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Airport Campus Master Plan at Murfreesboro Municipal Airport

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1. EXECUTIVE SUMMARY

The Middle Tennessee State University (MTSU) Department of Aerospace operates facilities at Murfreesboro Municipal Airport in support of the Professional Pilot and Maintenance Management concentrations. In response to accreditation recommendations and continued growth in enrollment, Campus Planning initiated a process to develop a master plan for MTSU facilities located at the Airport. This summary presents an overview of the planning process and the resulting recommended plan.

Facility Requirements

Future facility requirements were prepared on the basis of projected numbers of students in the Professional Pilot and Maintenance Management concentrations along with space programs for functional areas including classrooms, labs, flight briefing areas, hangar space, and support functions which were benchmarked against comparable programs at other universities. Over the past thirteen years Professional Pilot enrollment has grown at a 6.2 percent compound annual growth rate. Applying this growth rate into future, enrollment is forecast to increase from 721 students in 2019 to 1,350 in 2029. Maintenance Management enrollment grew at a 3.5 percent compound annual growth rate. This growth rate results in an increase in enrollment from 89 students in 2019 to 125 in 2029.

In total the Department occupies approximately 45,300 square feet of building space along with parking apron for 26 aircraft at the Airport. The baseline facility requirement for today's enrollment is 124,400 square feet of building space and apron for 30 aircraft. The ten year facility requirement to accommodate the growth presented above is 144,000 square feet of building and hangar space and 60 aircraft parking positions. These facility requirements served as a guide in the development of alternatives for future facility development at the Airport.

Recommended Plan

Several initial alternatives were developed and reviewed with stakeholders including Campus Planning, Aerospace faculty and staff, and Airport management. Based on operational efficiency, prioritization of needs, and likely funding availability, one alternative was carried forward and refined to serve the operations of the Department and enhance compatibility with Murfreesboro Municipal Airport development goals. **Exhibit ES 1** presents the recommended plan and consists of the following development items:

Flight School Maintenance Hangar – a new 16,000 square foot hangar for the maintenance of the MTSU fleet of aircraft. The Donald McDonald Hangar would transition to use by the Maintenance Management program to address the need for additional space identified in the accreditation report.

Aerospace Instructional Building – a new 10,000 square foot building with classroom and flight briefing rooms to accommodate growth in Professional Pilot enrollment.

Aircraft Parking Apron – incremental addition of aircraft parking growth in the MTSU aircraft fleet.

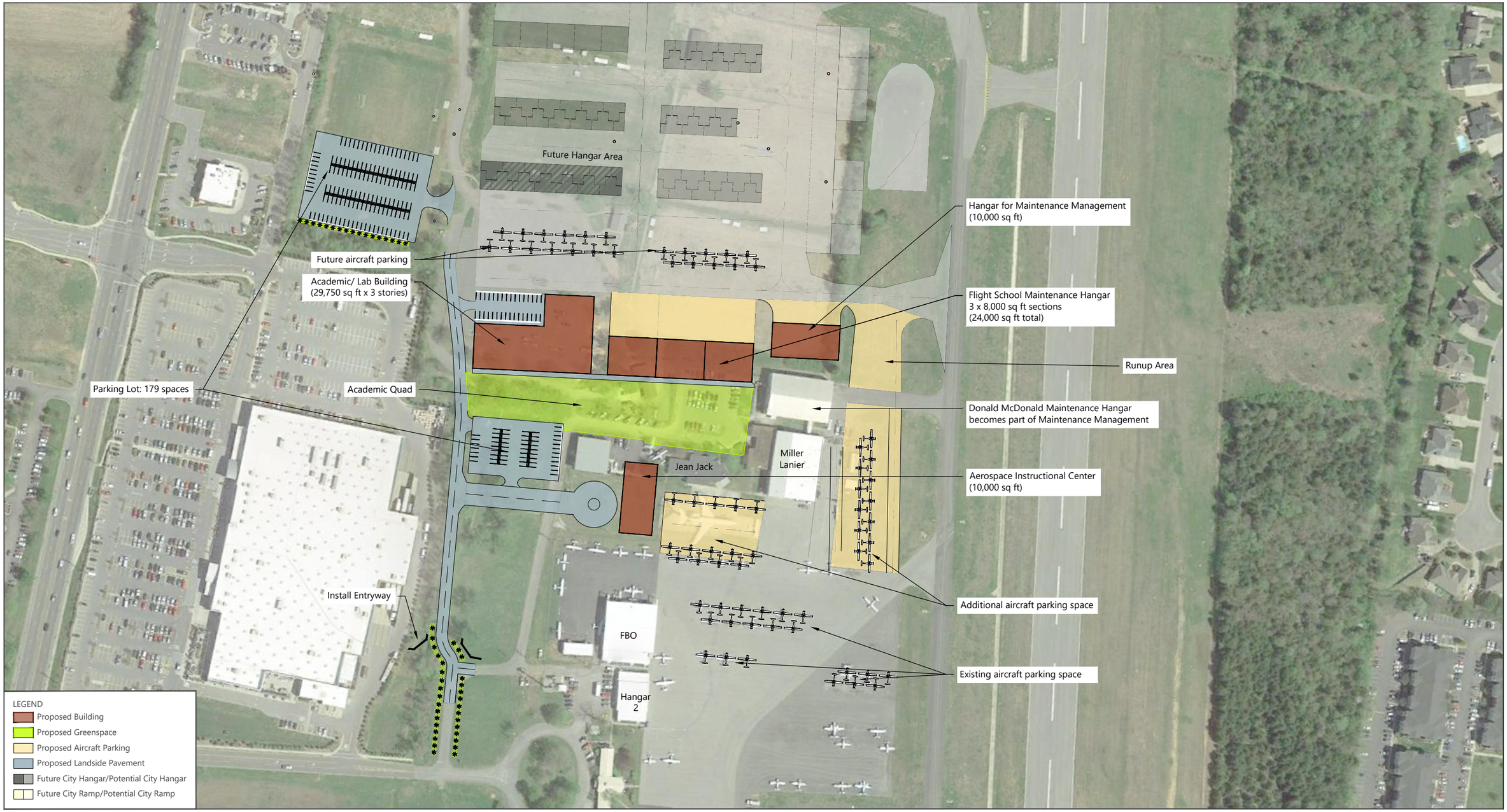
Academic/Lab Building –a three-story, 89,000 square foot academic and lab building is proposed to serve both Professional Pilot and Maintenance Management students.

Maintenance Management Hangar – to meet the long-term requirements for hangar space, a third hangar is proposed north of the Donald McDonald Hangar keeping the Maintenance Management hangars adjacent to one another.

Expand Flight School Maintenance Hangar – With continued growth in aircraft fleet, additional space will be required for flight school aircraft maintenance. The plan allows for an additional 8,000 square foot hangar bay to be added to the maintenance hangar for additional capacity.

The recommended plan can be phased to meet the immediate needs of the Department while positioning facilities for growth in enrollment over the long term. In a first phase, the flight school maintenance hangar would be constructed, and the Donald McDonald Hangar would be converted for Maintenance Management instruction. The Aerospace Instructional Building and additional aircraft parking apron would also be constructed in the first phase.

Subsequent phases of development would occur as demand warrants. Following the initial phase, the Academic/Lab Building and the academic quad would be constructed along with additional vehicle parking. Final phases of the plan include the third Maintenance Management hangar and an expansion to the flight school maintenance hangar.



SOURCE: Google Earth Pro, Image Landsat/Copernicus, April 2018, (for visual reference only - may not be to scale); Atkins, December 2019; Ricondo & Associates Inc., January 2020.

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EXHIBIT ES-1

RECOMMENDED PLAN

2. BACKGROUND AND EXISITNG CONDITIONS

The Middle Tennessee State University Department of Aerospace operates facilities at Murfreesboro Municipal Airport in support of the Professional Pilot and Maintenance Management concentrations. In response to accreditation recommendations and continued growth in enrollment, MTSU Campus Planning initiated a process to develop a master plan for MTSU facilities located at the Airport.

2.1 BACKGROUND

In 2017, the Aviation Accreditation Board, International (AABI) completed an accreditation review of the undergraduate and graduate degree programs in the Aerospace Department. Based on that review, accreditation was received from AABI with a series of recommendations for program improvement. One recommendation from the AABI accreditation review was related to the educational facilities for the Maintenance Management concentration and the need for additional hangar, classroom, and lab space. That specific recommendation is as follows:

> **Recommendation 3:**
> *Assess if the airport Maintenance classrooms (AWS 105 and 106) and the maintenance hangar (AWS 150) are appropriate to the program objectives. Furthermore, if the analysis determines the hangar is not appropriate, establish a timeline for replacing the hangar with the type encountered in industry and practice (AABI Criterion 4.6.1).*

In its response to AABI, MTSU committed to study the needs of the Aerospace Department facilities at Murfreesboro Municipal Airport. In addition to the AABI recommendations, unprecedented growth in enrollment in the Professional Pilot concentration has led to constraints on those facilities as well.

A series of visioning sessions were conducted with faculty and staff to identify long term department needs as aviation education evolves. Following the visioning sessions, MTSU Campus Planning identified the need to formally develop a long-term plan for facilities at the airport.

2.2 EXISTING CONDITIONS

The MTSU facilities at the Murfreesboro Municipal Airport are generally concentrated north of the Airport terminal building as depicted in **Exhibit 1**.

The Maintenance Management facilities include the following:

- The Miller Lanier Airway Science Building provides 18,580 square feet of space that includes two classrooms, faculty offices, lab space, and a hangar for aircraft used in maintenance instruction. The hangar has dedicated apron frontage to facilitate movement of aircraft in/out of the hangar.
- Hangar 2 includes classroom space, a composites lab, and hangar space in an area of 6,000 square feet.

Facilities used by the Professional Pilot concentration are:

- The Jean Jack Flight Education Building is the hub of the flight training program and provides 2,950 square feet of space for aircraft dispatch, offices, flight briefing rooms, and records storage.
- The Flight Simulator Building houses flight simulators and supporting equipment along with one classroom and flight briefing rooms. Total space for this building is 5,050 square feet.
- The Donald McDonald Maintenance Hangar is approximately 11,000 square feet in size and is used for maintenance of the Department's fleet of aircraft.
- The program also has 26 dedicated aircraft parking positions on the apron adjacent to the Jean Jack Flight Education Building.
- The Airport is currently constructing a new terminal building. The Department has agreed to lease 1,680 square feet for use as a classroom and assembly room for flight instructor meetings.

SOURCE: Google Earth Pro, Image Landsat/Copernicus, April 2018, (for visual reference only - may not be to scale); Ricondo & Associates Inc., October 2019.

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EXHIBIT 1

MTSU - MURFREESBORO MUNICIPAL AIRPORT
EXISTING CONDITIONS

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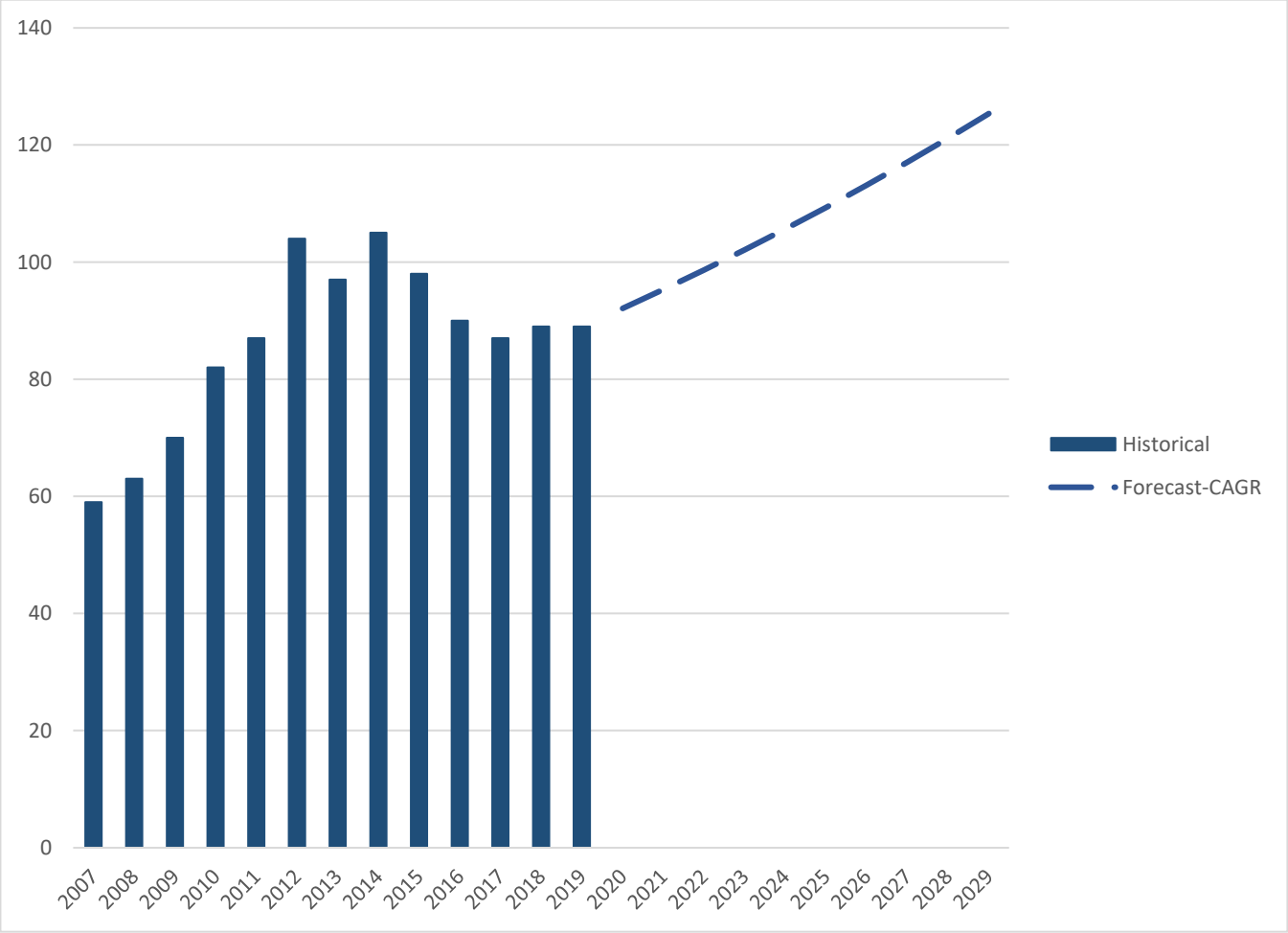
3. FACILITY REQUIREMENTS

In order to establish the physical space needs for Aerospace Department facilities at Murfreesboro Municipal Airport, a projection of student populations was developed for Maintenance Management and Professional Pilot concentrations. These projections were based on historical growth rates for enrollment and not constrained by current facilities, potential policies limiting enrollment, or faculty and flight instructor availability.

As presented in **Exhibit 2**, Maintenance Management enrollment grew from 59 students in 2007 to a peak of 105 students in 2014. Following a slight decline, enrollment has been stable and was 89 students in 2019. For the 2007 to 2019 period as a whole, enrollment grew at a 3.5 percent compound annual growth rate (CAGR). Applying that growth rate for the ten-year period 2019 through 2029 results in a projected enrollment of 125 students, or a 40.9 percent increase in enrollment over the 2019 level.

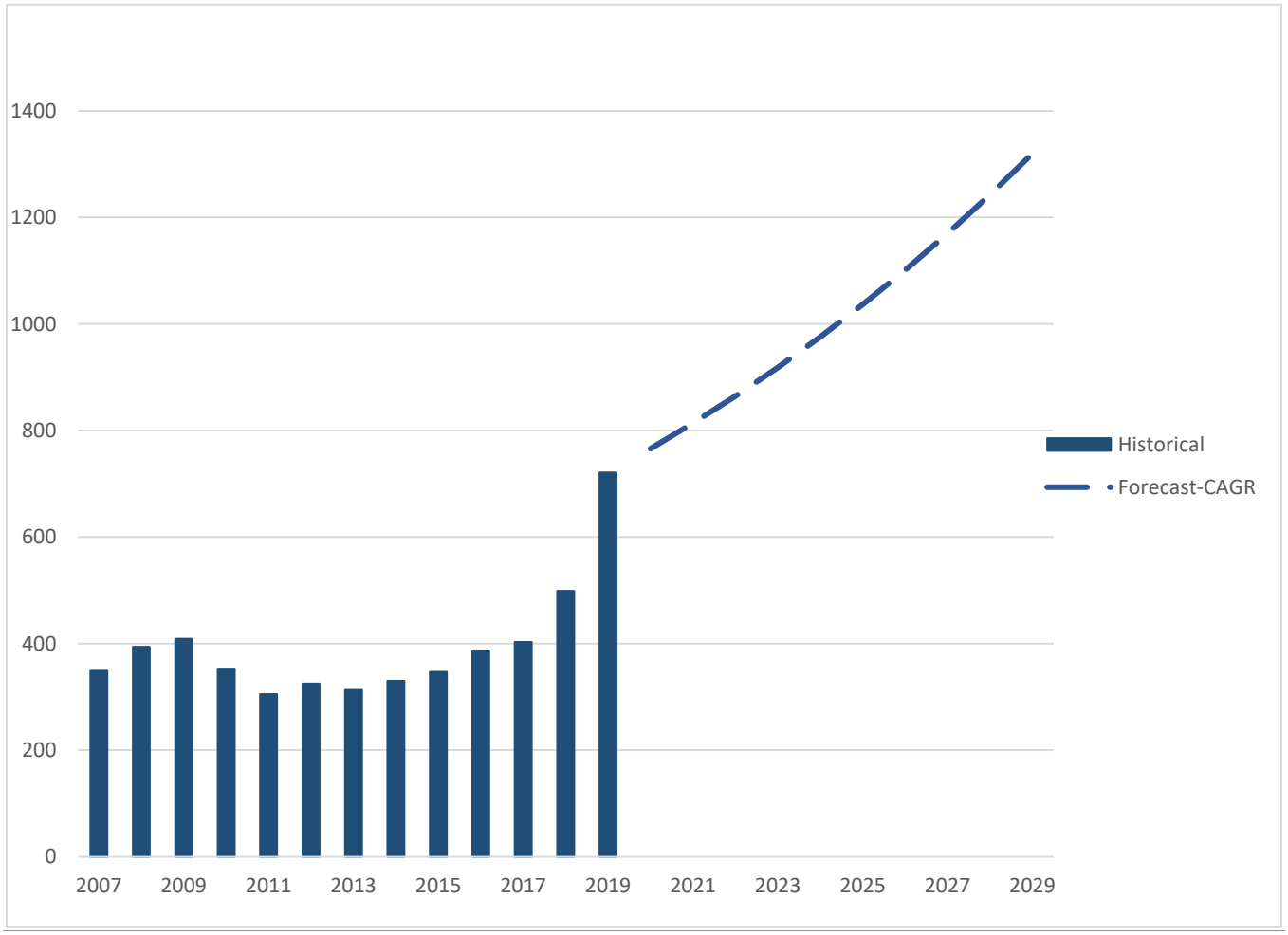
EXHIBIT 2 HISTORICAL AND PROJECTED MAINTENANCE MANAGEMENT ENROLLMENT



Sources: MTSU Aerospace Department, Ricondo & Associates, Inc. projections

Professional Pilot enrollment is presented in **Exhibit 3** and has experienced significant growth over the past four years. As shown, enrollment grew from 349 students in 2007 to 721 students in 2019, a CAGR of 6.2 percent. At that rate, the ten-year projection for Professional Pilot enrollment is 1,320 students, an 83.1 percent increase over 2019 enrollment.

EXHIBIT 3 HISTORICAL AND PROJECTED PROFESSIONAL PILOT ENROLLMENT



Sources: MTSU Aerospace Department, Ricondo & Associates, Inc. projections

Using the current and projected enrollment for both concentrations, a facility program was prepared using input from both MTSU Campus Planning and Aerospace Department Faculty and Staff. A baseline requirement for existing enrollment and a ten-year growth requirement based on the enrollment projection were prepared to reflect the state of the industry in maintenance and pilot education. A detailed breakdown of the facility requirements by functional area is presented in **Table 1**.

For the Maintenance Management concentration, a 30,000 square foot hangar was identified as a primary requirement to provide parking for a mix of aircraft utilized for instruction along with adequate separation for student observations and general circulation around the aircraft. Additionally, a number of discrete lab spaces were identified by faculty as needing additional space. These include powerplant, airframe, turbine, avionics/electricity, fabrication/welding, hydraulics, and composites labs and range from 2,000 to 6,000 square

feet each. In total, the baseline requirement for Maintenance Management space is 78,760 square feet. In coordination with faculty, functional areas were identified as requiring additional space with added students. Some spaces would utilize the baseline space with additional class sections rather than requiring additional space. The requirements for those spaces that would increase with additional enrollment were adjusted for that projected increase. The resulting ten-year requirement for Maintenance Management is 82,060 square feet.

As previously noted, Professional Pilot spaces at the Airport are constrained as a result of the recent growth in enrollment. Additional classroom space is largest single functional area requirement with three classrooms at 1,500 square feet each. Briefing rooms, where students and flight instructors meet before and after flight instruction, require 3,840 square feet in the baseline requirement. In total, the current required Professional Pilot instructional space is 20,710 square feet. Using the same methodology described above, the ten-year requirement increases to 37,190 square feet.

Likewise, increased enrollment will require additional aircraft to support flight training. During preparation of this plan, the Aerospace Department is increasing its fleet size to 33 aircraft to support the current enrollment. This will require approximately 94,000 of apron for parking and taxiing. The ten-year projection will require an additional 27 aircraft increasing the aircraft parking apron requirement to 172,260 square feet.

TABLE 1 FACILITY REQUIREMENTS FOR PROFESSIONAL PILOT AND MAINTENANCE MANAGEMENT CONCENTRATIONS

Functional Area	Existing Area	Baseline Requirements						Ten Year Growth Requirement		Notes
		Dimensions			Area (sf)	Quantity	Total Area (sf)	Growth Adjustment?	Total Area (sf)	
Professional Pilot Academic Space										
Dispatch Inbound Queue		10	x	30	300	1	300	Y	550	
Dispatch Outbound Queue		25	x	30	750	1	750	Y	1,370	
Dispatch Counter		35	x	11	385	1	385	Y	700	
Dispatch Offices		10	x	15	150	3	450	Y	820	
Briefing Rooms		10	x	12	120	32	3,840	Y	7,030	
Common Area Flight Planning		45	x	25	1,125	1	1,125	Y	2,060	Includes space for vending.
Conference Room		20	x	15	300	1	300	Y	550	
Admin Offices		10	x	15	150	13	1,950	Y	3,570	
Restrooms		12	x	20	240	4	960	Y	1,760	
Records Room		15	x	20	300	1	300	Y	550	
Classroom		30	x	50	1,500	3	4,500	Y	8,240	
Instructor Lounge		25	x	30	750	1	750	N	750	
Simulator Bay		40	x	60	2,400	1	2,400	Y	4,390	
Circulation and Utilities					2,700	1	2,700		4,850	15 percent of total of above space
Subtotal Professional Pilot Academic Space	**9,684**						**20,710**		**37,190**	Existing space includes 1,680 square feet of leased classroom space in the Airport Terminal currently under construction.
Flight School Maintenance Hangar		200	x	125		1	25,000	N	25,000	
Subtotal Flight School Maintenance Hangar	**11,088**						**25,000**		**25,000**	
Aircraft Parking Positions	**26**	43	x	66		33	94,080	Y	172,260	Calculated as the space of the aircraft tie-down plus one half of the fronting taxilane OFA.
Subtotal Apron Area	**72,215**						**94,080**		**172,260**	
Maintenance Management Space										
Hangar		150	x	200	30,000	1	30,000	N	30,000	Includes the full-height hangar space; no offices, labs, or other space constructed within hangar.
Powerplant Lab		45	x	100	4,500	1	4,500	N	4,500	
Airframe Lab		50	x	60	3,000	1	3,000	N	3,000	
Turbine Lab		60	x	100	6,000	1	6,000	N	6,000	
Avionics/Electricity Lab		50	x	50	2,500	1	2,500	N	2,500	
Fabrication/Welding Lab		50	x	60	3,000	1	3,000	N	3,000	
Hydraulics Lab		50	x	50	2,500	1	2,500	N	2,500	
Non-destructive Testing Lab		50	x	40	2,000	1	2,000	N	2,000	
Composites/Finishing Lab		60	x	80	4,800	1	4,800	N	4,800	
Waste Oil/Hazmat Storage		25	x	30	750	1	750	N	750	
Parts Cleaning Room		10	x	20	200	1	200	N	200	
Engine Test Cell Control		50	x	20	1,000	1	1,000	N	1,000	

TABLE 1 FACILITY REQUIREMENTS FOR PROFESSIONAL PILOT AND MAINTENANCE MANAGEMENT CONCENTRATIONS

Functional Area	Existing Area	Baseline Requirements				Ten Year Growth Requirement		Notes
		Dimensions	Area (sf)	Quantity	Total Area (sf)	Growth Adjustment?	Total Area (sf)	
Tool Storage		25 x 40	1,000	1	1,000	Y	1,410	
Parts Room		25 x 40	1,000	1	1,000	N	1,000	
Battery Storage		10 x 20	200	2	400	N	400	
Classrooms with Storage		30 x 40	1,200	3	3,600	N	3,600	
Computer Lab		25 x 30	750	2	1,500	N	1,500	
Microfiche Room		20 x 21	420	1	420	N	420	
Faculty Offices		10 x 15	150	10	1,500	Y	2,110	
Conference Room		15 x 20	300	1	300	N	300	
Front Lobby		20 x 25	500	1	500	Y	700	
Student Gathering Area		50 x 30	1,500	1	1,500	Y	2,110	
Restrooms		20 x 30	600	2	1,200	Y	1,690	
Circulation and Utilities			5,590	1	5,590		6,570	15 percent of total of above space
Subtotal Maintenance Management Space	**24,582**				**78,760**		**82,060**	

NOTE:

Ten year growth requirement (2019-2029) based on 6.2 percent compound annual growth rate for Professional Pilot enrollment (83.1 percent net increase) and 3.2 percent compound annual growth rate for Maintenance Management enrollment (40.9 percent net increase).

4. AIRPORT CAMPUS ALTERNATIVES

Alternatives for meeting the facility requirements identified in Section 3 were developed and refined with input from MTSU Campus Planning and Aerospace Department faculty and staff. In additional to meeting space requirements the development of the alternatives focused on operational efficiency and also tried to create an environment that supported the airport campus being an extension of the main campus to give a sense of identity to Aerospace Department facilities at the airport. Additionally, alternatives development took into consideration the Murfreesboro Municipal Airport's long-term plan for development of airport property to the north of the existing facilities and significant coordination with the Airport Manager and Airport Commission took place as the plan evolved to ensure a coordinated planning effort.

Initial alternatives were based on two approaches to how the airport campus could evolve over time and as alternatives were refined and reviewed with stakeholders additional detail added. The first alternative is a series of incremental improvements designed to meet immediate needs while transitioning towards an expanded campus with academic and lab space in a single building. Phase 1, shown in **Exhibit 4**, envisioned constructing a new flight school maintenance hangar (24,000 square feet) immediately south of the Jean Jack Flight Education Building. The Donald McDonald Hangar would be used for Maintenance Management hangar space. A new building connecting the Jean Jack Flight Education Building and the Flight Simulator Building is also proposed in this alternative to provide additional classroom and flight briefing space.

Exhibit 5 shows Phase 2 of the first development alternative. In this phase a two-story academic building is proposed to the north for both Professional Pilot and Maintenance Management classrooms, labs, and support space. A third Maintenance Management hangar is also proposed to the north of the Donald McDonald Hangar. The three hangars in total would provide the 30,000 square feet of required hangar space for the program.

The second development alternative (**Exhibit 6**) proposes constructing a 30,000 square foot hangar for the Maintenance Management concentration along with a two-story academic building to provide classrooms, labs, and support space for both the Professional Pilot and Maintenance Management programs. The Miller Lanier Airway Science Building would ultimately be an expanded flight school maintenance facility with the Donald McDonald Hangar.

The two initial development alternatives were reviewed with stakeholders to gather input, select a preferred plan, and guide further refinement. Alternative 1 was selected to be carried forward based on operational efficiency, prioritization of needs, and likely funding availability.

SOURCE: Google Earth Pro, Image Landsat/Copernicus, April 2018, (for visual reference only - may not be to scale); Atkins, November 8th, 2016 (aerial photography); Ricondo & Associates Inc., October 2019.

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EXHIBIT 4

MTSU - MURFREESBORO MUNICIPAL AIRPORT
CONCEPT 1 - PHASE 1

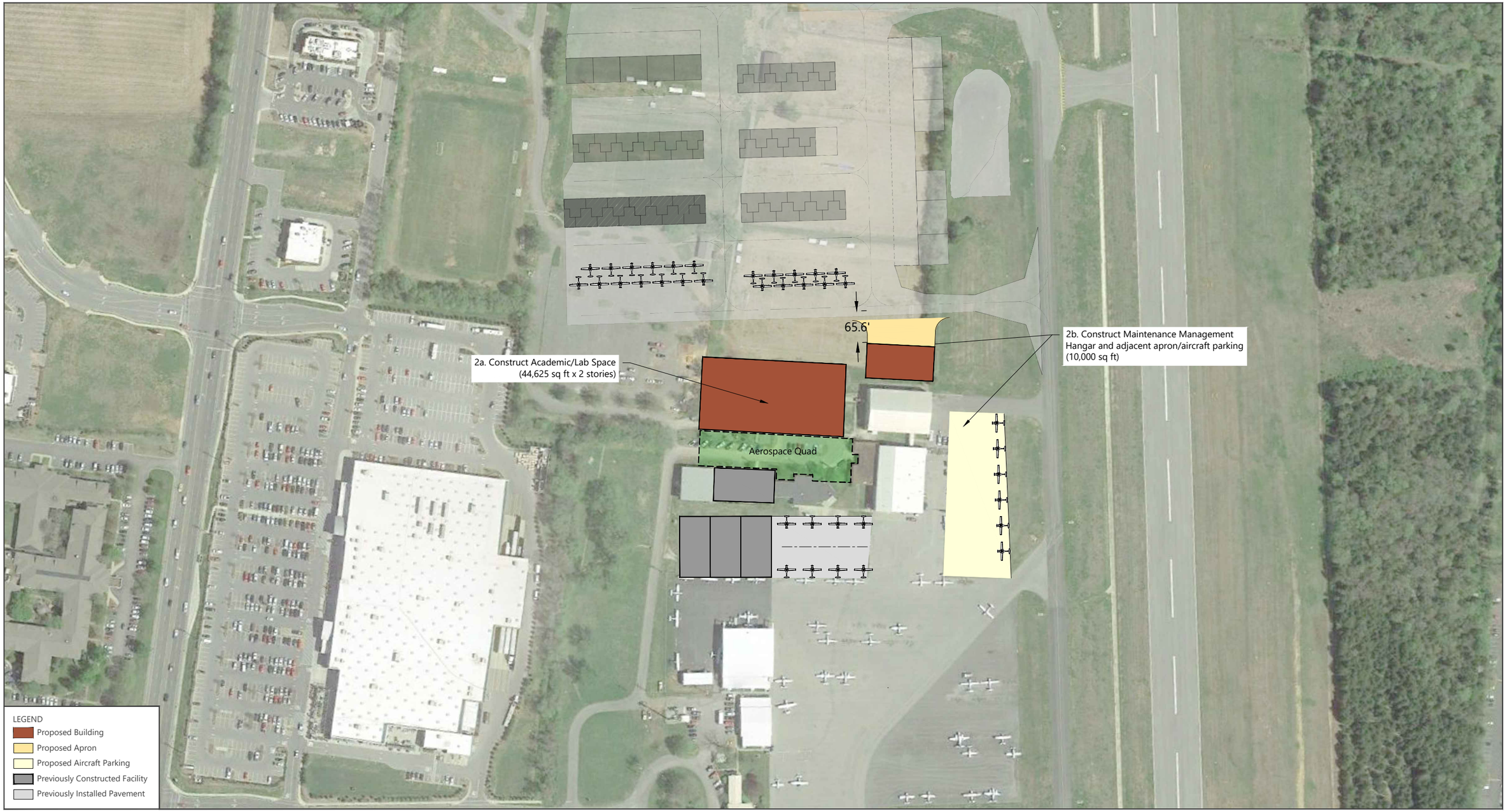

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EXHIBIT 5

MTSU - MURFREESBORO MUNICIPAL AIRPORT
CONCEPT 1 - PHASE 2

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SOURCE: Google Earth Pro, Image Landsat/Copernicus, April 2018, (for visual reference only - may not be to scale); Atkins, November 8th, 2016 (aerial photography); Ricondo & Associates Inc., October 2019.

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EXHIBIT 6

MTSU - MURFREESBORO MUNICIPAL AIRPORT
CONCEPT 2

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5. RECOMMENDED PLAN

Alternative 1 was refined through a series of stakeholder work sessions. Through the refinement process additional detail, such as aircraft parking, vehicle parking, and access improvements, was added to the concept plan. Continued refinements also enabled enhanced compatibility with Murfreesboro Municipal Airport development goals.

Exhibit 7 presents the overall Recommended Plan. At the completion of the proposed improvements the Airport Campus will be centered around an open quad space. Access is improved by shifting the existing road to the west and creating an entry feature that defines the area as a distinct MTSU campus.

Given that the implementation of the Recommended Plan will occur over several years, a phasing plan is presented to illustrate the logical sequencing of improvements that allow the existing facilities to function in the interim. Exhibits 8-12 present the series of five phases:

Phase 1 (**Exhibit 8**):

Flight School Maintenance Hangar – a new 16,000 square foot hangar for the maintenance of the MTSU fleet of aircraft. The Donald McDonald Hangar would transition to use by the Maintenance Management program to address the need for additional space identified in the accreditation report.

Aerospace Instructional Building – a new 10,000 square foot building with classroom and flight briefing rooms to accommodate growth in Professional Pilot enrollment.

Aircraft Parking Apron – incremental additional of aircraft parking growth in the MTSU aircraft fleet.

Phase 2 (**Exhibit 9**):

Road and Entry Relocation – The primary access to the MTSU facilities would be enhanced by relocation of the road to west, thereby eliminating the series of turns to access the Aerospace buildings and providing the opportunity for a defined Airport Campus entrance.

Phase 3 (**Exhibit 10**):

Parking Expansion and Quad – Construction of additional vehicle parking and the open space comprising the quad.

Phase 4 (**Exhibit 11**):

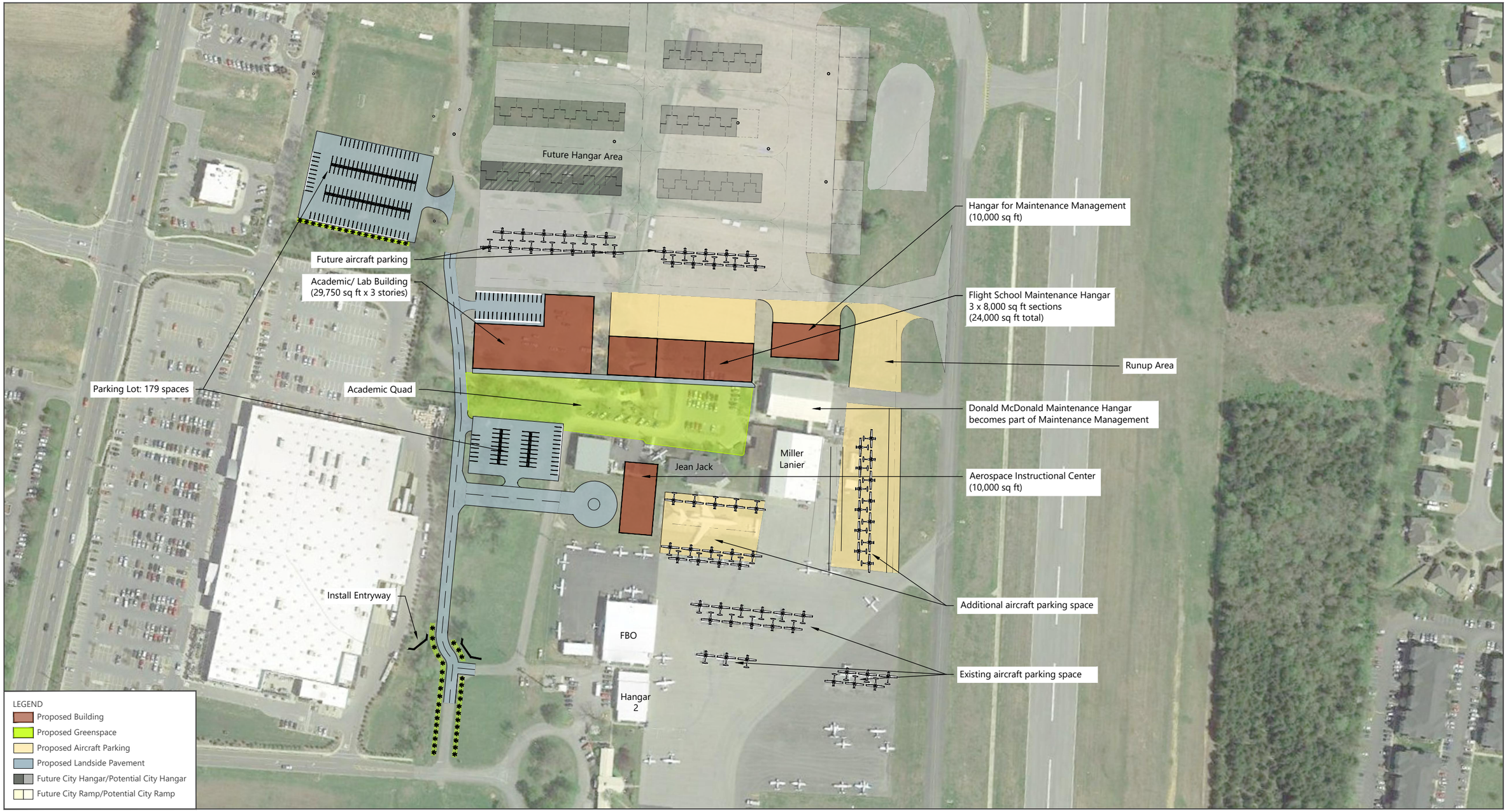
Academic/Lab Building –a three-story, 89,000 square foot academic and lab building is proposed to serve both Professional Pilot and Maintenance Management students.

Aircraft Parking Apron – incremental additional of aircraft parking growth in the MTSU aircraft fleet.

Phase 5 (**Exhibit 12**):

Maintenance Management Hangar – To meet the long-term requirements for hangar space, a third hangar is proposed north of the Donald McDonald Hangar keeping the Maintenance Management hangars adjacent to one another.

Expand Flight School Maintenance Hangar – With continued growth in aircraft fleet, additional space will be required for flight school aircraft maintenance. The plan allows for an additional 8,000 square foot hangar bay to be added to the maintenance hangar for additional capacity.



SOURCE: Google Earth Pro, Image Landsat/Copernicus, April 2018, (for visual reference only - may not be to scale); Atkins, December 2019; Ricondo & Associates Inc., January 2020.

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EXHIBIT 7

RECOMMENDED PLAN

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SOURCE: Google Earth Pro, Image Landsat/Copernicus, April 2018, (for visual reference only - may not be to scale); Atkins, December 2019; Ricondo & Associates Inc., January 2020.

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EXHIBIT 8

RECOMMENDED PLAN - PHASE 1

SOURCE: Google Earth Pro, Image Landsat/Copernicus, April 2018, (for visual reference only - may not be to scale); Atkins, December 2019; Ricondo & Associates Inc., January 2020.

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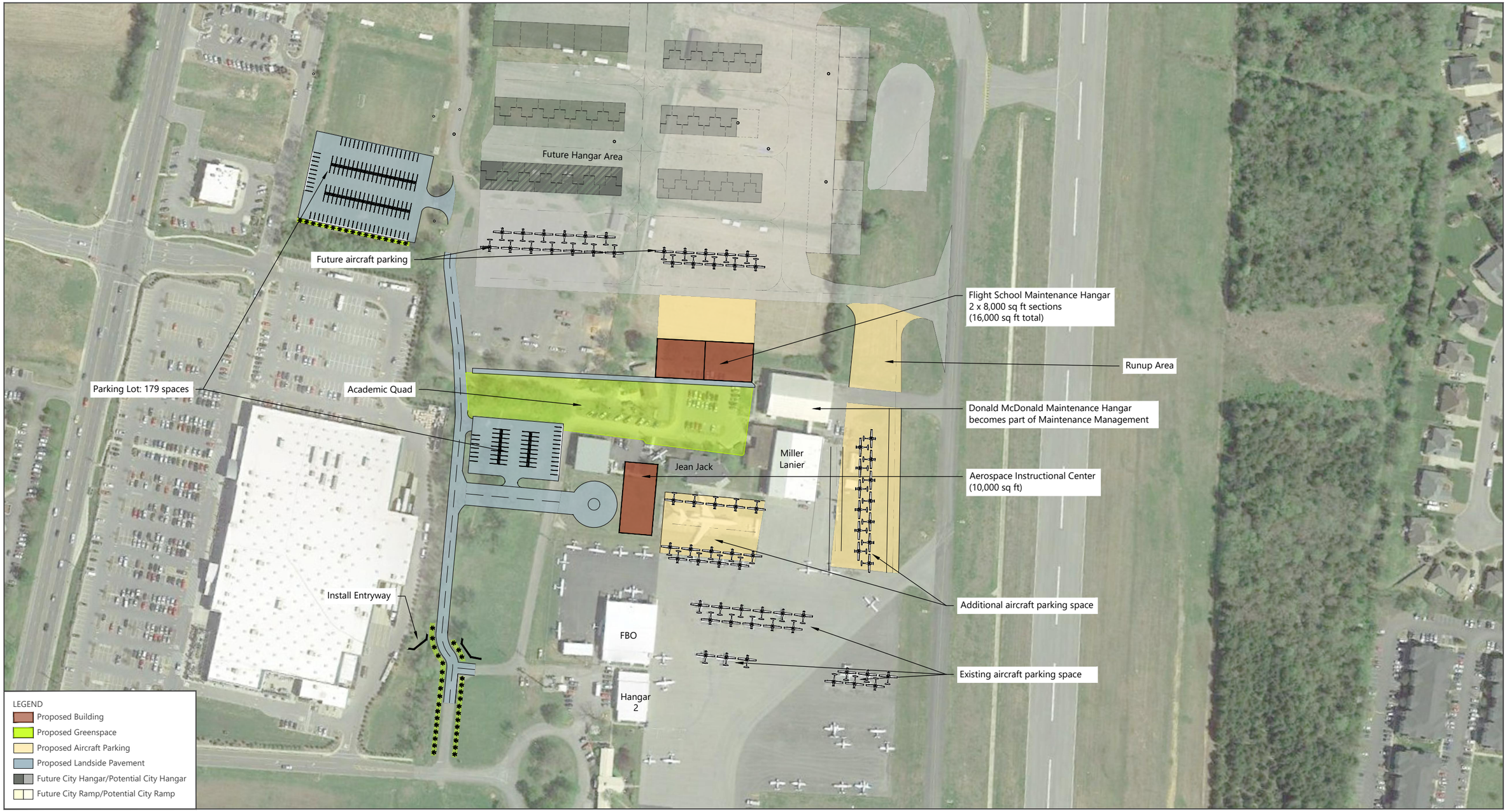
EXHIBIT 9

RECOMMENDED PLAN - PHASE 2



SOURCE: Google Earth Pro, Image Landsat/Copernicus, April 2018, (for visual reference only - may not be to scale); Atkins, December 2019; Ricondo & Associates Inc., January 2020.

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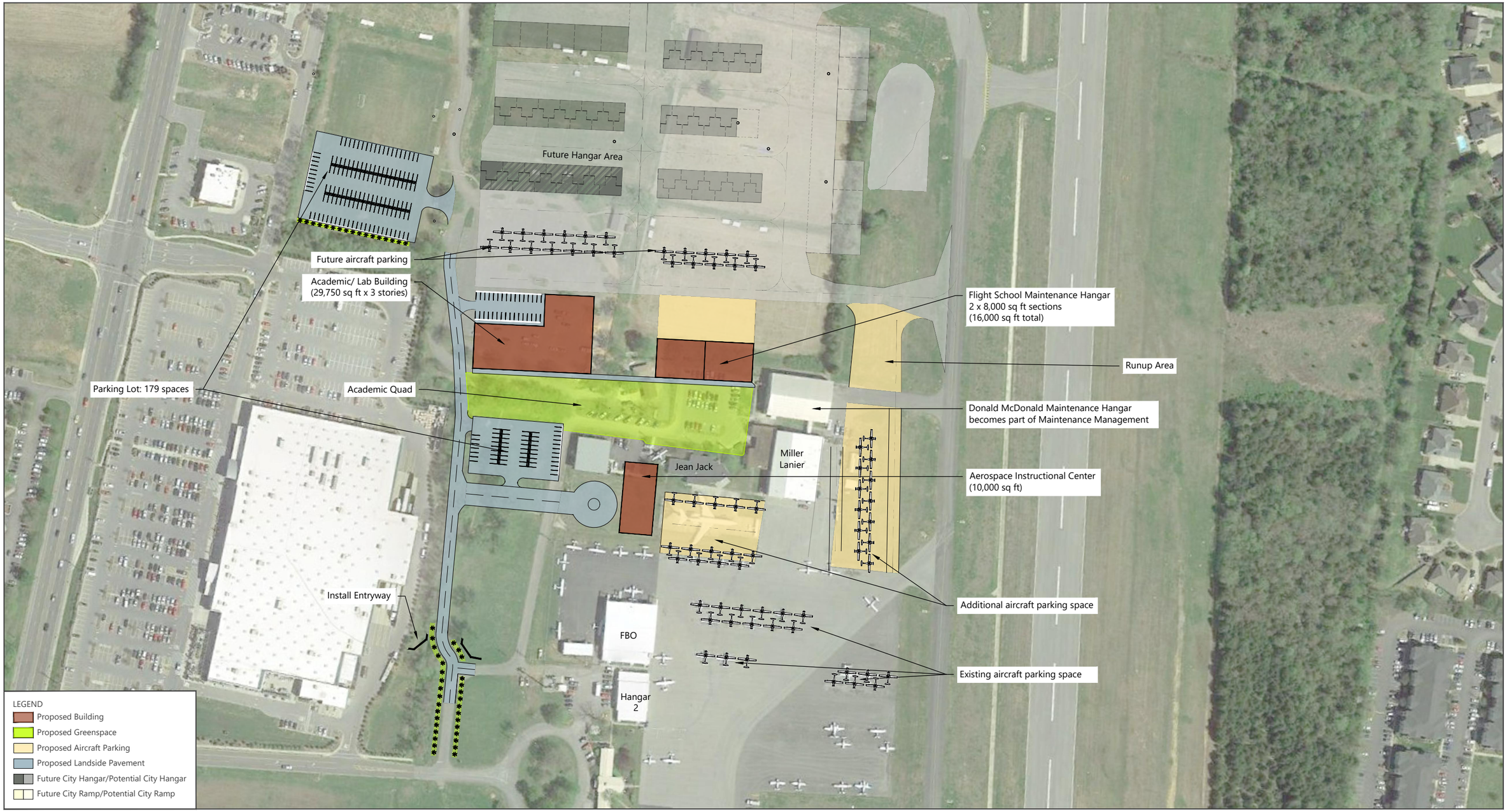
EXHIBIT 10

RECOMMENDED PLAN - PHASE 3



SOURCE: Google Earth Pro, Image Landsat/Copernicus, April 2018, (for visual reference only - may not be to scale); Atkins, December 2019; Ricondo & Associates Inc., January 2020.

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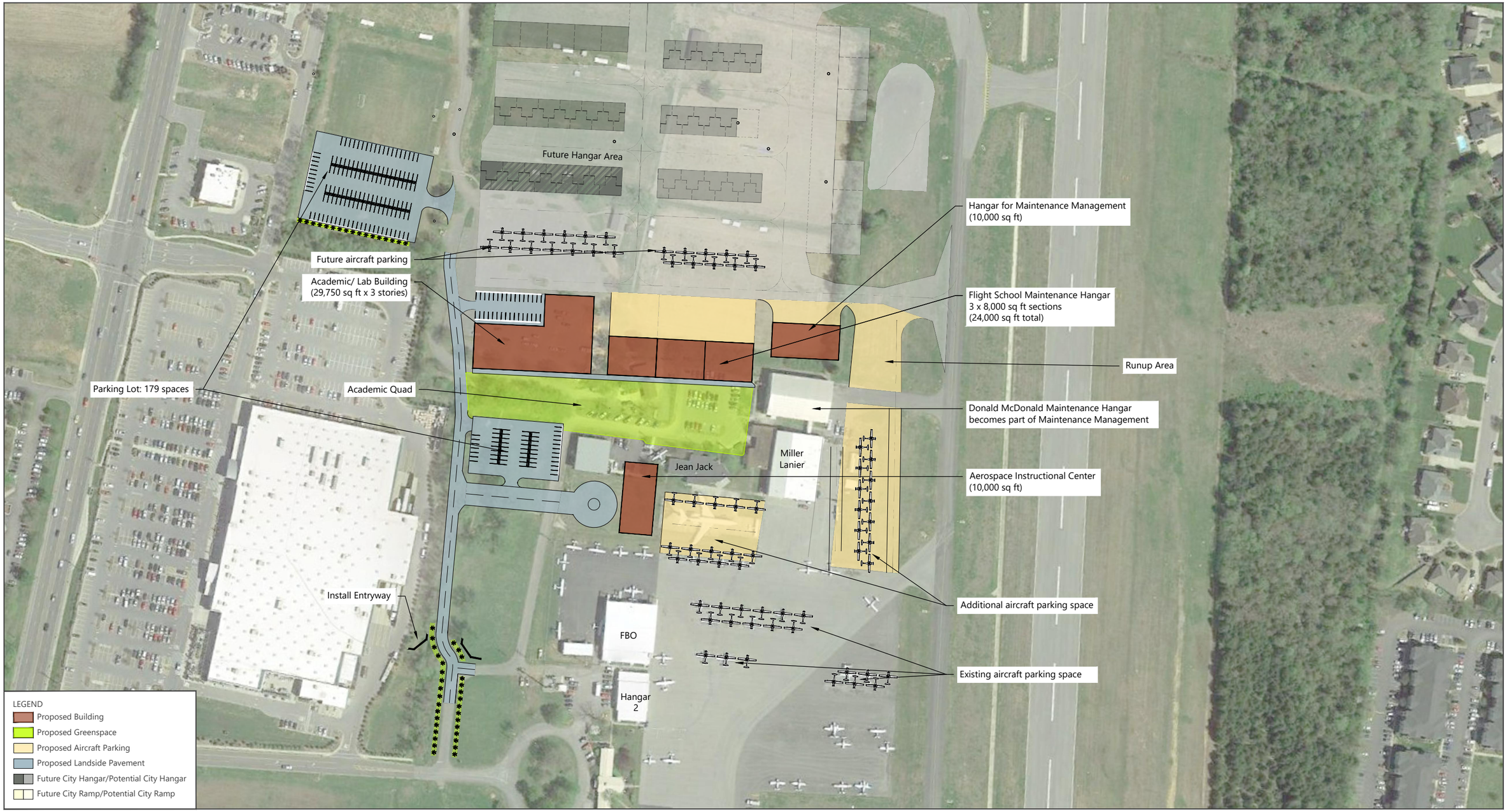
EXHIBIT 11

RECOMMENDED PLAN - PHASE 4



SOURCE: Google Earth Pro, Image Landsat/Copernicus, April 2018, (for visual reference only - may not be to scale); Atkins, December 2019; Ricondo & Associates Inc., January 2020.

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EXHIBIT 12

RECOMMENDED PLAN - PHASE 5

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