accidents and Gulf of Mexico Low-Altitude Efficiency</li> </ul>	
Total	1,51	<ul> <li>Full evaluation for NAS infrastructure and CATM portfolios pending</li> </ul>	

## MASKED EXAMPLE AIRLINE BENEFITS Airline A operations are estimated to reduce costs by ~\$XM (~Y% of OpEx, Z% of current operating income) due to NextGen in 2020



1 Benefits for some ADS-B, CATM-T, DataComm, NVS, TBFM, Colorado WAM, AIM, TFDM, NWP improvements taken from PMO estimates and apportioned based on Airline A's share of NAS departures in 2013; SWIM not included; assumes full compliance with ADS-B Out mandate and ~30% DataComm equipage across NAS

2 Assumed SWAC fuel price = \$2.45/gal (constant); ADOC escalated to FY2014 3 Estimated based on YE3Q2014

SOURCE: SWAC model, NGIP, Form 41 operating expense information, non-SWAC FAA NextGen studies, SEC filings

## MASKED EXAMPLE AIRLINE BENEFITS NextGen benefits are sensitive to key assumptions; benefit range for Airline A is \$YM to \$ZM in 2020

### **Scenarios**

High sensitivity assumptions

Assumption	Low benefit case	Expectation	High benefit case
Air traffic growth <sup>1</sup>	<ul> <li>No annual operations growth</li> </ul>	<ul> <li>~2% CAGR ops growth (airport specific, TAF<sup>4</sup>), ~2% CAGR enplanement growth</li> </ul>	<ul> <li>~3% CAGR operations growth</li> </ul>
Fuel price <sup>1</sup>	<ul> <li>Fuel price 20% lower</li> </ul>	<ul> <li>Fuel price = \$2.45/gallon</li> </ul>	<ul> <li>Fuel price 20% higher</li> </ul>
NextGen rollout <sup>1</sup>	<ul> <li>Average program delayed 1 year</li> </ul>	<ul> <li>Programs delivered on-time per 2014 NextGen implementation plan</li> </ul>	<ul> <li>Average program accelerated 1 year</li> </ul>
2020 equipage <sup>1</sup>	<ul> <li>Static FY14 levels: + ADS-B</li> <li>100% ADS-B</li> <li>7% DataComm</li> </ul>	<ul> <li>NextGen projection:</li> <li>100% ADS-B out</li> <li>30% DataComm</li> </ul>	<ul> <li>Full equipage:</li> <li>100% ADS-B out</li> <li>100% DataComm</li> </ul>
Runway infra- structure <sup>2</sup>	<ul> <li>All runway projects accelerated by 2 years</li> </ul>	<ul> <li>All runway projects delivered as planned (includes FLL, SAT, ORD, etc.)</li> </ul>	<ul> <li>Runway projects delayed by 2 years</li> </ul>
Airline-specific Assumptions	<ul> <li>All scenarios assume flight schedule is grown proportionally and fleet migrated within size categories to newer models<sup>3</sup></li> </ul>		
2020 ops benefit (FY13)	• \$YM	• \$XM	• \$ZM

1 Estmates based on SWAC model sensitivities and benefit growth rates; 2 Assumes airline is impacted by runway infrastructure that has <1% impact on overall benefits from basecase; 3 This ensures NextGen is not credited with benefits from inefficient aircraft; realistic fleet model is used in equipage investment case; 4 TAF is a demand based model but accounts for gauge, load factor etc. assumptions to derive operations projection

# NextGen delivers operating improvements: example flight from LGA to ATL saves 11% airline OpEx cost



1 Gate delay modeled in SWAC

# 3 Analysis suggests ~\$XXM annual flying overhead expense savings in 2020

Category	Description	Unit cost improvement	Estimated savings	
Airport gate savings	Reduced gate delay frees up gatesand streamlines operations	Annual gate fees of ~\$800,000	\$X M	
Reserve crew savings	Fewer pilot, FO, FA, reserve crews daily	Pilot/FO at \$170k all-in pay; FA @ \$36k	\$X M	
Flight dispatch savings	NextGen systems and automation reduce workload demands on dispatchers	\$97k all-in pay per dispatcher	\$XM	
Ground personn savings	Reduced delay and better information power efficient allocation of rampers, gate and ticketing agents	\$24k annual pay per gate agent / ramper	\$X M	
Airframe lease reduction	Efficient air traffic management reduces delays and reallocates utilization of airframes, which can be used for other flying	Average narrowbody lease rate for mid-age 738 of \$200k/month → \$2.4M/year	\$X M	
Off-schedule recovery	Revenue protection and cost avoidance due to incremental off-schedule operations recovery, excluding delay and cancellation savings <sup>1</sup>	10% improvement on OSO recovery and spoilage costs of \$50M per anum	\$X M	
Note that excess resources are valued at cost in this estimation; resources such as gates and personnel could also be used to generate revenues				

1 Delay and cancellation savings modeled in "direct benefits"

# A NextGen adds ~9% capacity at Core 30 airports and increases potential ops by 11% in poor weather Base case operations Additional operations with NextGen



1 Weighted average calculated from average frontier for Pareto curve for Core 30 NAS airports

2 Calculated from average frontier of Pareto curve

### 4 Forecasts estimate that added NextGen capacity may reduce per flight delay by 5-25% at major stations

delay by 5-25% at major stations



### Average ATC delay<sup>1</sup> at major stations (no traffic growth)

Additional expected average ATC delay without NextGen

Average delay minutes per flight by arrival airport, FY2020



1 Includes taxi in, taxi out, airborne, and gate delay; GDP excluded to avoid double counting; all delay attributed to arrival airport of segment

# 5 Improvements in predictability enable carriers to reduce buffers and block times



# 5 NextGen flight and delay time savings are accompanied by an increase in system predictability, allowing airlines to fully "bank" savings



- For high-traffic highdelay segments,
   NextGen reduces both delays and delay uncertainty
  - Airlines can "bank" delay time savings through schedule changes (incl. OpEx and overhead savings) without impacting on-time performance and other operational performance metrics
- Delay variance reduction is even more dramatic than time reduction
  - Significantly improved delay predictability allows further reduction in OpEx savings and flying overheads without increasing operational risks

## MASKED EXAMPLE AIRLINE BENEFITS **5 Additional savings from predictability adds \$XXM in 2020 benefit**

Example airline 2020 cost improvements from impacts of NextGen If airlines schedule block technologies, including predictability savings time to 80<sup>th</sup> percentile delay \$M FY2013 time instead of mean delay, NextGen improvements to system predictability will drive addtiional \$XXM in Х benefit  $X^2$ X Х 2020 time savings Х X Millions minutes per year **X**<sup>1</sup> From reduced Х average delay Х Х From reduced Х delay variation **Total NextGen** Х time savings Assumes airlines Fuel Non-fuel Direct OpEx Flying Profit from **Total 2020** schedule to 80<sup>th</sup> savings1 OpEx savings overhead additional benefits percentile delay time savings<sup>1</sup> capacity instead of mean delay expense

1 Assumes maintainance costs are not saved through variability reduction, only accounts for crew costs based on scheduled block-times; subject to airline ability to capture

2 Assumes reserve crew savings, flight dispatch savings, airframe lease reduction and off-schedule recovery reduction apply to time savings form reduced delay variation

# EQUIPAGE INVESTMENT Equipage-dependent NextGen benefits of \$XXM for Airline A imply a Yyear payback period



1 Most of equipage dependent benefit from SWAC model, remainder from PMO estimates 2 Also required for ADS-B In benefits

### EQUIPAGE INVESTMENT

# NextGen benefits grow 15% per annum and the proportion of equipage dependent benefits rises from 18% to 42%



### EQUIPAGE INVESTMENT

# For each airline, we presented the equipage investment case and sensitivity analyses around the NPV

#### **Assumptions** PV of 2020-2030 2020-2030 NPV return on 2020 equip-driven PV of equipage equipage investment **Airframes** benefit (2013 \$M) cost<sup>1</sup> (2013 \$M) (2013 \$M) Fleet 10-year NPV \$XX \$XX \$XX XX 737-700 All values calculated in XX 737-800 2013 dollars 737-900 ХХ Assumed 4% NPV return on equipage investment: sensitivity to aircraft retirement inflation-adjusted ХХ 747-400 and equipage cost (2013 \$M) WACC 757-200 ХХ Fleet retirement Aircraft retire at: at ~27 years 25 years 27 years 30 years 757-300 XX Benefits grow at 767-300 ХХ • \$XX • \$XX \$XX Reduced 2% p.a. cost Benefits accruing ХХ 767-400 (-10%) between 777-200 XX equipage and • \$XX • \$XX • \$XX Equipage 2020 not counted Expected 788/789/781 XX costs: Average cost for XX 737 MAX ADS-B Out and • \$XX • \$XX • \$XX Increased partial A319 ХХ cost DataComm : (+10%) \$154,000 (retrofit) XX A320 or \$82,000 A350 XX (forward fit) **Total** YYY

#### 1 Assumes full ADS-B out, 30% DataComm equipage