KRC Insights

FLYHT AEROSPACE SOLUTIONS LTD.

FLY-V: $1.33; FLYLF-OTC: US$1.01

17 MARCH 2019

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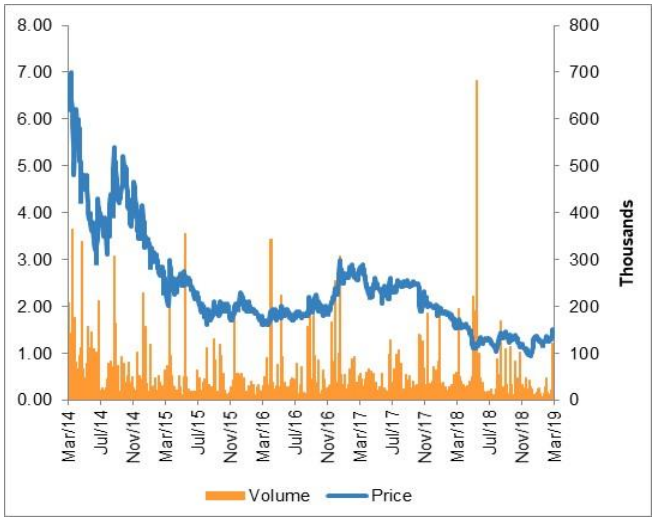
Price	**$1.33**	Market Cap ($m)	$27.3
Target Price	$3.40	Debt	$2.7
Projected Return	156%	Convert. debt	$2.0
52 Week Range	1.73 / 0.94	Cash	$2.1
Basic Shares O/S	21,059	EV	$29.9
FD Shares O/S	24,479		
Insiders	5.3%		

Y/E December	**2017A**	**2018E**	**2019E**	**2020E**
Revenues ($000's)	14,019	13,495	24,113	33,136
EBITDA ($000's)	(1,078)	(2,511)	(589)	1,474
EPS	-0.09	-0.14	-0.05	0.05
EV/Sales	2.13x	2.15x	1.20x	0.88x



Profile

FLYHT Aerospace Solutions Ltd is a Canadian designer and developer of hardware and software for the aerospace industry. Its primary product, the Automated Flight Information Reporting System (AFIRS), operates on multiple aircraft types and provides real-time streaming functions, such as safety services voice and text messaging, data collection and transmission, as well as on-demand streaming of flight data recorder (black box), engine and airframe data. AFIRS data is transmitted via the Iridium satellite network to its UpTime ground-based server, which in turn routes the data to customer-specified end points and provides an interface for aircraft interaction. FLYHT has announced trials with Inmarsat to expand its service offering.

Disclosures

Please refer important disclosures on p36.

HIGHLIGHTS

- FLYHT is well-positioned as a pure-play in the upcoming evolution of the airline industry to the connected aircraft. (Cockpit safety/operations connectivity as opposed to cabin/passenger connectivity).
- FLYHT's product, its Automated Flight Information Reporting System (AFIRS) enables aircraft to capture, process and stream aircraft data via satellite with real-time alerts, including the flight data recorder (FDR). This was expanded with the October 2018 Panasonic Weather Solutions (PWS) asset acquisition and its FlightLink/TAMDAR product.
- A combination of regulatory requirements, financial and operational benefits derived from connected aircraft solutions and the PWS integration drives our 2.4x revenue growth from $13.8m in 2018E to $33.4m in 2020E.
- The short-term catalyst for AFIRS adoption is the Chinese CCAR 121 R5 deadline of 31 December 2019 where all Chinese aircraft are required to have Satcom-based voice connections. We believe that FLYHT's current 10% market share will increase as the deadline approaches.
- Medium term, and more meaningfully to FLYHT, is the International Civil Aviation Organization's (ICAO) Annex 6 Amendment 40 recommendation for timely recovery of FDR data. FLYHT completed trials with Boeing/ Embraer which successfully tested proof-of-concept and left AFIRS as the only product which has demonstrated Satcom-based real-time streaming of FDR and CVR data. FLYHT will further entrench this competitive position with trials with Inmarsat for its "Black Box in the Sky".
- Longer term, the connected aircraft market represents a substantial opportunity for FLYHT. A 2x increase in airline fleet sizes over the next 20 years and the sheer volume of data generated by these aircraft will drive airlines to establish an IP-based connection with their aircraft and successfully mine the data to improve efficiencies, reduce costs and improve general fleet management.
- We derive a $3.40 target price based on the sum of 5x monthly recurring (SaaS) revenues and 1x hardware revenues. We assumed a $5.0m raise during this period.

Executive Summary

FLYHT sells satellite-based, real-time streaming services to the airline industry. Focusing on the cockpit as opposed to the passenger, its services help improve safety, efficiency and profitability of airlines.

FLYHT's primary product, its Automated Flight Information System (AFIRS) hardware, is installed on aircraft, aggregates real-time aircraft data and transmits it via satellite to its UpTime server allowing ground-based crew to monitor the health of the aircraft. Its current target market was primarily China and those fleets that serve the transoceanic routes, the PWS acquisition and the connected aircraft market opportunity increases its total addressable market.

FLYHT is at the cutting edge of technology which has been a two-edged sword. Its leading technology is recognized and acknowledged by both regulators and leading airline industry participants. But the long lead times involved in setting new industry standards and implementing these changes has resulted in a slow revenue ramp which has so far frustrated investors. **This about to change for four reasons**.

Firstly, the integration of the Panasonic Weather Solutions (PWS) asset acquisition. On 10 October 2018, FLYHT acquired the assets of PWS which included:

- its complementary product portfolio comprising the FlightLink satellite data unit and the Tropospheric Airborne Meteorological Data Reporting (TAMDAR) weather sensor,
- 200 revenue generating weather-focussed TAMDAR units. Some of these units create monthly recurring revenues (AirAsia & others), and all are contributing to the National Oceanic and Atmospheric Administration (NOAA) weather contract,
- the significant tier one AirAsia client, which is now FLYHT's largest customer and has 494 aircraft on order,
- $20m in backlog which includes AirAsia increasing its order from 90 to 190 aircraft.

Secondly, the major short-term driver of increased AFIRS and SaaS related revenue growth over the next 12 months is the Chinese 31/12/19 deadline as its backlog is deployed in anticipation of this deadline. The Chinese market is driven by the Chinese govt mandate CCAR 121 R5 which requires all domestic aircraft to have Satcom-based voice communications and 4-minute responsiveness.

The bulk of FLYHT's current order book comprises the 23 smaller Chinese airlines FLYHT has signed to date. We estimate that FLYHT has about 10% market share. Our forecasts include only these airlines signed to date and excludes potential contribution from any larger Chinese airline. We forecast 140 AFIRS installs during 2019E and 150 installs during 2020E and believe that there is upside to our numbers if FLYHT can sign a larger Chinese airline.

Thirdly, Adherence to Amendment 40 to Annex 6 which requires the timely recovery of flight data recorder (FDR) data in the event of a distress event (effective 1 Jan 2021). The technology allowing aircraft to make a secure, IP-based connection at the required satellite bandwidth has only been recently introduced and the standards are still being formulated to ensure streaming of FDR data.

Specifically, satellite service providers, Inmarsat and Iridium, have both introduced higher bandwidth satellites and safety services. These services meet current ACARS standards, have already been introduced and hardware vendors are supplying equipment. **But** this is not the same as streaming high bandwidth FDR and other operational data in real-time from the aircraft to the ground crew.

Streaming FDR data requires higher bandwidth and the equipment to aggregate the data and prepare it for transmission. In this regard, FLYHT was requested by Boeing to participate in its EcoDemonstrator trial to test its FDR streaming capabilities. The trials, completed 15 August 2018, validated the proof of concept leaving FLYHT's AFIRS as currently the only hardware

which has demonstrated the aggregating and transmitting aircraft data in compliance with Amendment 40. FLYHT has a patent to protect the triggered streaming of this data. We believe that Amendment 40 technology decisions will start to be made in late 2019 so that the supply chains can be implemented, we view FLYHT as an obvious solution provider.

Finally, the increased attractiveness of the connected aircraft to drive cost savings is expected to materially benefit AFIRS adoption longer term. This is a significant industry development, currently at the early stage of ramping and offers benefits to both land-based and transoceanic fleets. We have included a notional 50 AFIRS units in our forecasts in 2020E from these two sources (i.e. 200 units in total for 2020E).

To facilitate FLYHT's participation in the above evolution, FLYHT is broadening its focus from 100% Iridium-based revenues to now include Inmarsat's SB-S service-based revenues. Courtesy of the EcoDemonstrator trials, FLYHT is the first company certified for Inmarsat's Certified Application Program (CAP), which is a 3rd party partner to enable Inmarsat's "black box in the cloud". We see the EcoDemonstrator trials and further Inmarsat trials as a precursor to increased activity on this service provider's satellites.

The impact of the above four business drivers results in a forecast 2.4x increase in revenues from $13.9m in 2018E to $33.0m in 2020E. FLYHT is reporting the PWS revenue streams into its existing Software as a Service (SaaS) revenues and Hardware revenues.

FLYHT's revenue composition is expected to change from its existing roughly 30% AFIRS hardware, 30% licensing (L-3 Aviation Recorder's Airbus installs) and 30% SaaS revenues to almost 45% hardware (AFIRS+FlightLink) and 45% SaaS (AFIRS, TAMDAR and NOAA weather contract) in 2019E due to the PWS acquisition and declining trend in the licensing revenues.

Based upon the current backlog and a notional 50 AFIRS units in 2020E for the connected aircraft, **we derive a valuation for FLYHT of $3.40/share** using a sum-of-parts approach: 5x SaaS revenues and 1x hardware. This approach implies a capital value of $94,500/revenue generating unit (both AFIRS and FlightLink), or roughly 6.5x the annual revenue stream generated per unit.

During the next 18 months we expect to see further contract wins in China, FLYHT's first Inmarsat-based contract, first connected aircraft win and further penetration into AirAsia. Evidence of execution will motivate investors to pay up for the shares.

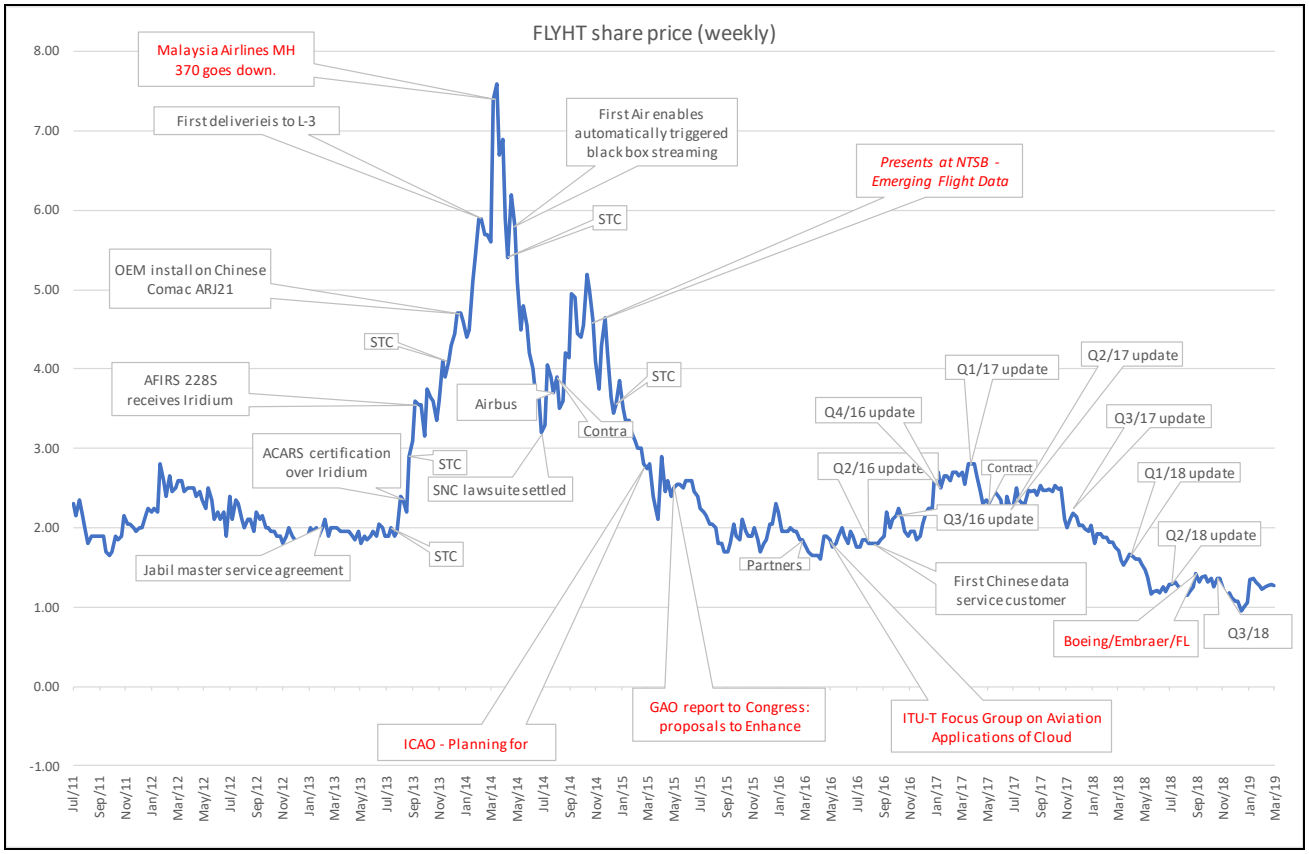
Contents

Share Price History

The FLYHT shares underwent rapid appreciation from $1.90 in July 2013 to peak at $7.60 on 21 March 2014. This was a period of initial technical progress (Boeing STCs, Iridium certification) and initial contracts wins including the significant L-3 Aviation contract (for Airbus) and the COMAC contract (Chinese aircraft OEM, now not applicable). The shares ultimately peaked almost two weeks after the Air Malaysia MH 370 accident on 8 March 2014.

In Figure 1 we show certain FLYHT milestones with emphasis on progress made at a regulatory level (red).

Figure 1: FLYHT share price (weekly) highlighting material events



Source: KRC Insights, company reports

More recently, the shares have been under pressure due to exit of a major shareholder through the first half of 2018, 2018 year-end tax loss selling and limited evidence of traction with AFIRS installs. The significant PWS acquisition is not reflected in the share price.

We calculate that FLYHT is currently trading at 0.9x enterprise value/2020E revenues.

Markets

Historically, aircraft connectivity has been driven by passenger-related benefits such as in-flight wi-fi connectivity. This is not the market that FLYHT addresses.

FLYHT's solutions deal with the aircraft management systems, specifically inflight, real-time cockpit connectivity addressing the issues of flight safety and real-time data to improve decision making for improved operational control of the aircraft. The maturation of real-time connectivity is seeing the expansion of technology adoption across the aircraft and increasingly into the cockpit.

Managing these data flows means that an aircraft is progressively becoming an extension of an airline's IT network. It is becoming easier to manage flight efficiency, aircraft productivity and reducing operating costs in real time. From takeoff to landing, real time and improved bandwidth capabilities are allowing visual real-time weather monitoring, inflight aircraft health and performance monitoring.

Significant growth is expected from this market. The expected tremendous increase in inflight data volumes driven by the forecast doubling of aircraft fleet sizes which is then compounded by the concomitant increase in inflight data generated by these planes. The increased Inflight data generation is due to the combination of:

- increased regulatory requirements,
- continually improving aircraft self-monitoring capabilities. A key driver of this focus on aircraft management is the enablement of operational cost savings:

"A …5% reduction in unscheduled maintenance…for wide body jets…could result in a total cost reduction of US$456 million annually in 2025, increasing to US$656 million in 2035." [1]

The nature and volume of this data is changing the way aircraft fleets are being managed. Below we further explain the growth factors of this emerging market and ultimately how FLYHT is well positioned.

Aircraft volumes are forecast to grow strongly

Both Airbus (AIR-Paris) and Boeing (BA-N) provide long term aircraft demand forecasts. One of FLYHT's primary markets is China, hence we also provide region-specific data for that geography. All three forecasts expect the number of aircraft in service to more than double over the next 20 years (summarized in Figure 2).

Figure 2: Summary of Airbus, Boeing and COMAC 20-year aircraft demand forecasts

	Airbus*	Boeing**	COMAC***
Traffic growth - world	4.4%	4.7%	
Traffic growth – Asia-Pacific	5.5%	5.7%	
Traffic growth – China		6.1%	6.5%
Fleet growth - world	4.2%	3.5%	
Fleet growth – Asia-Pacific	5.5%	4.6%	
Fleet growth – China		4.5%	5.3%
Aircraft required to 2037	37,390	42,730	42,702
Asia-Pacific deliveries	15,640	16,930	
China specific	7,400	7,690	9,008
Asia-Pacific % deliveries to 2037	42%	40%	
Traffic flow increase to 2037 – Asia-Pacific		3.1x	
Traffic flow increase to 2037 – China	3.5x	3.3x	

Source: https://www.airbus.com/aircraft/market/global-market-forecast.html
https://www.boeing.com/commercial/market/commercial-market-outlook/
*=commercial, 100+ seats; **=commercial, all sizes; **=Commercial Aircraft Corp. of China Ltd-a Chinese aircraft OEM

[1] London School of Economics: Sky High economics: Evaluating the Economic Benefits of Connected Airline Aircraft (p19)

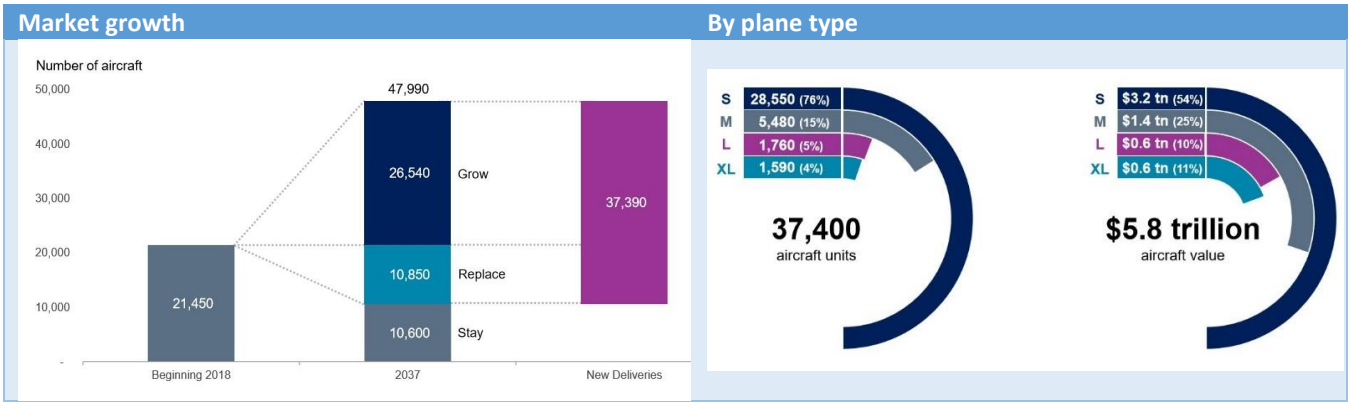
To provide context for the Chinese aircraft growth, the state-run China Daily made the following statements: The Civil Aviation Administration of China (CAAC) reported that the Asian nation aims to build 216 new airports in the country by 2035. CAAC noted that China currently has 234 civil airports and plans to have approximately 450 by 2035.[2]

Airbus

In its 2018 Global Market Forecast 2018-2037, Airbus provided its view of aircraft growth expectations:

- 4.4% p.a. traffic growth over the next 20 years
- 37,400 aircraft required
- 30% for replacement
- 70% for growth
- Small segment expected to drive 76% of deliveries (Figure 3). Small segment=capacity 100-230 seats
- Asia-Pacific is expected to account for 42% of deliveries. Domestic China is forecast to become the largest traffic flow country in the world before the end of 2037. Its domestic traffic is forecast to increase 3.5x vs the domestic US' 1.5x.

Figure 3: Airbus Global Market Forecast (GMF) 2018-2037 (number of aircraft)



Source: Airbus; Market segments defined as follows: S=100-230 seats, M=up to 300 seats, L= up to 350 seats, XL=350 seats+

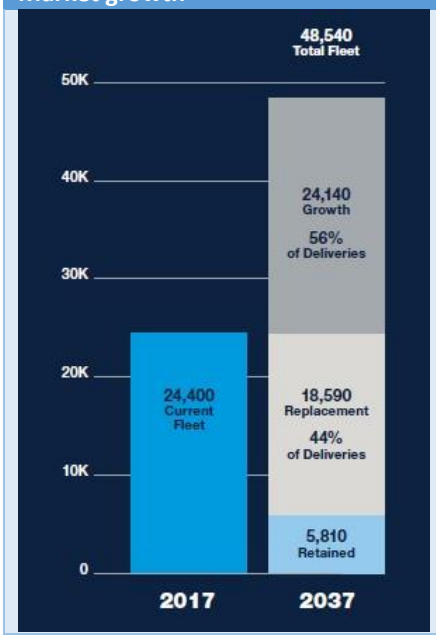
Boeing

In its 2018-2037 Commercial Market Outlook (CMO) covering the global market, Boeing stated:

- Robust demand expected over the next 20 years as strong economic growth, growing middle class, increased spending on services, and evolving airline business models bring more value to passengers and support the long-term outlook.
- Single aisle aircraft will comprise 74% of aircraft deliveries to 2037 (Figure 4).
- Given the expected rise in services (maintain, repair, and overhaul), these are now included in its CMO outlook
- As e-enabled aircraft have become more common, the number of sensors on aircraft have increased from a couple hundred per aircraft a decade ago to thousands today. Each sensor collects a unique datum that can be used to perform real-time analysis and reporting on a factor such as the condition of aircraft parts, fuel consumption during flight, and engine performance. (p29)

[2] https://www.intelligent-aerospace.com/articles/2018/12/china-aims-to-nearly-double-the-number-of-airports.html

Figure 4: Boeing Forecast 2018-2037 (number of aircraft)

Market growth	By plane type
	• 31,360 single aisle aircraft • 8,070 Widebodies • 2,320 Regional jets • 980 Freighters 42,730

Source: Boeing 2018-2037 Commercial Market Outlook

To provide context for the forecasts, below are the order books of Airbus and Boeing from 2015 to the end of 2018.

Figure 5: Airbus historical net orders by aircraft type (commercial only)

	A220**	A320	A330	A350	A380	Total	Backlog
2015		945	136	-3	2	1,080	6,831
2016		607	83	41	0	731	6,874
2017		1054	21	36	-2	1,109	7,265
2018	135	541	27	40	4	747	7,577*

Source: https://www.airbus.com/aircraft/market/orders-deliveries.html ; *= 9+ years of production
**=formerly Bombardier C Series

Figure 6: Boeing historical net orders by aircraft type (commercial only)

	737**	747	767	777	787	Total	Backlog
2015	656	6	49	58	93	862	5,795
2016	630	18	26	23	80	777	5,715
2017	828	6	15	52	98	999	5,864
2018	760	18	40	59	131	1,008	5,873*

Source: http://www.boeing.com/commercial/#/orders-deliveries; *= 7+ years of production; **737 Max 8 and 9 =currently grounded due to Ethiopian air crash

Conclusion: The expected doubling in aircraft fleet size over the next 20 years provides a solid expanding market opportunity for FLYHT.

Bandwidth required for real-time aircraft data transmission needs to grow

The volume of inflight data generated by aircraft has increased dramatically over the past several years. Airbus made the following points:

- Single aisle aircraft: observable data parameters increased from 400 to 24,000
- Long range aircraft: observable data parameters increased from 1,400 to 40,000

On a more granular level, the A350 has around 6,000 sensors throughout the aircraft.[3] And, Inmarsat sees "broadband connectivity is fast becoming a catalyst for change in the airline industry"[4].

In its study to examine the feasibility of using recent developments in commercial broadband services (report dated April 2016), as well as the existing infrastructure for real-time flight data streaming, the International Telecommunications Union (ITU) estimated that the existing infrastructure was adequate (Figure 7) [5]:

Figure 7: Anticipated bandwidth requirements for the connected aircraft

FDR Standard	Aircraft position only	64 wps* FDR	1024 wps** FDR
Bandwidth needed for routine continuous FDR streaming	72 bps/aircraft	768 bps/aircraft	12.3kbps/aircraft
Global bandwidth needed for 10,000 aircraft	690 kbps	7.32 Mbps	117 Mbps
Global bandwidth required per month for 10,000 aircraft	130 GB	1.4TB	22 TB

Source: ITU-T Focus Group on Aviation Applications of Cloud Computing for Flight Data Monitoring
*=1995 standard, **=2015 common standard.

With regards to this study and the capability of existing satellite capacity to handle these volumes, it concluded:

- At 1024 wps, the volume of flight data was "considerably less that might be expected"[6].
- At 72 kps many narrowband data link systems have the potential to be used to continuously stream position data
- Inmarsat's Swiftbroadband service has sufficient capacity for both routine flight data streaming and triggered transmission of flight data.
- Iridium does not have sufficient bandwidth for commonly used standards of 256 wps or 512 wps, but its Iridium NEXT system will have sufficient bandwidth. (Iridium NEXT was fully deployed 5 Feb 2019).

The sheer volume of data being generated by aircraft (combined with a fast IP connection, covered below) is facilitating the airlines' ability to manage aircraft as if they were an extension of their IT systems.

Conclusion: The expected bandwidth requirements to meet real-time aircraft data streaming was adequate in 2016 (date of report). However, there have been improvements in satellite technology subsequent to the release of the report. We cover these satellite advances below.

[3] https://www.datasciencecentral.com/profiles/blogs/that-s-data-science-airbus-puts-10-000-sensors-in-every-single
[4] Inmarsat Aviation – SB-S real-time visibility into global operations, p2
[5] ITU-T Focus Group on aviation Applications of Cloud Computing for Flight Data Monitoring, p4
[6] ITU-T Focus Group on aviation Applications of Cloud Computing for Flight Data Monitoring, p7

Satellite Service capabilities are now available to process expected volumes

The expected increase in cockpit bandwidth requirements was anticipated by the two major aircraft satellite service providers that serve the cockpit communications, aircraft tracking and aircraft safety markets. Both have introduced high bandwidth services and are actively targeting the connected aircraft market:

- Iridium Communications Inc (IRDM-Q) – Iridium Certus over its Iridium NEXT low earth orbit satellite constellation. Certus broadband went live 16/1/19
- Inmarsat PLC (ISA-London) – Swiftbroadband-Safety (SB-S) over its I-4 L-band satellites entered commercial service 19 April 2019.

For a service provider to offer the regulated safety-critical services of cockpit voice and data over satellite, the service must meet "safety" regulations. As such, the service undergoes specific testing and qualification. It is then sold as "safety" compliant. In Figure 8, we show certain safety qualified satellite services and their respective upload bandwidths.

Figure 8: Summary of safety-qualified satellite technology by service name and bandwidth

	Satellite technology	Classic Aero H/H+	Swift64	Swiftbroadband	NEXT
Data rate from aircraft	L-Band GEO	0.6-10.5 kbps	64 kbps	432 kbps	
	LEO				352 kbps*

Source: ITU Focus Group (p6), company reports. *= iridium NEXT not operational at time of report, 352 kbps per Iridium 2019 Investor Day presentation p66 for iridium Certus 350 service

Inmarsat

Inmarsat has shut down, or is planning to shut down, certain of its legacy safety services (Classic Aero H, Swift64, Classic Aero I) and migrate users to its Classic Aero H+ and Swiftbroadband-Safety (SB-S)[7] services.

This is a transition to more modern and cost-effective technology which has the added benefit of higher bandwidth required for the connected aircraft.

SB-S is targeting the transoceanic market routes for flight data streaming to comply with the Global Aeronautical Distress and Safety System (GADSS) requirement of speedy recovery of flight data in the event of an incident at sea. It supports the following services to the aircraft cockpit:

- 2 channels of voice
- Aircraft Communications, Addressing and Reporting System (ACARS) data
- Prioritised IP data (for new flight deck applications)
- Electronic Flight Bag data

Specifically, SB-S is positioned as:

- Low cost – at least 30% opex cost savings over Classic Aero ACARS
- Improved flight deck communications
- New features – aircraft positioning and reporting, private network capable, prioritised IP links

Inmarsat tested its SB-S network with Hawaiian Airlines with Cobham SATCOM (Aviator 300D), Rockwell Collins and SITAonAir. The trial ran from June 2015 to December 2017.

[7] Inmarsat presentation: Flight operations and SwiftBroadband safety services, Alan Schuster et al

Having undergone successful testing by PARC, Inmarsat announced commercial service of SB-S on 17 April 2018. On 3 July 2018, PARC submitted its request to the FAA for final approval of Future Air Navigation System (FANS) 1/A over SB-S. FANS is an avionics system which provides direct data link communication between the pilot and the air traffic controller.

Iridium

The Iridium NEXT low-Earth orbit satellite constellation will power the Iridium Certus service, a new multi-service communications platform bringing a more efficient, reliable and cost-effective way to achieve 100 percent global connectivity. With full global coverage, download speeds of up to 1.4Mbps and upload speeds of up to 512 kbps. Initial flight trials were to take place later in 2018, with Iridium Certus commercial service introduction for aviation users expected later in 2019.[8] Iridium announced 16/1/19 that its Certus broadband service was live.

On 21/12/15 FLYHT granted a non-excusive license to a technology company for US$2.5m. Also, FLYHT obtained the right to resell the Licensee's future Iridium Certus product.

FLYHT's AFIRS system operates on the Iridium network. The FlightLink/TAMDAR solution operates on the Iridium network as well.

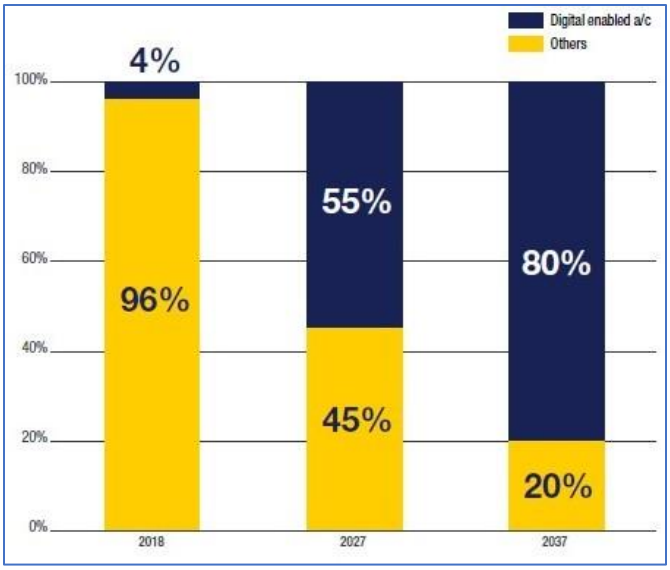
Conclusion. Technology allowing the transmission of higher bandwidth real-time data has only recently become operational. Both satellite service providers are providing services catering to this market.

Increased, focus will be on connected services driving operational benefits and cost savings

Access to and analysis of data from aircraft to their ground operations will be at the heart of these innovations.

Airbus extends its Global Market Forecast (GMF) to cover services and provide its Global Services Forecast (GSF). It expects "connected" aircraft to increase from 4% in 2018 to 80% in 2037 (Figure 9):

Figure 9: Airbus Global Services Forecast (GSF)



Source: Airbus

[8] https://www.rockwellcollins.com/Data/News/2018-Cal-Yr/IMS/20180723-Iridium-Deliver-Next-Gen-Aviation-Services.aspx

The analysis of this data will enable optimization of maintenance, aircraft scheduling and utilization, especially as it pertains to flight operations services. Airbus believes that new data analytics tools will particularly help in the fields of:

- managing airport congestion
- unnecessary fuel consumption, and
- real time adjustments to flight plans and flight management systems

These all lead to improved operational efficiencies.

Boeing believes that the Asia-Pacific region will lead the demand for aviation services and will represent 40% of the next 20 year's demand. This is of relevance to FLYHT as it landed AirAsia as a customer through the PWS acquisition which has 494 aircraft on order.

Two market studies concluded that airlines will indeed invest on the connected aircraft with costs savings a key benefit.

In June 2018, Honeywell issued its *Airlines Push Connectivity Beyond the Cabin* report. The report surveyed more than 100 technology decision makers across the commercial aviation sector to understand their companies' connectivity aircraft requirements. Some data points:

- **99% of respondents would use connectivity** to solve their airlines' biggest issues. One of the biggest reasons given was for predictive maintenance.
- 67% expected connectivity-related products to **save costs** in the next year.
- With 55% rating Maintenance a 5 (significant concern) for business challenges, **57% of respondents rated Maintenance a 5 (extremely important) for importance of connectivity**
- 49% rated pilot flight (flight path awareness weather etc.) a 5
- 61% responded very likely to extremely likely to spend on new connectivity-related technologies over the next year,
- **58% would spend on predictive maintenance**
- With regards to spending **per plane** on connectivity related products, 51% expected to spend between US$500k-US$10m+ (33% could not disclose/not considering)

The London School of Economics in conjunction with Inmarsat produced a detailed report *Sky High Economics* of which *Chapter Two: Evaluating the Economic Benefits of Connected Airlines* is of specific interest as it pertains to FLYHT. Some salient highlights from the report include:

- Connected Operations Services – Satcom services can provide efficiency and safety improvements in terms of pre- and post-flight reporting, flight planning and logistics, flight optimisation. Better **weather prediction could save 850m liters of fuel p.a.** Improved reliability of flight arrival times could save US$1.2bn p.a.
- Maintenance Operations Control Services – modern long-haul aircraft can generate up to 500GB of data per flight. Transmission of this data to control centers on the ground and its analysis **preventing unscheduled aircraft on the ground could save US$3bn-US$4.6bn p.a.**
- Airline Operations Control Services – a secure connection to the aircraft with real time telemetry tracking and streaming flight data, including the "Black Box In The Cloud" and others, could save US$1.3bn p.a. **Avoiding turbulence could generate fuel savings of US$1.3bn-US$2.6bn, and US$409m-US$806m in airframe inspections**. Telemedicine connectivity could save substantially by obviating the need for diversion landings.
- Air Traffic Control Services – **satellite navigation and automated aircraft position reporting** and providing digital communications could save the industry **US$3.0bn p.a.**

Conclusion: These two studies show that there is a willingness by airlines to spend on the connected aircraft and that these benefits/cost savings are quantifiable and significant.

Connected aircraft revenues are starting to ramp

Our analysis indicates that we are at the early stages of the ramp in the connected aircraft market. The data is being generated by the aircraft and the infrastructure is in place (Inmarsat SB-S) or soon will be (Iridium Certus) for the IP-enabled cockpit.

Analysis of the revenue streams derived from high bandwidth, cockpit-specific, safety data stream shows it is at the nascent stage of generation.

Inmarsat

In the Aviation segment, Inmarsat operates in three market segments: In-Flight Connectivity (IFC), Business and General Aviation (BGA) and Safety and Operational Services (SOS); we are only interest in SOS as it pertains to FLYHT.

Figure 10 shows Inmarsat's Safety and Operational Services (SOS) revenue stream. It currently comprises principally its Classic Aero services, its legacy safety service which can achieve some forms of limited data streaming, but the company is positioning SB-S as an upgrade to Classic Aero. Inmarsat's Classic Aero service is used by more than 90% of the world's oceanic aircraft for communication, navigation and surveillance.[9]

Figure 10: Inmarsat Aviation segment revenues (US$m)

	Q1/18	Q2/18	Q3/18	Q4/18
SOS*	10.7	10.9	13.1	11.1
Total Aviation	56.0	59.5	68.2	72.4
No. of aircraft	9,000	9,000	9,000	**

Source: Company reports. *= Safety and Operational Services revenue stream, comprises primarily Inmarsat's Classic Aero;**=not disclosed

On 17 April 2018, Inmarsat launched its new aviation safety product, SB-S, which will help to further develop its SOS business going forward. It has signed a major distribution agreement in China for safety products and services.[10] In its Q3/18 presentation, Inmarsat saw "progress on (the) launch of SB-Safety". On the Q3/18 conference call, management noted that the cockpit transformation (connected aircraft) is one of two major trends and comprises three drivers due to higher bandwidth:

- Revolution in safety
- Emergence of the connected aircraft
- Next-generation air traffic management

In its Q4/18 presentation, Inmarsat stated that one of its SOS services objectives was the "Full commercial roll-out of SB-S for next gen aero safety" and hence, one of its priorities in 2019 for its Aviation segment was "Increased usage in SOS products."

Iridium

Iridium does not provide the same level of disclosure. Iridium's service targeting aviation safety services is included in its Certus program. Below is a timeline of its Certus progress from the quarterly conference call transcripts:

[9] https://www.inmarsat.com/press-release/inmarsat-signs-cttic-and-adcc-as-china-distribution-partners-for-aviation-safety-and-operational-services/
[10] Inmarsat Q1/18 presentation

- Q1/18 – Iridium has "moved quickly" since the beginning of the year to finalize the selection of Certus service providers. 19 distribution partners were announced to date across maritime, aviation and land mobile with more to follow. Aviation terminals expected to ramp late 2019 or early 2020 after they are certified.
- Q2/18 – Iridium systems are installed on over 40,000 aircraft; with regards to safety voice, it is now on over 1,000 aircraft. (We believe that most of this number are AFIRS sales through the L-3 channel). Management believes that Iridium has the slightly dominant market share. The Certus upgrade is a natural progression to these existing safety services. Expect product availability in 2019 and it is more a 2020/2021 revenue story.
- Q3/18 – 2020 will be the big year with units going to partners in Q2/Q3 2019.
- Q4/18: Iridium NEXT constellation was fully deployed 5 Feb 2019. Several aviation antenna suppliers like Collins Aerospace and Thales are working to bring Iridium service offerings to market…given the regulatory work involved in aviation products IRDM expects that it will take most of 2019 to occur.

Conclusion: Both satellite providers are encouraging and expect substantial growth from these safety revenue streams. They have expanded their bandwidth capabilities and are at the early stages of recording revenues associated with the connected aircraft.

The standards are still being defined….using FLYHT's AFIRS (EcoDemonstrator trials)

As mentioned previously, GADSS comprises the following main components:

- Aircraft tracking normal and abnormal conditions (effective 8/11/2018, mandatory over oceans)
- Autonomous Distress Tracking - locating and tracking an airplane in distress (effective 1/1/2021)
- Post Flight Localization and Recovery (PFLR) - including
    - Post flight localization of the aircraft; and
    - Timely recovery of the flight recorder's data – either streaming or ejectable (effective 1/1/2021)

One ICAO document that is still currently in the process of being drafted: is document 10054. This is the document that is forming the basis for satellite data streaming and its two possibilities:

- Continuous transmission of FDR data to the ground, and
- Triggered transmission of FDR data to the ground.

Enter FLYHT and Boeing's EcoDemonstrator trial.

Boeing's EcoDemonstrator Trials

In anticipation of the Amendment 40 to Annex 6, FLYHT's market leading position was the driver behind its technology being asked to trial with Boeing and Embraer. The point of the trial was to demonstrate the potential of FLYHT's FDR streaming capability to support the Timely Recovery of Flight Data Recorder Data as outlined in in the GADSS ConOps and in Doc 10054.

The scope of the tests was to:

- Stream the entire FDR and cockpit microphone audio in real time (primarily over Inmarsat's Swiftbroadband service using 4 different data rates);
- Capture the data using FLYHT's UpTime Cloud server;
- Set up streaming triggers to report unusual flight parameters;
- Validate the data streamed Identify data latency.

The trials were concluded over two different satcom systems: Iridium's Short Burst Data Service but the primary focus was on Inmarsat's Swiftbroadband-Safety service due to its higher bandwidth capabilities. The data was captured in FLYHT's UpTime Cloud server allowing ground-based operators to view a Virtual Cockpit Display of the pilot's Primary Flight Display, crucial engine gauges and flight controls in near real time (an acceptable 8 second delay).

The results supported several key aspects of the guidance material outlined in Doc 10054. In other words, a Satcom-based solution combined with real-time data streaming technology could be developed and be used to address the near-term requirements for Aircraft Tracking and Autonomous Distress Tracking (ADT) – proof of concept was validated.

The technical data generated by the EcoDemonstrator trials was allowed to be shared with Inmarsat. The result was that on 25/5/18 Inmarsat announced that FLYHT was its first partner for its Aviation Certified Application Provider (CAP) Programme. FLYHT has stated that it is in further trials with Inmarsat, we see this is a precursor to a deeper relationship.

On 15 August 2018 the trial's results were formally released[11]. The tests showed that the tested proof of concept system worked and that a Satcom-based solution combined with real-time, data streaming could be developed to address the near-term requirements of Aircraft Tracking and ADT.

This was the first time ever that in real time:

- a FDR's contents were streamed,
- real-time cockpit voice recorder (CVR) flight deck audio was streamed, and
- FDR and CVR data streaming was activated by triggered events. Triggers were set up to simulate the ADT function such as when the aircraft experienced excessive or unusual bank angle, pitch angle, and vertical speed. Triggering was initiated either from the ground through FLYHT's UpTime server or automatically activated through customized event detection. From the time of trigger, 20 minutes of historical (buffered) FDR data and a minimum of 20 minutes of real time FDR data from point of trigger was transmitted simultaneously.

Conclusion: FLYHT's involvement with industry leaders in proof-of-concept testing of upcoming industry recommendations/ standards implies FLYHT has a technologically competitive product. Consequently, we believe that it has a competitive lead in the market and its AFIRS solution is in a strong strategic position to be used when airlines make their Amendment 40 (deadline 1 Jan 2021) technology decisions. Further trials with Inmarsat support this view.

[11] Analysis of Flight Data Streaming Trials on the Boeing 2018 EcoDemonstrator report

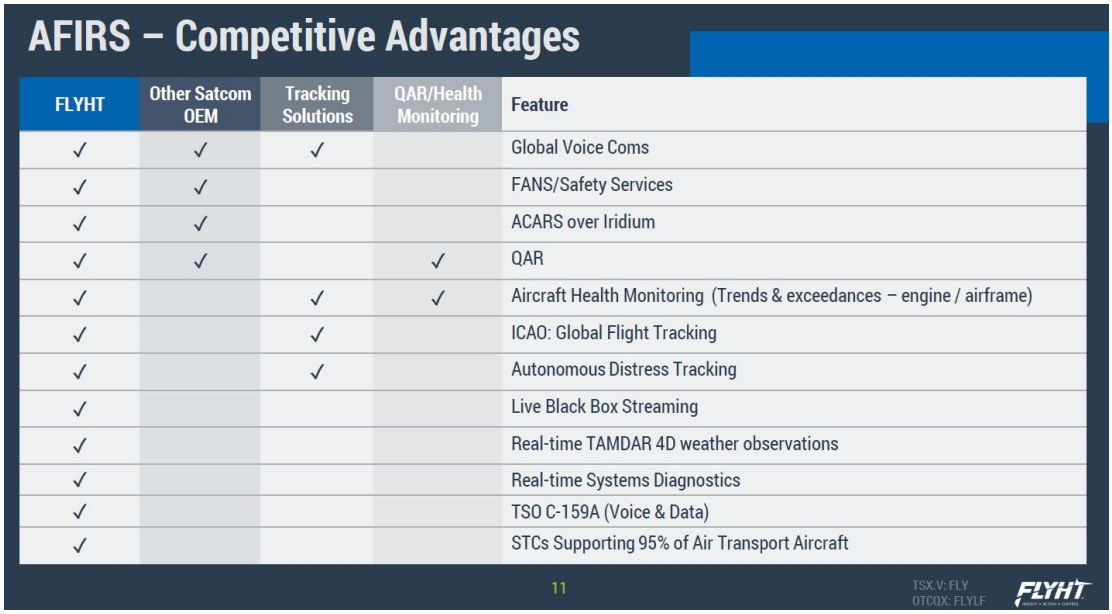
Competitive Landscape

FLYHT's major competitors include:

- Thales SA (TCFP-Paris)
- Honeywell International (HON-N)
- Cobham PLC (COB-L)
- Rockwell Collins Inc. (merged with United Technologies Corp – UTX-N)

In its Investor Presentation, FLYHT shows its product offerings which can be bundled with AFIRS to generate monthly recurring revenues, and their relative competitive position (Figure 11).

Figure 11: FLYHT - Competitive landscape



Source: Company

Conclusion: We believe that the streaming flight data recorder market and connected aircraft markets are at the early stage of development. FLYHT has a unique competitive position with its proven AFIRS product. The EcoDemonstrator trials with Boeing and the impending Inmarsat "Black Box in the Cloud" trials imply a significant first-to-market opportunity for FLYHT.

Consequently, we believe that FLYHT is uniquely positioned to:

- Sell AFIRS and its streaming FDR solution to meet Amendment 40 requirements and then capitalise on the market evolution to the connected aircraft market thereafter.
- Use this sale to "pull through" and upsell other AFIRS capabilities. The PWS acquisition with its weather product and its improved situational display will help in this regard.

Business Model Drivers

We identify four revenue drivers of the FLYHT business model (Figure 12). The first two are aviation mandate driven, the third is value-add services facilitated by increased satellite bandwidth connectivity and the final is its newly acquired weather service, a subset of operational efficiency.

Figure 12: FLYHT revenue drivers

Driver	Details	Specifics	Implementation	Impact on FLYHT
International mandate	ICAO Annex 6	Amendment 39	November 2018	Weak
		Amendment 40	1 January 2021	Strong
China mandate	CCAR 121 R5		31 December 2019	Strong
Aircraft Operational Efficiency			Currently	Very strong
Weather Services*			Currently	Very strong

Source: Company, KRC Insights; * = Weather is a subset of Aircraft Operational Efficiency

International mandate

The loss of Air Malaysia MH370 on 8 March 2014 was a significant motivator for international flight organizations and governments to improve aircraft tracking and connectivity. The Malaysian Minister of Communications and Multimedia raised the idea of the use of cloud computing for flight data during the ITU World Telecommunications Development Conference held in April 2014 in Dubai. He urged the airline industry to develop better ways to constantly monitor flight data and cockpit dynamics.

The International Telecommunications Union (ITU) is the United Nations specialized agency dealing with information and communications technologies.

Consequently, the ITU held a conference 26-27 May 2014 where it decided to form groups which would establish the international standards for the use of an aviation cloud for real-time monitoring of flight data. The first meeting of the Focus Group on Aviation Applications of Cloud Computing for Flight Data Monitoring (FG AC) was held in Kuala Lumpur on 1-3 December 2014.

Simultaneously, US Congress asked the United States Government Accountability Office (GAO) what could be done to prevent the unaccounted loss of an aircraft. A study was undertaken by the GAO to explain to Congress the impact on the US aviation fleet of the international organizations and industry proposals to enhance oceanic flight tracking and flight data recovery on a global scale (post Malaysia Airlines MH370). GAO released its report *Aviation Safety: Proposals to Enhance Aircraft tracking and Flight Data Recovery May Aid Accident Investigation, but Challenges Remain (April 2015)*.

For the report, GAO interviewed 21 aviation stakeholders including US Federal agencies, international organizations, airframe manufacturers, airlines, avionics manufacturers (FLYHT, Honeywell, L-3 Communications and DRS Technologies), air transport communications service providers, industry trade associations and satellite communications companies.

The two most salient extracts from the report that pertain to FLYHT include:

Technical challenges: *Two avionics manufacturers and an air transport data communications provider also stated that it could be technologically difficult for an aircraft in distress with its satellite antenna not pointing in a fixed position prior to impact to transmit data to satellites. However, there is at least one commercial product—FLYHT's Automated Flight Information Reporting System—capable of streaming up to all FDR data and position information in near real-time via*

satellites when triggered by an onboard emergency, and according to this manufacturer, a test flight showed FDR data transmission even when the plane was in an unusual position during flight. (page 39)

and

***Equipage and data costs**: Stakeholders, including FAA, airframe manufacturers, a trade association, and a U.S. domestic airline, stated that streaming flight recorder data could result in data transmission costs to airlines, especially using satellite communications over oceanic regions, and might require more equipment on aircraft that comes at a cost. The cost of the FLYHT's Automated Flight Information Reporting System described above is estimated at $70,000 per unit for parts and installation, according to the manufacturer. Assuming that as an average cost, we found that the total cost for the current U.S. long-haul transoceanic fleet could approach $35 million. (page 39)*

FLYHT was referenced as the base case. Based on AFIRS cost of US$70,000/installation, the GOA estimated the total cost to outfit the then current US long-haul transoceanic fleet would cost US$35m (GAO report, p40). This implies that the size of the addressable market for the US was 500 aircraft.

In April 2016 (a year after the release of the GAO report) the ITU's FG AC Working Group 4 delivered its report which examined the feasibility of recent developments in commercial broadband services as well as reusing existing infrastructure for real time flight data streaming where appropriate. *ITU Focus Group on Aviation Applications of Cloud Computing for Flight Data Monitoring – Avionics and Aviation Communications Systems (April 2016*).

Salient extracts from the report as they pertain to FLYHT include:

There are several systems which are designed for flight deck and avionics data communications that utilize Iridium that are not linked with the ACARS system. These include the following systems:
i) Panasonic (formerly Airdat) FlightLink weather data link system; (now acquired by FLYHT)
ii) STAR Navigation's in-flight safety monitoring system (Star-ISMS);
iii) FLYHT's automated flight information and reporting system (AFIRS). (Page 17)

and

FLYHT in particular has developed extensive ability to harvest, package, and transmit different types of data. (Appendix 1: Summary of ground-based infrastructure capabilities, p30)

In March 2016 (updated July 2016), the International Civil Aviation Organization (ICAO) established the Global Aeronautical Safety System (GADSS) and also Autonomous Distress Tracking (ADT). ICAO recommended the roll out of GADSS to occur in two phases:

Amendment 39 to Annex 6 (global flight tracking): operators must be able to track aircraft operating with a 4-dimensional position report under normal flight conditions every 15 minutes with an optional abnormal event tracking capability. More than 95% of the world's transoceanic commercial fleet are equipped with Inmarsat's Classic Aero system which allows them to achieve this objective.

Given most major airlines are already able to meet this requirement, we don't expect any benefit to accrue to FLYHT. The recommendations became effective 8 November 2018.

Amendment 40 to Annex 6 (autonomous distress tracking and flight data recovery): This amendment comprises the following components effective January 1, 2021:

- ability to produce a 4-dimensional position report once per minute when under abnormal flight conditions/distress. Effective 1 Jan 2021, it includes the recommendation that new production airframes be equipped with this capability and existing aircraft to be retrofitted.
- Aircraft shall be equipped with cockpit voice recorders (CVR) capable of retaining the last 25 hours of information
- Have the ability to recover flight data recorder and make it available in a timely manner

The practical impact of reducing the position update from 15min to 1min is the equivalent of reducing a search area from 44,788 square miles to 154 square miles[12]. For context, it was estimated that the Air Malaysia search cost over US$200m after searching 15,500 square miles[13].

It should be borne in mind that ICAO's recommendations are just that and it is up to a civil aviation regulatory agency to mandate the changes. e.g. FAA in the US. Civil aviation agencies are abiding by the Amendment 40 deadlines.

Also, a specific point regarding aircraft tracking requires clarification: Aircraft equipped with Automatic Dependent Surveillance-Broadcast Out (ADS-B) transponders are tracked automatically with their position broadcast in real-time. Since ADS-B Out 1090MHz is mandated throughout the world, most aircraft do not require additional equipment to be Amendment 40 GADSS tracking compliant. Aireon's GlobalBeacon provides this service. The clarification being made is that tracking/position data is not the same as streaming FDR data.

Impact on FLYHT: Amendment 40 represents a substantial opportunity for FLYHT, specifically as it relates to the ability of aircraft to recover the FDR in a timely fashion (recording vs ejecting). The standards are still being finalized and FLYHT is actively involved on 2 levels:

- Boeing's EcoDemonstrator project which validated proof of concept
- Trials with Inmarsat

We believe that FLYHT's satellites streaming solution will appeal to the fleets serving the transoceanic routes.

China mandate

Inmarsat's VP safety and operational services: China "is arguably the most active area we have right now".[14]

In China, the Civil Aviation Administration of China (CAAC) sets the standards for aircraft communications.

In September 2013 CAAC mandated that the aircraft communications methods necessary to legally operate in Chinese airspace were to be Satcom based. These regulations mandated Satcom voice communications between an aircraft and its airline operations center (AOC), independent of the air traffic control system, within four minutes anywhere within Chinese airspace.

The original deadline was December 2017 however, the deadline was moved to December 2019 via CCAR 121 R5.

COMAC estimates the size of the Chinese fleet at ~3,600 aircraft.[15] FLYHT has engaged 23 of the smaller airlines (refer to Appendix I for a list of Chinese airlines). We believe that these small airline wins are a segue way to a larger sized airline leading up to the 31/12/19 deadline.

[12] https://connectedaviationtoday.com/every-airline-exceed-gadss-flight-tracking-standards/
[13] http://time.com/5289619/mh370-missing-plane-search-ends/
[14] https://runwaygirlnetwork.com/2018/12/30/china-market-hots-up-for-inmarsat-and-iridium-cockpit-comms/
[15] english.comac.cc/news/latest/201811/14/t20181114_6610546.shtml

Impact on FLYHT: FLYHT's $60m backlog comprises $40m for the core AFIRs business, the large part of which is China related. We expect to see sequential growth on a quarterly in the number of AFIRS installs through 2019 as the existing backlog is deployed in anticipation of the 31/12/19 deadline. Its current backlog implies market share of around 10%, a larger airline win would raise its market share to a level commensurate with its technological lead. Such a win would be accretive to our forecasts.

Aircraft Operational Efficiency

We have written about the growing trend of broadband connectivity for the cockpit. We believe that it represents a substantial opportunity for FLYHT. To recap, from FLYHT's perspective:

- More than 2x increase in aircraft fleet sizes combined with increased amounts of data generated by aircraft will cause airlines to run their fleets more efficiently. The number of assets under management, benefits of fuel conservation and impact of more efficient asset utilization will require a more data-mining methodology of fleet management.
- Amendment 40 deadline represents an excellent opportunity for airlines to begin the process of upgrading their aircraft to IP-enabled.
- Two major satellite service providers catering to airline safety services have introduced higher bandwidth satellites, and hence services, in anticipation of this evolution.
- Two market studies show:
    - Airlines are committed to the concept of the connected aircraft and are committing increased capital in this regard - Honeywell's Airlines Push Connectivity Beyond the Cabin, June 2018)
    - There are substantial cost savings to be generated (refer p11) as airlines stream line their operations and take advantage of the connected aircraft – London School of Economics' Sky High Economics, Chapter Two: Evaluating the Economic Benefits of Connected Airline Operations
- FLYHT is acknowledged by industry regulatory bodies (ICAO through the ITU) and government bodies (GAO) as having one of the referenced solutions.
- FLYHT has trialled with Boeing/Embraer and proved the concept of streaming real time FDR data. This has extended to FLYHT being the first company approved by Inmarsat's CAP program. There are further trials to be undertaken with Inmarsat which will solidify its competitive position as a market leader.

Impact on FLYHT. We have included only a nominal contribution (50 AFIRS units) in our forecasts for 2020E. This revenue stream represents the biggest upside potential to our forecasts as the connected aircraft trend becomes established. Milestones in this regard include successful Inmarsat trials and larger airline wins. We believe that there is the opportunity to license AFIRS technology to other aircraft part OEMs. FLYHT's competitive technological lead positions the company to achieve meaningful market share as its solution appeals to airlines with both land-based and transoceanic fleets.

Weather/Panasonic Weather Solutions (PWS)

The operational benefits of improved real-time weather data is a subset of operational efficiency, covered above. However, we cover it in depth here as:

- the PWS acquisition was material to FLYHT from a financial perspective.
- Its FlightLink/TAMDAR solution doubles FLYHT's product offering, plus it
- Brings a significant customer, AirAsia, who after the acquisition closed increased its order of FlightLink/TAMDAR by 100 aircraft.
- AirAsia has 494 aircraft on order giving it the potential to increase its orders to FLYHT by more than triple the current level.

On 10 October 2018 FLYHT announced that it had acquired the assets of PWS. It will contribute to FLYHT revenues with effect from the beginning of Q4/18. AFIRS is an Iridium based system, so is FlightLink so there will be some economies of scale.

Background

AirDat LLC developed the TAMDAR systems, in April 2013, Panasonic Aviation Corp. (PAC) acquired AirDat to complement its number one position in in-flight entertainment and communications and to benefit from the combination of AirDat's Iridium and Panasonic's Ku satellite bands.

Asset Acquisition

FLYHT acquired the assets for no monetary consideration and PAC will pay FLYHT a subsidy of US$3.3m to keep it cash flow neutral to FLYHT during the transition phase which ends 31 March 2020. This amount may increase to $4.3m depending on the rate of FlightLink/TAMDAR installs. FLYHT received $1.1m upfront for Q4/18 contribution and $742k for Q1/19.

We believe that these amounts will be disclosed in Other Income as they are offsets to PWS costs. We have modelled PWS such that it achieves breakeven during Q1/20 off the back of the additional 100 AirAsia FlightLink installs.

PWS serves more than 12 airlines with 200 active units in service with Iridium satellite communications systems, comprised of 27 employees, 10 service contracts, including AirAsia, which is now FLYHT's largest customer. PWS is also an Iridium value-added reseller. Of the 200 active units, around 100 generate meaningful monthly recurring revenues (all AirAsia).

AirAsia, including its long-haul operation AirAsia X, have 494 aircraft on order[16] of which 394 are from its AirAsia Malaysia subsidiary[17]. This implies that FLYHT could more than triple the size of its largest customer over the next 20 years as the aircraft are delivered.

Product

PWS primary product is **FlightLink**, an Iridium satellite data unit**.** It supports flight deck voice and data, independent GPS-based system that features event triggered reporting (like AFIRS) and continuous real-time aircraft tracking and TAMDAR. The FlightLink solution comprises three line rack units (LRU):

- The satellite data unit which houses all the communications protocols,
- An Antennae, and
- **TAMDAR** – (Tropospheric Airborne Meteorological Data Reporting) is a key component of FlightLink. It collects, in real time, weather data from the atmosphere during the flight including humidity, temperature, wind, pressure, icing and turbulence.

Given the higher bandwidth data requirements for this solution, Panasonic was going to use its IFE Ku bandwidth for the solution, evolving over to Iridium NEXT when it became available.

Revenues

The FlightLink/TAMDAR solutions generate monthly recurring revenues while the TAMDAR-only solution generates raw weather data sold to Synoptic Data PBC. With regards to raw weather data, the PWS acquisition came with a US$2.0m p.a. NOAA contract via Synoptic Data PBC which was subsequently increased to US$15m over 5 years subsequent to the acquisition, on 24 October 2018.

[16] https://www.mba.aero/se-asia-fleet-review-airasia-and-vietjet-to-grow-while-lion-group-orders-less-%D0%B0ircraft/
[17] https://blueswandaily.com/malaysias-airasia-plans-more-rapid-expansion-in-2019-despite-airport-constraints-and-pilot-shortage/

Both weather streams will be disclosed as SaaS revenues while FlightLink/TAMDAR hardware will be disclosed as Hardware sales.

Competitive positioning

TAMDAR's genesis is well described by Wikipedia:

In response to a government aviation safety initiative in the early 2000s, NASA, in partnership with the FAA, NOAA, and private industry, sponsored the early development and evaluation of a proprietary multifunction in situ atmospheric sensor for aircraft. The predecessor to Panasonic Weather Solutions, AirDat (formerly ODS of Rapid City, SD), located in Morrisville, North Carolina and Lakewood, Colorado, was formed in 2003 to develop and deploy the…TAMDAR system based on requirements provided by the Global Systems Division (GSD) of NOAA's Earth System Research Laboratory (ESRL), the FAA, and the World Meteorological Organization (WMO).

….. The TAMDAR system has been in continuous operation since initial deployment in December 2004.

Wikipedia goes on to say:

Third-party studies have been conducted by NOAA-GSD, the National Center for Atmospheric Research (NCAR), and various universities and government agencies to verify the accuracy of TAMDAR data against that of weather balloons and aircraft test instrumentation, as well as quantifying the TAMDAR-related impacts on NWP. Ongoing data denial experiments show that the inclusion of TAMDAR data can significantly improve forecast model accuracy with the greatest gains realized during more dynamic and severe weather events.

Prior to acquisition by FLYHT Panasonic has stated that TAMDAR's service is superior to the:

- American Global Forecast System (**GFS**). The GFS is a global numerical weather prediction system containing a global computer model and variational analysis run by the United States' National Weather Service (NWS). The GFS is run by the US National Oceanic and Atmospheric Administration (NOAA).
- European Center for Medium Range Weather Forecasts (**ECMWF**)

For context, GFS and ECMWF are compared for predictive accuracy. During the hurricanes moving into the Caribbean during the past few years, tracking and course prediction was undertaken using both the "US" and the "European" models. Generally, the European model is viewed as more accurate and in 2015 the NOAA was provided with additional funds to upgrade its computing power.

The point of the above is not to comment on which model is better, but rather to help investors broadly understand the competitive environment in which PWS operates.

On September 18, 2017 The Washington Post ran an article "The best forecasts for Hurricane Irma came from a computer model few people knew about". In the article, TAMDAR data was credited with providing the most accurate forecast of Irma's landing in Florida, US, beating both the GFS and ECMWF models. The weather forecasting operation of PWS was not acquired by FLYHT, instead FLYHT now sells the raw weather data to NOAA to allow it to improve its predictive capability.

Synoptics/NOAA contract

On 24 October 2019 FLYHT announced that it had signed a 5-year, US$15m semi-exclusive TAMDAR weather observation sales and distribution agreement with Synoptic Data PBC.

Predicated upon a predetermined increase in minimum number of weather-related soundings over the term of the contract, Synoptic is obliged to makes its minimum payments to maintain exclusivity.

Upon acquisition of PWS, FLYHT acquired 200 TAMDAR units and must effectively double the installed base to 400 units to meet its minimum obligations in terms of the contract. Its 11 December 2018 announcement on AirAsia gives visibility to an increase in the installed base to 300 units meaning FLYHT will have made substantial progress towards meeting its minimum number of readings.

Synoptic licenses TAMDAR data for sub-license to NOAA (the National Oceanic and Atmospheric Administration).

Evidence of relevance

As an aside, per Advance Contract Award Notice: 5000042890, Environment and Climate Change Canada (ECCC) intends to enter into a contract with FLYHT to collect and deliver one month of upper air meteorological data. Using existing FLYHT customers First Air and Canadian North, the intention is to gather non-meteorological and meteorological data and to provide it to Canadian Center for Meteorological and Environmental Prediction (CCMEP) in real time.

The intention is to improve the quality of very sparse upper air data in Canada's remote communities. If the trial is successful, it may be rolled out to other aircraft/airlines. FLYHT was chosen because it is "the only data service provider that could provide AMDAR data from their respective client fleets/aircraft." FLYHT will receive $63k-$166k depending on the success and scope of the contract.

We read into this trial that if it is successful, all Canadian airlines servicing remote communities may have to subscribe to the full FlightLink/TAMDAR monthly service.

Impact on FLYHT: PWS is a transformative acquisition. It doubles SaaS revenues immediately, brings a tier one customer (AirAsia), doubles FLYHT hardware product offering, TAMDAR weather services will eventually be ported over to AFIRS. PWS had 200 active units prior to acquisition by FLYHT, of which 90 comprised Air Asia, and 80 of which were installed. Management stated at acquisition that it "holds existing agreements that could nearly double this number (the 90 AirAsia installs) over the transition period". On 11/12/18 FLYHT announced that it had secured a contract for an additional 100 AirAsia aircraft bringing its total Air Asia contract up to 190 aircraft. In addition, AirAsia has a backlog of 494 aircraft implying a potential more than tripling of FlightLink installs over the next 20 years.

Forecasts

Revenues

On 30 April 2018, FLYHT announced that it had sold its 2000th AFIRS unit to Turkish operator, Azur Havacilik A.S, for installation into its Boeing 767-300 aircraft.

In its February 2019 investor presentation, FLYHT states that it has sold 2,200+ AFIRS units.

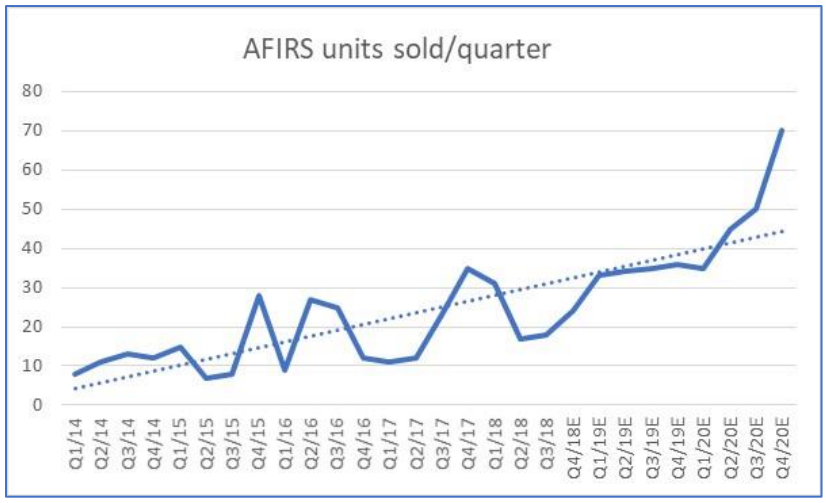
We believe that FLYHT will record recurring monthly (SaaS) revenues on 337 units (Figure 14) by the end of 2018E. This implies that the vast majority of AFIRS sales were sold through the L-3 Avionics channel as factory options on Airbus A320 and A330 aircraft. This level of penetration was indirectly confirmed by Matt Desch, CEO of Iridium, on its Q2/18 conference call where he stated that "safety voice …is now installed on over 1,000 aircraft" (p13).

These sales do not generate recurring monthly SaaS revenues. A potential opportunity for FLYHT is the upselling of monthly services into the L-3 Airbus installed base.

AFIRS sales vary on a quarterly basis (Figure 13). We see relative stability during 2019E as the Chinese market moves closer to the 31 Dec 2019 deadline and airlines commit to installation schedules. These units:

- are our assessment of the rate of buildout of the existing order book.
- Are FLYHT direct sales, hence exclude any L-3 Aviation license units sold, consequently
- All contribute to monthly recurring revenues

Figure 13: AFIRS units sold/quarter



Source: Company records, KRC Insights

We forecast AFIRS unit sales of a relatively steady 35 units per quarter until the latter end of 2020E when the Amendment 40 deadline approaches. At that stage we expect AFIRS deployments to begin to ramp.

Figure 14: AFIRS and FlightLink/TAMDAR unit sales

	2016	2017	2018E	2019E	2020E
AFIRS Units sold in year	73	81	90	140	200
FlightLink/TAMDAR sold in year				75	135
Revenue generating units (AFIRS)	166	247	337	477	677
Revenue generating units (FlightLink)			90	225	330

Source: Company reports; KRC Insights

The monthly recurring revenues derived from FlightLink/TAMDAR are derived from AirAsia. PWS currently generates revenues on 80 units and FLYHT signed an extension of the contract with AirAsia for an additional 100 planes, bringing the total AirAsia contract to 190 aircraft (10 were awaiting installation).

We modelled 75 FlightLink/TAMDAR installs for 2019E. Due to management distraction caused by the acquisition and the certification requirements for the Colorado facility, we believe that these units will recommence installation during Q2/19, implying a run rate of 25 units/quarter.

Weather services revenue are generated by the NOAA contract at US$2.0m p.a. or US$500k/quarter.

Given the newness of the PWS acquisition and lack of financial detail, we have broken it out separately so as to not obfuscate our view on the AFIRS business. The impact of the PWS on the Q4/18 results to be reported in early April 2019 is shown In Figure 15.

Figure 15: FLYHT Q4/18E (C$000's)

	Q4/18E		
	FLY	PWS	Consolidated
Voice and Data Services*	1,174	1,165	2,339
AFIRS sales	1,356		1,356
Parts sales/Licensing	213		213
Services	29		29
Revenues	**2,773**	**1,165**	**3,938**
Cost of revenue	(1,060)	(687)	(1,747)
Gross profit	1,713	478	2,191
Distribution Expenses	(1,199)	(580)	(1,779)
Administration Expenses	(719)	(580)	(1,299)
R&D	(624)	(580)	(1,204)
Total costs**	(2,542)	(1,740)	(4,282)
Operating income	**(828)**	**(1,262)**	**(2,091)**
Interest and other income	2		2
Forex, Interest	(38)		(38)
Other***		1,430	1,430
Net income before taxation	(864)	168	(697)
Taxation	15		15
Net income	**(849)**	**168**	**(681)**

Source: Company reports; KRC Insights

*= "For October….PWS…resulted in an immediate doubling of the monthly SaaS revenues" FLYHT press release 7/1/19

**= No breakdown of PWS costs available, assumed evenly spread. Focus is on the total PWS costs for the quarter

***=FLYHT was paid US$1.1m at closing representing Q4/18 and Q1/20 cash top up payment.

Major PWS assumptions for 2019E:

- 75 FlightLink/TAMDAR units sold
- GM at 41%
- Panasonic top up payment tapers off significantly into Q4/19 as PWS turns profitable at the tail end of the transition period (Q1/20)

We believe that FLYHT will be profitable in 2020E with its existing order book. In 2020E (Figure 16) we have modelled the following:

- SaaS revenue - 1037 units (AFIRS and FlightLink/TAMDAR) generating monthly recurring revenues
- Hardware sales – 335 units (AFIRS and FlightLink/TAMDAR)
- Gross margins – 57%
- Expense run rate – C$4.5m/quarter

Figure 16: FLYHT and PWS consolidated 2019E and 2020E forecasts (C$000's)

	FY2019			FY2020		
	FLY	**PWS**	**Consolidated**	**FLY**	**PWS**	**Consolidated**
Voice and Data Services	6,284	5,623	11,907	8,104	7,437	15,541
Hardware sales	7,826	2,730	10,556	11,266	4,680	15,946
Parts sales/Licensing	1,400		1,400	1,400		1,400
Services	250		250	250		250
Revenues	**15,760**	**8,353**	**24,113**	**21,020**	**12,117**	**33,136**
Cost of revenue	(5,516)	(4,929)	(10,444)	(7,147)	(7,028)	(14,174)
Gross profit	10,244	3,425	13,669	13,775	5,251	19,026
Distribution Expenses	(5,437)	(2,000)	(7,437)	(6,096)	(1,800)	(7,896)
Administration Expenses	(2,994)	(2,000)	(4,994)	(3,321)	(1,800)	(5,121)
R&D	(2,758)	(2,000)	(4,758)	(2,943)	(1,800)	(4,743)
Total costs	(11,189)	(6,000)	(17,189)	(12,359)	(5,400)	(17,759)
Operating income	**(946)**	**(2,575)**	**(3,521)**	**1,513**	**(311)**	**1,202**
Interest and other income	10		10	10		10
Forex, Interest	(200)		(200)	(200)		(200)
Other		2,670	2,670			
Net income before taxation	(1,136)	95	(1,040)	1,323	(311)	1,012
Taxation	6		6	(7)		(7)
Net income	**(1,130)**	**95**	**(1,034)**	**1,317**	**(311)**	**1,006**

Source: Company reports; KRC Insights

Balance Sheet

FLYHT's debt position is as follows:

Figure 17: FLYHT debt composition at 30/9/18

Debtor	Amount ($000's)	Salient Terms
SADI	1,198	Strategic Aerospace and Defence Initiative (SADI). Repayable over 15 years on stepped basis, commenced 30/4/14.
WINN	1,405	Western Innovation initiative (WINN). Repayable over five years commencing January 1, 2020.
Convertible debenture	2,000	Matures 24/7/21, 8% interest rate, convertible at option of debenture holder at $1.30 any time prior to maturity. Forced conversion at $1.30 if shares trade at $1.80+ for 20 consecutive days.
Total	4,603	

Source: Company reports

Valuations

We believe that there are 2 appropriate methodologies for deriving a valuation for FLYHT:

- As a Software as a Service (SaaS) model; and
- Capitalized value/unit installed

SaaS approach

We view FLYHT as a Software as a Service (SaaS) provider. In FLYHT's instance, software is licensed on a monthly subscription basis and is centrally hosted on its UpTime server. SaaS is a common delivery model for many business applications, including office software, enterprise resource planning, and supply chain management etc.

While its hardware sales are 'lumpy' and incur long sales cycles, the SaaS revenue stream benefits from its stable and recurring nature, as fees are paid over the life of the contract, typically 5 years.

Figure 18 highlights the major TSX-listed SaaS companies and the select SaaS companies that underwent their initial public offerings (IPO) during 2018 in the US.

Figure 18: Software as a Service (SaaS) comparable companies (currencies per country)

					EBITDA		Revenues		Rev	EV/Revenues	
	Symbol	Price	Mkt Cap $m	EV $m	2019E $m	2020E $m	2019E $m	2020E $m	Growth	2019E	2020E
FLYHT Aerospace Solutions Ltd	**FLY.V**	**1.33**	**27**	**30**	**(0.6)**	**1.1**	**24.1**	**33.1**	**39.2%**	**1.24x**	**0.89x**
BSM Technologies Inc	GPS.TO	0.89	72	67	(0.0)	7.5	62.0	64.7	4.4%	1.08x	1.04x
Solium Capital Inc	SUM.TO	19.06	1,081	727	0.2	34.6	128.9	145.8	13.1%	5.64x	4.99x
Descartes Systems Group Inc	DSG.TO	47.15	3,646	2,733	0.4	118.4	275.5	327.6	18.9%	9.92x	8.34x
Kinaxis Inc	KXS.TO	74.10	1,937	1,280	1.1	56.6	186.5	220.3	18.1%	6.86x	5.81x
Constellation Software Inc	CSU.TO	1,097.69	23,262	17,227	33.2	1,101.5	3,536.2	4,065.2	15.0%	4.87x	4.24x
Average							4,189.1	4,823.6	15.1%	**5.68x**	**4.88x**
Select SaaS IPOs (2018) US$											
DocuSign Inc	DOCU.O	58.85	9,725	9,063	0.1	74.7	694.9	872.0	25.5%	13.04x	10.39x
Dropbox Inc	DBX.O	22.13	9,101	8,176	0.4	463.4	1,639.7	1,878.5	14.6%	4.99x	4.35x
Pivotal Software Inc	PVTL.K	22.40	5,878	6,463	(0.3)	(24.6)	657.8	806.8	22.7%	9.83x	8.01x
Pluralsight Inc	PS.O	29.02	3,990	3,919	(0.3)	2.4	311.8	412.4	32.3%	12.57x	9.50x
Smartsheet Inc	SMAR.K	45.39	4,708	4,503	(0.4)	(35.3)	175.3	243.8	39.1%	25.69x	18.47x
Zuora Inc	ZUO	23.50	2,550	2,390	(0.6)	(38.6)	234.1	294.5	25.8%	10.21x	8.12x
Blue Apron Holdings Inc	APRN.K	0.99	192	180	(0.3)	26.3	574.1	598.3	4.2%	0.31x	0.30x
Snap Inc	SNAP.K	11.28	14,901	13,622	(0.3)	(82.5)	1,537.5	2,005.3	30.4%	8.86x	6.79x
							5,825.0	7,111.4	22.1%	**10.69x**	**8.24x**

Source: KRC Insights, Refinitiv Eikon

Broadly speaking, the multiple difference between the two groups is attributable to the US stocks having higher revenue growth rates, larger market caps and greater liquidity.

Using a sum of parts approach, we derive a target price of C$3.40. Assumptions include:

- Derived using 2020E revenue estimates
- A $5.0m capital raise is undertaken
- SaaS multiple of 5.0x applied vs the Canadian peer group trading at 4.88x.

Figure 19: FLYHT valuation. Sum of parts with PWS consolidated

	2020E	Multiple	Value
SaaS Revenues	15,540	5.0x	77,701
Hardware	15,946	1.0x	15,946
$000's			93,647
FD # shares		24,479	
$5.0m raise		3,333	
Total FD # shares			27,812
Price/share			3.37
		Rounded	$3.40

Source: KRC Insights

When FLYHT lands a significant Chinese airline/Inmarsat-based contract, we believe that the shares will undergo multiple expansion due to confirmation of the business model, FLYHT's technological lead and the stickiness of the contracts (typically 5 years). If we apply a 6x multiple to 2020E SaaS revenues, the target price increases to $4.00.

Capitalized value/unit

FLYHT's business model is to generate stable monthly revenues per hardware unit installed. The one-time hardware only L-3 Avionics' Airbus factory installs are winding down and hence are not expected to meaningfully contribute to sales in the future.

We estimate that the current product mix generates ~C$1,200/month (blended). Its revenue growth is directly driven off the ability to install either AFIRS or FlightLink/TAMDAR hardware from which the recurring revenues are derived. Hence, a capitalized value/unit is an appropriate alternative methodology of valuation (Figure 20).

Figure 20: FLYHT valuation/installed unit end 2020E

AFIRS units		677
FlightLink/TAMDAR units		330
Total revenue generating units		1,007
Revenues/month		$1,200
Annualized		$14,400
Capitalized	6.5x	$94,562
FD number of shares		27,812
Value/share		$3.40

Source: KRC Insights

A $3.40 target price implies a capital value/unit of $94,500, or 6.5x revenues. As the number of revenue generating units grows, we believe that eventually FLYHT may be valued using this metric.

Blue Sky

Our forecasts up to 2020E are primarily based on the existing order book, we include only 50, units in 2020E to account for the connected aircraft ramp. However, we believe that there is significant opportunity for FLYHT to both penetrate new markets (connected aircraft) and increasingly penetrate its existing markets. Opportunities for FLYHT include:

- Increasing penetration into China above 10% market share. This would include one of the larger Chinese airlines
- Penetration of the Inmarsat network given trials on that network and its CAP status
- Expanding AirAsia from 190 units to 684 units (190+494 on order)
- Amendment 40: Penetration into Boeing aircraft market given EcoDemonstrator trials
- Increased acceptance by airlines of the benefits of the connected aircraft

Appendix I: Chinese Airlines

Major Airlines	Fleet Size	On order		Minor Airlines	Fleet Size	On order
Air China	412	141		9 Air		
China Eastern Airlines	530	157		Air Guilin		
China Southern Airlines	606	269		Air Chang'an	10	
Hainan Airlines	241	81		Air Travel		
Shandong Airlines	121	40		Beijing Capital Airlines	80	8
Shanghai Airlines	105	25		Chengdu Airlines	42	23
Shenzhen Airlines	189	49		China Express Airlines	45	0
Sichuan Airlines	149	72		China Flying Dragon Aviation		
XiamenAir	171	24		China United Airlines	49	0
				Chongqing Airlines	28	1
				Colorful Guizhou Airlines		
				Dalian Airlines		
				Donghai Airlines	22	33
				Fuzhou Airlines	17	20
				Grand China Air		
				Guangxi Beibu Gulf Airlines	23	0
				Hebei Airlines	28	22
				Jiangxi Air	10	0
				Joy Air		
				Juneyao Airlines	73	7
				Kunming Airlines	27	8
				Longjiang Airlines	2	0
				Loong Air	41	0
				Lucky Air	55	1
				Meiya Air		
				Nanshan Jet		
				Okay Airways	30	23
				Suparna Airlines	24	0
				Qingdao Airlines		
				Ruili Airlines	18	42
				Spring Airlines	82	58
				Tianjin Airlines	90	20
				Tibet Airlines		
				Urumqi Air	18	4
				West Air	32	1
				ZYB Lily Jet		
				Total	**3,370**	**1,129**

Source: Wikipedia

Appendix II: FLYHT Supplemental Type Certificates (STC)

STCs are required to make appropriate modifications to an airline's approved design. FLYHT has STCs in place for the following aircraft:

TCCA- Canada, FAA – US, EASA – European Union, CAAC – China, ANAC – Brazil

	TCCA		FAA		EASA		CAAC		ANAC	
	220	228	220	228	220	228	220	228	220	228
Airbus A319, A320, A321	A	A	A	A	A	A	A	A		
Airbus A300				I						
Airbus A330	A									
ATR42 -300		A		A						A
ATR42 -500		A		I						
ATR-72 -100, -200		A		A						A
ATR42-500 "600 Version" (*STC Twenty One)						A*				
ATR72-212A "600 Version" (*STC Twenty One)						A*				
Boeing B737 -200	A		A		A		A			
Boeing B737 -300, -400, -500	A	A	A	A	A	A	A	A		A
Boeing B737 -600	A		A		A		A			
Boeing B737 -700, -800	A	A	A	A	A	A	A	A		A
Boeing B737 -900ER				A				I		
Boeing 747-200		A						I		
Boeing 757 -200	A	A	A	A	A	A	A	A		
Boeing 767 -200, -300	A	A	A	A	A	A	A	A		
Boeing B777		A		A						
Bombardier DHC 8 -100, -200, -300 (*Avmax)	A	A*	A	A*	A	A*				
Bombardier DHC 8 -400	A	A		I				I		
Bombardier CRJ 100, 200, 440	A	A	A	A	A			A		
Bombardier CRJ -700, 900		A		A				A		
McDonnell Douglas DC-10 (KC-10 military)	A		A							
McDonnell Douglas MD-82				A						
McDonnell Douglas MD-83		A		A						
Fokker 100	A									
Hawker Beechcraft -750, 800XP, 850XP, 900XP	A	A	A	A	A	A				
Viking Air DHC -7 (LSTC)	A									
Embraer EMB 190		A		I				A		A
Embraer Legacy 600 and EMB – 135/145			A							

Source: Company reports

A=Approved
I=In Progress
*=Partnered with 3rd party

Appendix III: Senior Management

Thomas R. Schmutz, Chief Executive Officer

Thomas R. Schmutz became the Chief Executive Officer for FLYHT Aerospace Solutions Ltd. in October 2015. Prior to FLYHT, Tom served as Vice President, Engineering at L-3 Communications, Aviation Recorders Division, in Sarasota FL, a position he held beginning in August 2006. Tom also served as Vice President, Engineering for the Aviation Products Sector within the Products/Electronic Systems Group. Prior to L-3, Tom served as Vice President of Engineering for AirNet Communications, a telecommunications firm he helped to form in 1994 and take public in 1999. Prior to AirNet, he worked for Harris Corporation and was a Captain in the United States Army Corps of Engineers. Mr. Schmutz holds an MBA from the University of South Florida, an MS from the Georgia Institute of Technology (GA Tech) where he studied Digital Signal Processing and Communication Theory and a BS degree from the United States Military Academy (West Point) where he studied Electrical Engineering. He holds nineteen U.S. design patents and has other patents pending.

Jeffrey Rex, VP Sales and Marketing

Jeffrey Rex was appointed to the role of Vice President of Sales and Marketing in November 2018. Jeff comes to FLYHT through its acquisition of the assets of Panasonic Weather Solutions (PWS) and is responsible for FLYHT's global sales and marketing efforts. As a director at Panasonic Avionics Corporation, with an aerospace engineering background, Jeff led the company's business and product development for advanced flight tracking, flight-deck communications and aviation weather solutions. Additionally, as a member of the Panasonic business development and strategic innovations team, Jeff worked to build strategic partnerships, support mergers and acquisitions activities, and help expand the marketability of existing products into alternative markets around the globe. At AirDat, the predecessor company of PWS acquired by Panasonic in early 2013, his responsibilities included airline, aviation and government business and product development. Prior to his work with AirDat, Jeff served as Vice President of L2 Aviation for more than 10 years and was a senior program manager at Aircraft Systems and Manufacturing. Based in the Denver area, Jeff holds a BSc in Aerospace Engineering, an ME in Management, and enjoys skiing, biking, and extensive traveling with his family.

Alana Forbes, Chief Financial Officer

Alana Forbes, CPA, CGA, was appointed into the role of CFO at FLYHT in March 2018. Alana achieved her CGA designation in 2002 and during her years with the Company, she has led many special projects. These include conversion to the International Financial Reporting Standards (IFRS) in 2010, implementation of the Company's new ERP system in 2016, and IFRS15 adoption in 2018. Prior to FLYHT, Alana was the Assistant Controller at Mentor Engineering, Inc. and before that she spent six years at Marsh Canada Ltd. in several positions, including Assistant VP Finance. Since 2010 Alana has been a volunteer board member of the Calgary Synchronized Skating Club and currently serves as club president. Alana has a Bachelor of Commerce from Mount Allison University in New Brunswick and over 20 years of accounting experience.

Derek Graham, Chief Technical Officer

Derek Graham has more than 10 years of combined aeronautical satellite product development and management experience, Derek brings extensive depth and leadership to the FLYHT Team. Derek has previously worked at a major avionics manufacturer for 10 years in product line Management and development responsible for a line of successful aviation Iridium and Inmarsat communications products.

Michael Fang, Vice President China Sales

Michael Fang is an Avionics Engineer with more than 15 years of work experience in the Chinese aerospace industry. He has worked with both the Chinese Airlines and Chinese government regulators. He holds an MBA from the Haskayne School of Business at the University of Calgary.

Matieu Plamondon, Chief Operating Officer

Matieu Plamondon was appointed Vice President in May 2016. He has over 15 years experience managing airline operational teams. He has also acquired experience in the IT and software industry while leading the operations team of a software provider supporting over 200 airlines worldwide. In his previous position as the Director Operational Control Centre at First Air he was responsible for the implementation of satellite communication and tracking within the centre.

Appendix IV: Directors

Bill Tempany – Chairman, FLYHT Aerospace Solutions Ltd.

John Belcher – Former Chairman and Chief Executive Officer, ARINC Inc.

Mike Brown – Partner, Geselbracht Brown

Barry Eccleston – President, Airbus Americas, Inc.

Jacques Kavafian – Director

Doug Marlin – President, Marlin Ventures Ltd.

Jack Olcott – President, General Aero Company

Mark Rosenker – United States Air Force (retired)

Paul Takalo – Director

Nina Jonsson – President of Viking Fleet Advisors and a Senior Advisor at Plane View Partners,

Appendix V: Glossary

Acronym	Brief description/explanation
ACARS	Aircraft Communications Addressing and Reporting system) is a digital datalink system for transmission of short messages between aircraft and ground stations via airborne radio or satellite.
ADS-B	Automatic Dependent Surveillance-Broadcast (ADS-B) can be via a satellite. Relies on aircraft broadcasting its identity, a precise GPS position and other information derived from on-board systems. Cheaper than radar.
AFIRS	FLYHT's hardware product: Automated Flight Information Reporting System
CAAC	China Civil Aviation Authority
FANS	The Future Air Navigation System (FANS) is an avionics system which provides direct data link communication between the pilot and the air traffic controller. Boeing announced a first-generation FANS product - FANS-1. It used existing satellite based ACARS communications. Airbus developed FANS-A, together, the two products are collectively known as FANS-1/A
FDR	Flight data recorder (black box)
GADSS	Global Aeronautical Distress and Safety System
GNSS	Global Navigation Satellite System.
ICAO	International Civil Aviation Authority. Promotes Standards and Recommended Practices (SARPS) regarding the safety of international civil aviation, including the Global Navigation Satellite System (GNSS) whenever it is used for aviation-related purposes
ITU	International Telecommunication Union. Responsible for providing international protection from harmful interference of ITU registered assignments in the Master International Frequency Register (MIFR), including GNSS
NOAA	National Oceanic and Atmospheric Administration is an American scientific agency within the United States Department of Commerce that focuses on the conditions of the oceans, major waterways, and the atmosphere.
OEM	Original Equipment Manufacturer
PWS	Panasonic Weather Solutions
SOS	Safety and Operational Services (Inmarsat revenue segment)
TAMDAR	Tropospheric Airborne Meteorological Data Reporting

Disclosure

- KRC Insights is the research and consulting arm of 2622632 Ontario Inc.
- KRC Insights undertakes paid research and was paid by FLYHT for this report.
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