Welcome to
The Great Aero Recovery
featuring
Richard Aboulafia
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Aero Markets: Climbing Out of a Pit Beats Falling Into One

Richard Aboulafia
February 28, 2022
National Aeronautic Association
We’re 23 Months In. It’s Been Bad, But Initial Expectations Were Generally Worse Than We’ve Seen.

<table>
<thead>
<tr>
<th>Aviation Segments by Damage (most to least)</th>
<th>Trends</th>
</tr>
</thead>
</table>
| Twin aisle jetliners                       | › International traffic hit hardest and longest  
› Already an overcapacity situation  
› Secular shift towards single aisles already underway  
› Today: Yeah, just that bad. |
| Single aisle jetliners                      | › Fuel prices a big problem  
› China comeback uncertain  
› Some relief due to deferred Airbus ramp, and MAX stop  
› Today: Much better, except for China |
| Business Jets                               | › Large cabin strongly correlated with oil prices  
› Small/medium strongly correlated with corporate profits, equities indices  
› Recovering quickly; just a 2020/21 downturn  
› Today: Much more upside than downside |
| Civil Rotary                                | › Oil and gas segment (large) hit again, before recovery even began  
› Today: No real change, but not better, either |
| Military Programs                           | › Emphasis on “shovel-ready.”  
› Advance development programs at greater risk  
› Pure-play contractors in best shape; suppliers with most defense in good shape too  
› Today: All good, as expected. In fact, better |
Aircraft Markets Have Had A Predictably Horrible Two Years

World Deliveries and CAGR for Aviation Segments, 2003 – 2021

<table>
<thead>
<tr>
<th>World New Deliveries</th>
<th>CAGR ’03–’08</th>
<th>CAGR ’08–’14</th>
<th>CAGR ’14–’19</th>
<th>Change ’19–’21</th>
</tr>
</thead>
<tbody>
<tr>
<td>In 2021 (2022 $)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jetliners-SA ($39.2 b)</td>
<td>9.7%</td>
<td>6.9%</td>
<td>-2.0%</td>
<td>-33.4%</td>
</tr>
<tr>
<td>Jetliners-TA ($21.4 b)</td>
<td>5.0%</td>
<td>13.5%</td>
<td>2.1%</td>
<td>-59.9%</td>
</tr>
<tr>
<td>Regionals ($3.1 b)</td>
<td>3.9%</td>
<td>-3.1%</td>
<td>-6.3%</td>
<td>-43.7%</td>
</tr>
<tr>
<td>Business Aircraft ($19.4 b)</td>
<td>16.7%</td>
<td>-2.2%</td>
<td>-1.2%</td>
<td>-12.0%</td>
</tr>
<tr>
<td>Civil Rotorcraft ($3.1 b)</td>
<td>18.5%</td>
<td>-2.5%</td>
<td>-7.2%</td>
<td>-6.5%</td>
</tr>
<tr>
<td>Military Rotorcraft ($10.4 b)</td>
<td>10.6%</td>
<td>9.7%</td>
<td>-6.9%</td>
<td>-13.4%</td>
</tr>
<tr>
<td>Military Transports ($4.2 b)</td>
<td>3.2%</td>
<td>-0.7%</td>
<td>-0.3%</td>
<td>-27.8%</td>
</tr>
<tr>
<td>Fighters ($23.6 b)</td>
<td>1.6%</td>
<td>0.8%</td>
<td>6.1%</td>
<td>-7.3%</td>
</tr>
<tr>
<td>All Civil ($86.5 b)</td>
<td>9.7%</td>
<td>5.6%</td>
<td>-0.5%</td>
<td>-33.9%</td>
</tr>
<tr>
<td>All Military ($41.9 b)</td>
<td>3.9%</td>
<td>4.1%</td>
<td>0.0%</td>
<td>-10.1%</td>
</tr>
<tr>
<td>Total ($128.3 b)</td>
<td>8.0%</td>
<td>5.2%</td>
<td>-0.4%</td>
<td>-27.8%</td>
</tr>
</tbody>
</table>
The Ultimate Cycle…Or, Welcome Back to 2006

World Civil Transport Deliveries, 1958 – 2021

- '68-'77: -11 CAGR; 65% peak-to-trough
- '80-'84: -13.9% CAGR; -45% peak-to-trough
- '84-'91: 16.1% CAGR
- '91-'95: -12.5% CAGR; 41% peak-to-trough
- '95-'99: 20.8% CAGR
- '01-'03: -10.7% CAGR; 28.8% peak-to-trough
- '04-'18: 8% CAGR
- '18-'19: A 14-Year Super Cycle
- '99-'03: -11 CAGR; 65% peak-to-trough

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ADVISORY

4
AeroDynamic RPK outlook: Revised with impacts from Omicron, China’s COVID-zero policy, weakened GDP outlook, and regional demand substitution

**Forecast Revisions**

1. Stronger 2021 summer season due to rapid vaccine rollouts and pent-up demand gives more positive overall 2022 outlook, even given Omicron wave.

2. Omicron wave limits growth in Q1 2022, especially on international routes, but impact expected to be short term.

3. Uneven recovery in China from persistent COVID-zero strategy and low immunity balanced by stronger growth in flows receiving substitution demand (e.g. Central America-North America, Domestic U.S.).

4. IMF downward revision to GDP growth impairs 2025 – 2026 outlook, primarily in China.

**AeroDynamic Advisory Revised Nominal Scenario for Air Travel**

- Revised with impacts from Omicron, China’s COVID-zero policy, weakened GDP outlook, and regional demand substitution.

Source: AeroDynamic analysis, IATA
Ideally, Interest Rates Would be <3% and Oil Would Be $50-85/bbl; The Ratio Matters Most

Source: EIA, FRED

COVID-19 Pressuring Both Downward; recovery pressuring fuel upward (with risk to interest rates)
Single Aisle Rates Have Revolved Around China For Years…That’s A Pre-COVID (and maybe Post-COVID) Problem

World market deliveries – China, India, Russia, Brazil, 2000 – 2021

THE THIRD FACTOR: ALL ABOUT CHINA

2000: China is 2% of world market

2018: China is 23% of world market
Good News: Book-To-Bill Is A Thing Again

Large Jetliner Orders and Deliveries, 1969 – 2021
Jetliners Coming Back in a Typical K-Shaped Recovery

Regional, Single Aisle, and Twin Aisle Deliveries, 2003 – 2031

- **Single aisles:**
  - Recovery accelerated by 737MAX return to production and delivery of ~450 already-built jets; Airbus rate 60+, then ~70.
  - Return to peak by 4Q 2022.

- **Twin aisles:**
  - Sharp increase in the 2010s due to influx of new aircraft.
  - Too much too sudden: A330s, 777s, 787s, and Gulf carriers
  - Hit hardest and longest due to capacity hangover; international traffic being hit hardest and longest; shift towards single aisles
  - Return to peak after 2031… probably.
Boeing Has Taken a Hit in Backlog Share Over The Past Five Years
With and Without ASC606 Provisions

Firm Order Backlog, 1997 – 2021
It’s All About The Middle Market, Which Airbus Increasingly Controls

Airbus and Boeing Jetliner Backlogs, End 2021

A321neo Orders
Gathering Momentum
Boeing Commercial IR&D Under Pressure Again
Right When They Need A New Jet, And Face Demographic and Inflation Challenges

Boeing IR&D in $ and % of Sales, 1995 – 2021
Airbus Seizes Middle Market and First Place as Middle Market Grows

Jetliner Market Shares by Deliveries, 2005 – 2031; 2022 $ Billions
Commercial aviation will be late to the recovery. It will be last in line to make capital investments, and to hire workers. Inflation may compound this problem. High defense spending is another complication. High defense RDT&E, plus other civil developments, make new civil products difficult.

**Nondefense Capital Goods Spending (Excluding Aircraft)**

- **Shaded areas indicate U.S. recessions.**
- **Source:** U.S. Census Bureau
- **fred.stlouisfed.org**

**US Inflation, 2012 – 2020**

**Source:** TradingEconomics.com | U.S. Bureau of Labor Statistics
DoD Investment: Much Better Than In The Last Jetliner Downturn

RDT&E particularly strong – record levels
DoD Tactical Aircraft Procurement, FY86-22; Tough Choices Ahead

Options: Buy More, Buy Different (fast trainers, Gen 4.5), Cut Force Structure, Spend More on Upgrades
Strongest Market In Aviation, With Strong Ancillary Spending
Big Questions: F-35 Peak, NGAD readiness

Deliveries Revenue by Platform, 2022 $ Bns
F-35 Dominates, But Legacy Programs Still Alive; B-21, T-7 In View Too

Big Question: NGAD

Deliveries Revenue by Platform
Europe: Coping Without a Fifth Gen…Germany, France, UK Program Decisions Loom

Deliveries Revenue by Platform
The Industry Is Climbing Out Of An Unexpected Pit

World Aircraft Deliveries by Value, 1989 – 2031
US Beginning A Slow Recovery, Led by Military Segment

US Industry output relative to the rest of the world, 1989-2021
The Market Is More Concentrated Than Ever

Top 5 platforms are 55% of total; next 15 are 22%; remaining 100+ are 23%; A320/321 dominates

Persistent Barriers To Entry.
- Legacy platforms predominate.
- Off chart but coming next decade: NGAD Tempest, SCAF, FLRAA, and just maybe a new Boeing jet.
- I don’t think AAM is coming to this chart anytime soon.
Divergent recovery paths

In Two Years, the COVID Downturn will be viewed as a day of reckoning for twin aisles; for everything else it will be seen as relatively brief and not particularly severe

Segment Deliveries by Value Compared to Peak Years (% of 2019/2018 for some segments)
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