INTRODUCTION

Over the next 10-15 years, the global pilot workforce will undergo a dramatic change. Aviation is continuing to grow, creating a demand for pilots that exceeds supply in most places; at the same time, an increasing number of pilots in the baby-boom generation are reaching mandatory retirement age. New pilots will join airlines that are larger than ever before, making it more difficult to build a connected and engaged workforce. And overhanging all of this is an evolution in technology set to usher in augmented and autonomous flying – fundamentally altering the cockpit working environment.

With these perspectives in mind, leading airlines and their suppliers are starting to rethink the way Flight Operations departments are designed and managed, with the goal of balancing operational, cost, and employee requirements. Flight Operations departments are being compelled to develop clear, supported strategies focused on pipeline and training, pilot connectivity and engagement, and the best use of new data and technology. Being successful in these areas will not only minimize costs but enable airlines to differentiate themselves as leaders of the pilot workforce of the future.

In this inaugural edition of Oliver Wyman’s Flight Operations Survey report, readers will be privy to the Flight Operations topics that are top-of-mind for aviation and aerospace industry leaders. Our perspectives are based on many years of experience working with Flight Operations departments around the world, one-to-one interviews with selected executives, and a survey of senior management at international airlines, cargo operators, original equipment manufacturers, and training companies.

This analysis builds on and adds to our comprehensive suite of aviation and aerospace research, including our annual Airline Economic Analysis, Global Fleet and MRO Forecast, and MRO Survey publications, as well as our continuously updated PlaneStats website.
MEGA-DISRUPTION IN FLIGHT OPERATIONS

Flight Operations leaders face many pressures in seeking to run efficient organizations (Exhibit 1). Cost pressures remain the most prevalent disruptor and few decisions are taken within the Flight Operations environment without a consideration of cost. Another emerging issue is a greater focus on the workforce of the future, from the pilot pipeline and how best to engage with pilots, to technology and data disruptors that could radically alter the nature of work.

THE NEXT GENERATION
Over the coming decade, an existing pilot shortage will be exacerbated by a bow wave of retirements. In the US alone, more than 30 percent of pilots will reach mandatory retirement age by 2027. According to Boeing’s 2018 Pilot Outlook, some 127,000 commercial airline pilots will be required in North America over the next 20 years in response to airline growth and retirements. This will create opportunities for new pilots as well as risks for airlines. While more heavily studied in the North American context, the challenge will be global, as Boeing also reports that Asia will need 240,000 new commercial pilots by 2037.

UNPRECEDEDNT AIRLINE SCALE
The average global commercial airline in the year 2000 had about 55 aircraft and 700 pilots. Today, through consolidation, bankruptcies, and rapid growth around the world, the average global commercial airline has seen its fleet grow by 45 percent, to an average of 80 aircraft, and...
its flight deck crew by 57 percent, to an average of 1,100 pilots. (The largest airlines in the world have workforces of up to 15,000 pilots.) Larger airline size will have a real impact on the pilot of the future, who will most likely join as a junior member of a massive workforce that is based on seniority. And for a distributed workforce, centralized events outside of mandatory training will be costlier, meaning fewer one-to-one touchpoints and a less direct relationship to the culture.

BIG DATA, BIG OPPORTUNITY
As the workforce changes, ways of working are expected to shift, too, with data being a core driver of change. For example, a major airline recently stated that it plans to be the most data-driven airline in the world and is investing heavily in advanced data and analytics capabilities. Within Flight Operations, industry leaders expect data transmission and collection to increase in volume, sophistication, and real-time availability.

Big data could enable airlines to more precisely pinpoint where and when pilots are in the network, for example, to more quickly recover from severe weather impacts. It could be used to better customize pilot training (by tailoring it to different learning styles and levels of performance) and to create better links between training and actual pilot behavior in the cockpit, while generating significant cost savings. At the same time, increased data availability will raise new questions about privacy and monitoring that could further challenge current relations among pilots, labor unions, and airlines.

TECHNOLOGY’S (LIMITED) TAKE OFF
The aerospace industry is entering an era of “mega-disruption” and no part of the aircraft is more a target for technological evolution than the flight deck. While most respondents to our survey believe that new technology will continue to challenge the status quo, surprisingly few believe that major advances will be ready for prime-time before 2030.

Flight Operations leaders expect that external factors such as regulatory approval and cybersecurity concerns will limit adoption of large-scale technology changes in the near term (Exhibit 2). One of the most critical constraints, however, is simply airline scale: Adopting major

Exhibit 2: “Which of these challenges do you expect to constrain progress the most significantly over the next 15 years as cockpit technology is developed?”
Percent of respondents (selecting up to three)

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulatory adaptation</td>
<td>63</td>
</tr>
<tr>
<td>Airline readiness</td>
<td>50</td>
</tr>
<tr>
<td>Implementation costs</td>
<td>47</td>
</tr>
<tr>
<td>Cybersecurity</td>
<td>37</td>
</tr>
<tr>
<td>Pilot adaptation</td>
<td>33</td>
</tr>
<tr>
<td>Pilot readiness</td>
<td>17</td>
</tr>
<tr>
<td>Retraining costs</td>
<td>10</td>
</tr>
<tr>
<td>Passenger readiness</td>
<td>10</td>
</tr>
<tr>
<td>Don’t know/unsure/other</td>
<td>7</td>
</tr>
</tbody>
</table>

Source: Oliver Wyman 2018 Flight Operations Survey
functionality changes means major costs to retrofit a big fleet and retrain a large pilot workforce.

As a result, the most promising technologies are those that are intuitive, fleet agnostic, and easily deployed. Only three technologies garnered a thumbs-up from more than a small proportion of survey participants as potential near-term cockpit additions: multi-touchscreen capabilities, an updating of the cockpit from the current configuration of levers and dials, to something resembling today’s tablets and laptops; synthetic vision, which would provide pilots with greater situational awareness, through 3D modeling of the surrounding environment; and wearable avionics, such as head-mounted displays (HMDs), which are already in use in military aviation.

ONE PILOT PER PLANE?
Constraints on near-term technology updates do not mean that technology’s impact on future pilots will be limited over the long term. Single-pilot operations and autonomous flying could radically reshape demand for pilots and pilot roles. Cargo carriers and passenger airlines in high-growth markets in Asia may be the first to adopt these technologies (Exhibit 3).

That said, a widespread shift to single-pilot operations is unlikely to happen quickly: 83 percent of survey respondents say not in the next decade, although 43 percent think it could happen in the following decade. Many challenges would need to be addressed, such as collective bargaining groups’ influence on work rules, regulatory and passenger readiness, flight safety and cybersecurity, and the bandwidth needed to ensure a continuous data link to the aircraft.

Exhibit 3: “Where do you think the first single-pilot commercial flight is likely to occur?”
Percent of respondents

Note: Excludes cargo flights and seven percent who responded “don't know/unsure”
Source: Oliver Wyman 2018 Flight Operations Survey
THE PILOT OF THE FUTURE

What do these potential disruptions on the Flight Operations horizon signify for the pilot of the future? Overall, we believe four key traits will define the next generation of pilots. Some of these build on existing trends, while others will be driven by a combination of new industry dynamics and technology. In some ways, future pilots will be more independent and in control than ever before, but in other ways, they will be even more vulnerable to forces beyond their control.

IN VERY HIGH DEMAND
Multiple job offers and career options await future pilots – starting even before flight school or immediately after military service, as airlines seek to lock in young pilots by offsetting the cost or risk of training. New pilots will be able to pick and choose among airlines, which will inevitably try to find new ways to differentiate themselves beyond standard pay and benefits.

Once on the job, new pilots will find that the offers don’t stop, as international airlines look to fill gaps with experienced hires, and new companies that oversee fleets of autonomous aircraft seek out pilots for their control centers. Being in higher demand and having more options will weaken the bond that seniority historically created between pilot and airline.

IN THE KNOW – AND BETTER KNOWN
Future pilots will have a constantly evolving suite of tools that provide visibility into the state of the operation and upcoming challenges. Today’s Electronic Flight Bag (EFB), used primarily to store manuals, will provide a single-touch view of station, airspace, and operational conditions. Advanced data and predictive analytics will enable pilots to anticipate problems and communicate seamlessly with dispatchers and air traffic control. Before and after flying, pilots will have access to a personal dashboard with visibility into their performance, benefits, and schedule.

Improving and expanding data will lead airlines to fine-tune how they measure and improve pilot performance. Many changes will be beneficial, such as tailored training based on current skills and gaps observed in recent performance. More data availability, however, also could lead to increased scrutiny, as pilots are assessed with more granularity in a search for greater efficiency.

HIGHLY CONNECTED
Future pilots will be people that have grown up with digital technology and an always-online environment. They will be more receptive to and adapt more quickly than previous generations to any new tech that make their jobs easier and will push for the adoption of connectivity-based tools in the cockpit to eliminate manual tasks or further augment the flying experience. They also will expect to be kept informed in real time and to be seamlessly connected to other airline personnel.

While these traits will enable new channels for training and communications, they will challenge airlines, too. Pilots will have access to and demand more information than ever. They’ll expect transparency and will be frustrated if information is inaccurate or insufficient, particularly around irregular operations and other disruptions that impact their quality of life. At the same time, airlines will need to figure out how to communicate clearly above the din of many voices – ranging from fellow pilots and unions to the daily news.

VULNERABILITIES
Despite the advantages that come with being in demand, future pilots will be increasingly wary of
disruptions that disadvantage their position. As autonomous vehicles become more prevalent on roads, the questions will invariably shift to when, not if, the same capabilities will be commonplace in the air. Some airlines will be early movers, leading to tension with their pilot workforce. Others will find inertia too much to overcome, only to be faced with new start-ups benefiting from different operating cost bases.

Future pilots may have less control of their daily lives and flight patterns as airlines struggle to maximize aircraft efficiency and respond with agility to disruptive events. The pilot’s search for consistency and predictability will be tested against the airline’s desire for flexibility to better meet customer demand. Pilots will be wary of new measures that reduce consistency but will appreciate actions that improve the predictability of their lives.
Success in Flight Operations will mean anticipating and responding to the wide array of changing dynamics in the industry. Based on survey results and executive conversations, there are three key areas for which all Flight Operations leaders will need to develop a clear strategy: pipeline and training, pilot engagement, and data and technology.

**PIPELINE AND TRAINING STRATEGY**

Historically, pipeline and training were predictable processes. Nearly two-thirds of survey respondents now see a shortage of qualified pilots as a major disruption. Airlines will need new, creative ways to both identify and attract candidates. Many will look earlier in the process: For example, American Airlines has set up a Cadet Academy as a pipeline into its regional carriers (and partners with a loan program to ensure affordability), while the Qantas Group plans to open a similar academy in 2019. Others will seek to differentiate themselves on pay and benefits, lifestyle, culture, or other factors. Regardless of the levers, a strategy will need to be defined and then continually refined to address pilot shortages.

This leads to yet another challenge for Flight Operations leaders to ponder: how do incoming pilots think, act, and learn differently than those who are retiring? Airlines are beginning to recognize that the next generation is growing up in an entirely different learning environment. They are investing more in understanding young pilots’ needs and starting to take a targeted approach to increase training effectiveness (Exhibit 4). Some now place more emphasis on teaching “soft skills” such as professionalism and customer service or are teaming up with academic and non-aviation organizations to refine their training programs and better understand their workforce.

Training delivery channels are changing with the times, too, as streaming video and mobile
apps replace books and presentations. Training departments are assessing new tools such as virtual reality and distance learning. And some of the Flight Operations leaders we interviewed expressed a fervent interest in tailoring training based on individual learning styles, although most airlines have yet to figure out how to effectively segment pilot populations (and in some cases, may face regulatory and labor resistance).

Another focus for the future will be on how to adapt training as the pilot population becomes more diverse. Women and ethnic minorities make up a small percentage of global pilots now, but these figures will grow in response to the overwhelming demand for new pilots. For example, women make up just 5.2 percent of pilots globally, but at some airlines – such as in India, Australia, South Africa, and Canada – women already account for a double-digit share of pilots. Similarly, the number of US women airline pilots has grown by 31 percent in the past decade. Airlines will want to ensure that their pipeline processes tap these underrepresented segments and that their training fully serves the needs of a more diverse workforce.

ENGAGEMENT

The thousands of new young pilots taking to the skies in the next decade will give airlines a once-in-a-lifetime opportunity to redefine their company culture and terms of engagement and to differentiate how they interact with their pilots. “Engagement” refers to how well pilots connect with their colleagues and how interested they are in sharing in the airline’s mission. It is an issue that matters to many airlines: 70 percent of survey respondents say pilot behavior and engagement will warrant significant attention and challenge for their companies over the next five years.

Engaging pilots is difficult, as they are a distributed workforce. Unlike office workers who have office events and frequent in-person interactions, pilots and copilots don’t usually know each other. Pilot interactions with airline managers occur mainly at periodic training intervals. This means that Flight Operations leaders must be creative in how they communicate – across a country or the globe – to give pilots a sense of a common mission, vision, and the value they bring to the company and industry.

Lower engagement potentially can lead to increased absenteeism and reduced willingness to pick up additional flights, resulting in less operational flexibility, decreased on-time performance, higher flight cancellation rates, lower passenger satisfaction, and ultimately, lower profitability (Exhibit 5). Low engagement that leads to pilots being unwilling to work certain routes or times can make it harder to recover from irregular operations, while schedules become more complex and difficult to manage.

As one Flight Operations leader told us, “Money doesn’t buy engagement. Pilots need to know that their voices are heard and their opinions matter. Most importantly, they have to trust that those they work for have their back.” Airlines are pursuing multiple options to increase pilot engagement; some have entire teams focused on engagement strategy (Exhibit 6). Key themes include developing consistent communication of the company mission and improving the pilot experience through a variety of platforms, tailored to pilot seniority and age. While some of these efforts have met with success, pilot engagement strategy is a developing field and there is further opportunity to improve the message, tactics, and communication channels.

DATA AND TECHNOLOGY STRATEGY

While we have highlighted some of the challenges with implementing significant changes to cockpit technology, airlines must continue to look for better ways to use data and technology to improve the Flight Operations
Exhibit 5: “Which areas of airline Flight Operations are the most impacted by a lack of pilot engagement?”
Percent of respondents

- Operational responsiveness: 67%
- Uncovered flying: 57%
- Schedule complexity: 37%
- Pilot retention: 30%
- Safety: 20%
- Other: 13%
- Training cost and time: 13%
- Recruiting: 7%
- Don’t know/unsure: 10%

Note: Uncovered flying refers to flights without assigned pilots.
Source: Oliver Wyman 2018 Flight Operations Survey

Exhibit 6: “What measures have you adopted or are considering adopting to sustain/improve the overall level of engagement with your pilots?”
Percent of respondents

- Sharing the company mission: Pilots 35 years old or younger (80%), Pilots more than 35 years old (77%)
- Internal campaigns: Pilots 35 years old or younger (73%), Pilots more than 35 years old (70%)
- Internal communication tools: Pilots 35 years old or younger (73%), Pilots more than 35 years old (67%)
- Targeted surveys: Pilots 35 years old or younger (67%), Pilots more than 35 years old (57%)
- Greater use of social media: Pilots 35 years old or younger (67%), Pilots more than 35 years old (40%)
- Targeted pilot events: Pilots 35 years old or younger (53%), Pilots more than 35 years old (50%)
- Increased responsibilities: Pilots 35 years old or younger (47%), Pilots more than 35 years old (43%)
- Connecting with peers: Pilots 35 years old or younger (33%), Pilots more than 35 years old (33%)
- Additional incentives: Pilots 35 years old or younger (33%), Pilots more than 35 years old (27%)

Source: Oliver Wyman 2018 Flight Operations Survey
In our conversations with executives, the greatest opportunities mentioned relate to targeted cockpit enhancements, planning and scheduling, and pilot engagement. While there are diverse solutions available, a clear roadmap that outlines the path forward and the associated benefits can help airlines keep pace with changing technology.

In the cockpit, most of the opportunities are related to technology that is intuitive and easily deployed (Exhibit 7). As mentioned previously, multi-touchscreen capabilities, synthetic vision, and wearable avionics share several characteristics that make them good candidates for adoption in commercial aviation: they are not specific to one manufacturer or aircraft platform, they would not be cost prohibitive to install on current fleets, and they could be easily adopted into pilots’ existing routines. Respondents made clear that for cockpit technology to be of interest to airlines, it must increase safety, reduce operational costs, and improve reliability.

For planning and scheduling, the increasing complexity of operations, as well as more stringent contractual and regulatory terms, are leading many airlines to rethink their core crew scheduling systems. This includes optimization solutions to more efficiently plan pairings, as well as recovery tools that improve the allocation of standby and the ability to recover lines of flying and avoid crew delays and cancellations. To meet this need, many crew systems vendors (Jeppesen, IBS, Lufthansa, Sabre) are in the process of upgrading their offerings.

The last area of opportunity is how companies use technology to communicate directly with their pilots. The pervasiveness of EFBs offers a readily accessible channel, and some airlines are exploring dashboards that can provide real-time information to pilots through their EFBs. Other airlines are experimenting with company intranets, message boards, and social networks. As technology and mobility options continue to evolve, we expect more communication solutions to become available – if airlines are willing to capitalize on them.

Exhibit 7: “Rank in order the importance of potential benefits that cockpit design and technology enhancements could deliver to airlines”
Percent of respondents scoring 1 to 7

<table>
<thead>
<tr>
<th>Potential Benefits</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduced operational costs</td>
<td>35</td>
<td>38</td>
<td>15</td>
<td>4</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased safety</td>
<td>46</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>23</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Increased reliability</td>
<td>15</td>
<td>23</td>
<td>35</td>
<td>15</td>
<td>8</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Commonality/adaptability</td>
<td>19</td>
<td>19</td>
<td>27</td>
<td>19</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial value</td>
<td>4</td>
<td>8</td>
<td>15</td>
<td>12</td>
<td>38</td>
<td>8</td>
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<td>Improved communication</td>
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<td>4</td>
<td>27</td>
<td>31</td>
<td></td>
<td>35</td>
<td></td>
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</tbody>
</table>

Source: Oliver Wyman 2018 Flight Operations Survey
NEXT WAYPOINT FOR FLIGHT OPERATIONS?

While the degree of impact will vary by airline and geography, no airline will be completely immune from upcoming disruptions. For Flight Operations leaders and industry participants, we expect that many of the following questions will become ever more pervasive:

- How can airlines differentiate themselves in the competition for pilots? What tactics can be used to ensure a steady pipeline to enable future growth?
- How must airlines adapt to improve pilot engagement? What key cultural changes are required? How can technology enable new communication channels?
- How can training content and mechanisms be adapted to different learning styles? How can data and technology be harnessed to improve this?
- How can aviation and aerospace companies capitalize on big data and machine learning to drive better results, e.g., improve pilot training, smooth disruptions, and reduce operational costs?
- Which flight deck technologies are likely to impact Flight Operations in the next five to ten years? In the next 20? What could speed up or slow down the introduction of a specific technology?

The answers to some of these questions won’t be clear immediately, but as global aviation demand continues to increase, the cockpit working environment evolves, and the workforce changes, having a robust strategy to address these shifting dynamics will be essential to ensure an engaged and productive pilot workforce.
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