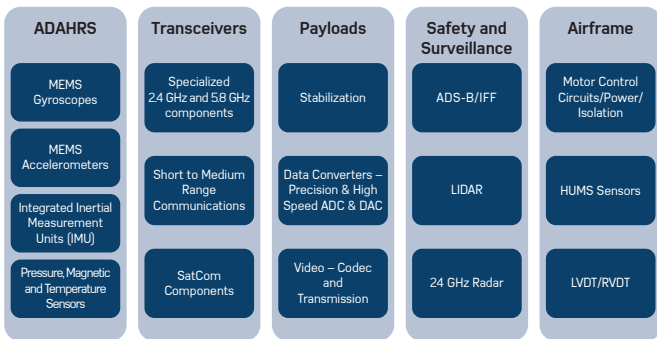


ADI CIVILIAN UAV SOLUTIONS

ADI Civilian UAV Overview

ADI has a team and business unit focused on supporting the emerging unmanned systems market. ADI's product portfolio covers airborne, terrestrial, and marine unmanned vehicles ranging from small consumer up through large long endurance systems. The ADI portfolio focuses on five major area to support the unmanned systems business:



Aside from the products above, ADI's broad portfolio supports a wide base of products including control stations and data acquisition.

Main Challenges and System Design Considerations

As the market matures and unmanned systems assume more missions from manned systems, considerations must be given to reliability, liability, and certification. At present, more complexity, greater payloads, and longer range are driving the need for mature system design processes.

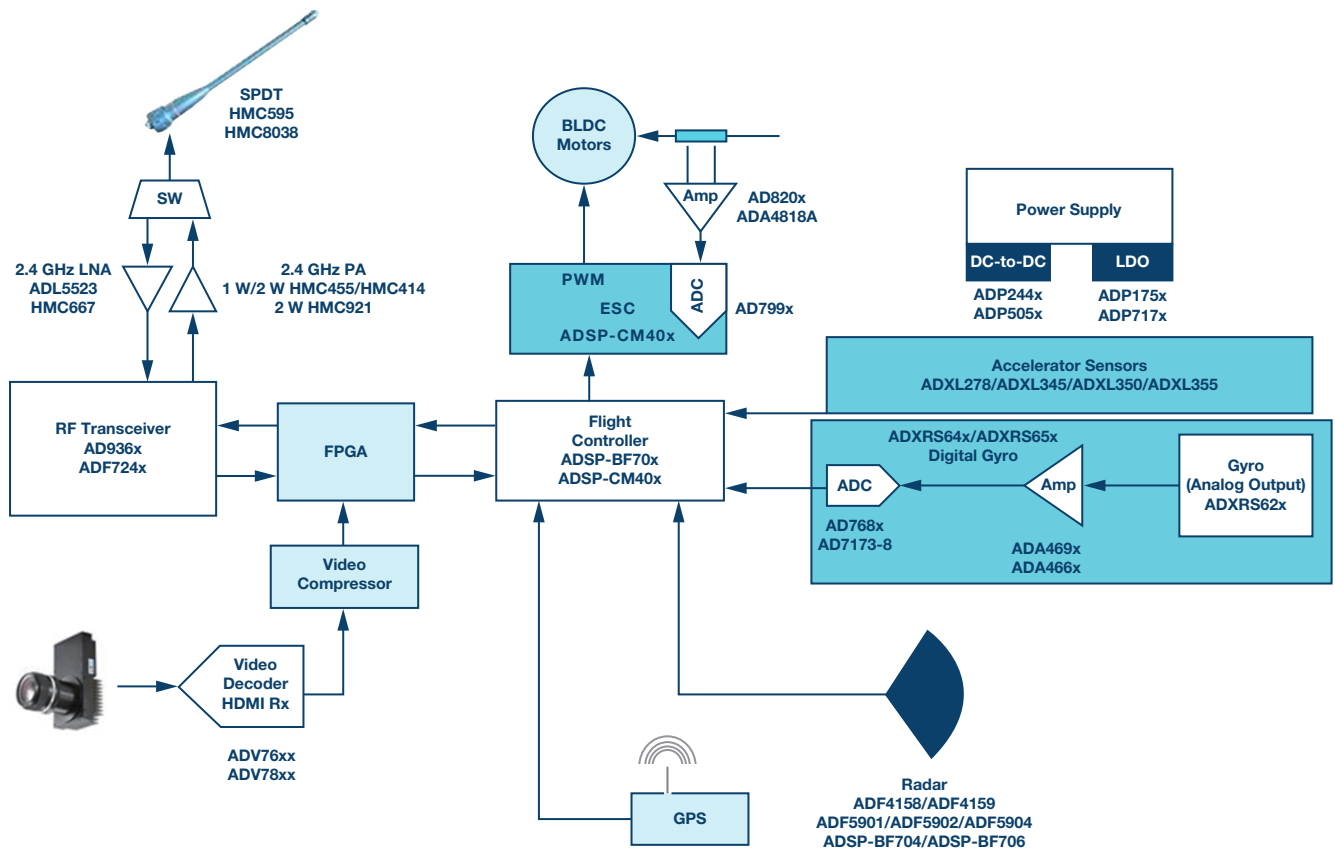
If government certifications are required, then standards like DO-178B/C and DO-254 will become a concern for UAV manufacturers. Similar consideration for ISO 26262 may evolve to cover terrestrial unmanned systems.

ADI has extensive experience in functional safety requirements across a broad spectrum of industries. At present, the aerospace group is working to incorporate support for aviation certifications.

Why Choose ADI

ADI has a team dedicated to support unmanned systems development and production across the broad market across the globe. We are continually expanding the applicability of ADI products to support the quickly evolving market. We have expertise in both the avionics and unmanned systems market that ADI applies to building and supporting our customers.

Civilian UAV Signal Chain



Featured Products

Part Number	Description	Key Features	Function and Benefit
<i>MEMS</i>			
ADXRS45x	Single-axis gyro	Digital output, vertical mount package, easy for building orthogonal systems; full temp compensation version, ADI quad-core industry-leading leading vibration immunity	Platform stabilization, dead reckoning
ADXRS62x	Single-axis gyro	Widely used in drone market for nearly 10 years, good reliability and repeatability across the full temp, shock, vibration conditions	Platform stabilization, dead reckoning
ADXRS64x	Single-axis gyro	Enhanced ADXRS62x, pin and package compatibility to ADXRS62x, superb vibration rejection	Platform stabilization, dead reckoning
ADXRS29x	Dual-axis gyro	Pitch and roll rate response, ultralow noise, high vibration rejection, integrated HPF and LPF, low phase delay	Platform stabilization, dead reckoning
ADXL278	Dual-axis accelerometer	Wide measurement range, good for antivibration inclinometers	Platform stabilization, dead reckoning
ADXL345	3-axis accelerometer	Digital output, good full temp repeatability, robust to shock and vibration, no stiction issue	Platform stabilization, dead reckoning
ADXL350	3-axis accelerometer	Digital output, low tempco, good full temp repeatability, robust to shock and vibration, no stiction issue	Platform stabilization, dead reckoning
ADXL203	Dual-axis accelerometer	Low noise, high 0 g bias stability, high sensitivity accuracy, low tempco, $\pm 1.7 g$, $\pm 5 g$, $\pm 18 g$ option	Platform stabilization, dead reckoning
ADXL326	3-axis accelerometer	Analog output, easy for signal conditioning, good full temp repeatability, robust to shock and vibration, no stiction issue	Platform stabilization, dead reckoning
ADIS1644x	6 DOF/10 DOF IMU	Single chip solution for orientation angle estimates, full temp calibration, outstanding cross-axis sensitivity, g sensitivity, and vibration immunity	Platform stabilization, dead reckoning
ADIS16460	6 DOF IMU	Single chip solution for integrating accurate, multi-axis inertial sensing: triaxial gyroscope and triaxial accelerometer	Platform stabilization, dead reckoning
ADIS1648x	6 DOF/10 DOF IMU	Single chip solution with the best in-run bias stability and ARW; full temp calibration, outstanding cross-axis sensitivity, g sensitivity, and vibration immunity	Platform stabilization, dead reckoning
<i>Processors/DSPs</i>			
ADSP-BF70x	Fixed-point DSP	400 MHz Blackfin® processor, 136 kB L1 SRAM, up to 1 MB L2 SRAM. DSP instruction designed suitable for image processing. Ultra-low power	Flight controller, high performance imaging processing for indoor positioning (optical flow) radar signal processing
ADSP-BF60x	High performance fixed-point DSP	500 MHz dual core Blackfin processor, 2 × 148 kB L1 SRAM, 128 kB/256 kB L2 SRAM, hardware accelerator for objection detection	Designed for object detection: support binocular vision processing
ADSP-CM40x	Mixed-signal processor	240 MHz ARM® Cortex®-M4, 384 kB SRAM and 2 MB flash memory, dual 16-bit SAR ADCs and 14-bits of accuracy, 2.6 MSPS, integrated sinc filters	Designed for motor drivers: supports four BLDC motors; suitable for flight controller and motor drivers
ADuC7021/ ADuC7020	Mixed-signal processor	Multichannel, 12-bit, 1 MSPS ADC, 12-bit voltage output DACs, voltage comparator, trimmed on-chip oscillator ($\pm 3\%$), 62 kB Flash/EE memory, 8 kB SRAM, 3-phase 16-bit PWM generator, programmable logic array (PLA), ARM7TDMI core	BLDC motor drivers
<i>ADCs</i>			
AD7091R-4	12-bit, 1 MSPS SAR ADC	Ultralow system power, small system footprint, integrated programmable channel sequencer can simplify host MCU workload; the alert functionality can simplify h/w circuitry and improve MCU interrupt response timing	Motor control
AD7682/ AD7689	16-bit, 4-channel/8-channel, 250 kSPS ADC	16-bit resolution with no missing codes, throughput: 250 kSPS, INL: ± 0.4 LSB typical, ± 1.5 LSB maximum (± 23 ppm or FSR), dynamic range: 93.8 dB, SINAD: 92.5 dB @ 20 kHz, THD: -100 dB @ 20 kHz, analog input range: 0 V to V_{REF} with V_{REF} up to V_{DD}	Analog MEMS
<i>Amplifiers</i>			
AD8207	Zero-drift, high input common-mode, bidirectional current sense amplifier	Input offset drift: 1 $\mu V/^\circ C$ (max), high input common-mode voltage range (-4 V to $+65$ V), CMRR: >90 dB (dc to 10 kHz), integrated EMI filter	Ideal for current sensing in motor control that has large input PWM common-mode voltage and big noise
AD8418A	Bidirectional, zero-drift, current sense amplifier	Input offset drift: 0.4 $\mu V/^\circ C$ (max), high input common-mode voltage range (-2 V to $+70$ V), CMRR: > 86 dB (dc to 10 kHz), integrated EMI filter	Ideal for current sensing in motor control that has large input PWM common-mode voltage and big noise
ADA4807	3.1 nV/ \sqrt{Hz} , 1 mA, 180 MHz, RRIO amplifier	Low noise, low distortion, low input offset, RRIO, 1 mA I_o	Low noise, low THD, and quick settling time make it a good choice for ADC drivers
AD8605	Precision, low noise, CMOS, RRIO op amp	Offset voltage: 65 μV max, low input bias current: 1 pA max, low noise: 8 nV/ \sqrt{Hz}	Small dc error make it suitable for applications where the signal frequency is low

Part Number	Description	Key Features	Function and Benefit
<i>Power</i>			
ADP244x	36 V, 1 A, synchronous, step-down dc-to-dc regulator	Wide input voltage range of 4.5 V to 36 V, low minimum on time of 50 ns, maximum load current of 1 A, high efficiency of up to 94%, adjustable output down to 0.6 V, $\pm 1\%$ output voltage accuracy, adjustable switching frequency of 300 kHz to 1 MHz	Power management
ADP5052	5-channel integrated power solution with quad buck regulators and 200 mA LDO regulator	Wide input voltage range: 4.5 V to 15 V, $\pm 1.5\%$ output accuracy over full temperature range, 250 kHz to 1.4 MHz adjustable switching frequency, adjustable/fixed output options via factory fuse, power regulation: Channel 1 and Channel 2: programmable 1.2 A/2.5 A/4 A sync buck regulators with low-side, FET driver, Channel 3 and Channel 4: 1.2 A sync buck regulators, Channel 5: 200 mA low dropout (LDO) regulator, always alive 5.1 V LDO supply for tiny load demand	Power management
ADP175x	Low V_{IN} LDO regulator	Input voltage range: 1.6 V to 3.6 V, maximum output current: 1.2 A, low shutdown current: μA , very low dropout voltage: 70 mV @ 0.8 A load, initial accuracy: $\pm 1\%$, accuracy over line, load, and temperature: $\pm 2\%$	Power management
ADM717x	6.5 V, ultralow noise, high PSRR, fast transient response CMOS LDO	Input voltage range: 2.3 V to 6.5 V, maximum load current: up to 2 A, low noise: 5 μV rms independent of output voltage at 100 Hz to 100 kHz	Power management
<i>Transceivers</i>			
AD80402	2 \times 2 RF agile transceiver	RF 2 \times 2 transceiver with integrated 12-bit DACs and ADCs; band: 2.4 GHz to 2.5 GHz; supports TDD and FDD operation; tunable channel BW: <200 kHz to 20 MHz; dual receivers: 6 differential or 12 single-ended inputs; superior receiver sensitivity with a noise figure < 2.5 dB; 2.5 dB Rx gain control	Ideal for HD video transmission in 2.4 GHz ISM band, small form factor
AD80403	2 \times 2 RF agile transceiver	Band: 2.4 GHz to 2.5 GHz and 4.9 GHz to 6 GHz; tunable channel bandwidth: <200 kHz to 40 MHz	Ideal for HD video transmission in 2.4 GHz and 5.8 GHz ISM band, small form factor
AD936x	2 \times 2 RF agile transceiver	Band: 70 MHz to 6 GHz; tunable channel bandwidth: <200 kHz to 56 MHz	Ideal for wireless video transmission and remote controller, cover wide frequency band
ADF724x	Low power IEEE 802.15.4/proprietary GFSK/FSK zero IF 2.4 GHz transceiver IC	Frequency range: 2400 MHz to 2483.5 MHz; programmable data rates and modulation: IEEE 802.15.4-2006-compatible (250 kbps) GFSK/FSK/GMSK/MSK modulation, 50 kbps to 2000 kbps data rates; low power consumption: 19 mA (typical) in receive mode; 21.5 mA (typical) in transmit mode (PO = 3 dBm); 1.7 μA , 32 kHz crystal oscillator wake-up mode	Low power, wireless remote controller
<i>PAs</i>			
HMC414	InGaP HBT power amplifier SMT; 2.2 GHz to 2.8 GHz	Gain: 20 dB, saturated power: 30 dBm, 32% PAE, supply voltage 2.75 V to 5 V	Wireless image transmission
HMC921	GaAs HBT MMIC 2 W power amplifier; 0.4 GHz to 2.7 GHz	High output IP 3: 48 dBm, high output P1dB: 33 dBm, high gain: 16 dB @ 900 MHz, single supply: 5 V, 32% PAE @ 33 dBm P_{OUT}	Wireless image transmission
<i>LNA</i>			
ADL5523	400 MHz to 4000 MHz low noise amplifier	Operation from 400 MHz to 4000 MHz, noise figure of 0.8 dB at 900 MHz, single-supply operation from 3 V to 5 V, gain of 21.5 dB at 900 MHz, OIP3 of 34.0 dBm at 900 MHz, P1dB of 21.0 dBm at 900 MHz	Wireless image transmission
<i>RF Switch</i>			
HMC8038	High isolation, silicon SPDT, nonreflective switch; 0.1 GHz to 6.0 GHz	Nonreflective, 50 Ω design, high isolation: 60 dB typical, low insertion loss: 0.8 dB typical, high power handling, 34 dBm through path, 29 dBm terminated path, high linearity, 0.1 dB compression (P0.1dB): 35 dBm typical, input third-order intercept (IP3): 60 dBm typical	Wireless remote control and image transmission

¹ Please contact ADI or distributors if you need any further information on the AD80402 and AD80403.

Part Number	Description	Key Features	Function and Benefit
<i>Video</i>			
ADV7610	Low power, 165 MHz HDMI receiver	High-Definition Multimedia Interface (HDMI®): all mandatory and additional 3D video formats supported extended colorimetry, including sYCC601, Adobe RGB, Adobe YCC 601, and xvYCC extended gamut color CEC 1.4-compatible; HDMI receiver: 165 MHz maximum transition-minimized differential signaling (TMDS) clock frequency 24-bit output pixel bus	HD video transmission
ADV7511	225 MHz, High Performance HDMI® Transmitter with ARC	Incorporates HDMI 1.4 features, audio return channel (ARC); 3D video support, 225 MHz supports 12-bit deep color operation in all video formats up to 1080p, supports gamut metadata packet transmission, integrated CEC buffer/controller—upgraded to HDMI 1.4, compatible with DVI 1.0 and HDCP 1.4, video/audio inputs accept logic levels from 1.8 V to 3.3 V	HD video transmission
ADV7619	Dual port, Xpressview, 3 GHz HDMI receiver	High-Definition Multimedia Interface (HDMI): 1.4 A features supported, all mandatory and additional 3D video formats supported, extended colorimetry, including sYCC601, Adobe RGB, Adobe YCC 601, xvYCC extended gamut color CEC 1.4-compatible, HDMI 3 GHz receiver: 297 MHz maximum TMDS clock frequency, Supports 4k × 2k resolution, Xpressview fast switching of HDMI ports	HD video transmission
ADV7280	10-bit, 4× oversampled SDTV video decoder with deinterlacer	Worldwide NTSC/PAL/SECAM color demodulation support, one 10-bit analog-to-digital converter (ADC), 4× oversampling per channel for CVBS, Y/C, and YPrPb modes; analog video input channels with on-chip antialiasing filter; video input support for CVBS (composite), Y/C (S-Video), and YPrPb (component)	Video transmission
<i>Radar</i>			
ADF4158	Direct modulation/waveform generating, 6 GHz fractional-N frequency synthesizer	500 MHz to 6000 MHz range, 25-bit divider modulus, 32 MHz PFD maximum frequency, normalised PN floor = -207 dBc/Hz, FSK deviation up to 32 MHz	Anticollision radar
ADF5901	24 GHz radar Tx MMIC	24 GHz VCO +250 MHz frequency range, 2-channel 24 GHz PA and 8 dBm typ. Single-ended outputs, 24 GHz local oscillator (LO) output buffer	Anticollision radar
ADF5904	24 GHz radar Rx MMIC	4-channel 24 GHz LNA and Rx non I/Q downconverter and + LO buffer, Rx channel gain: 22 dB, noise figure (NF): 10 dB, RF signal bandwidth: 250 MHz	Anticollision radar
ADAR7251	4-channel, 16-bit, continuous time data acquisition ADC	Wide input signal bandwidth: 500 kHz at 1.2 MSPS sample rate, 16-bit resolution, LNA and PGA with 45 dB gain range in 6 dB steps, selectable equalizer, supports FSK mode for FMCW radar systems, internal oscillator/PLL input: 16 MHz to 54 MHz high speed serial data interface	Anticollision radar

Design Resources

Reference Design and Demo Boards

- ▶ Evaluation Board for ADF5901, ADF5904, and ADF4159 Chipset for a 24 GHz FMC Radar—www.analog.com/en/eval-radar-mmhc
- ▶ ADAR7251 evaluation board—www.analog.com/en/eval-adar7251
- ▶ **AD-FMCOMMS5-EBZ** : An FMC board for the AD9361, a highly integrated RF Agile Transceiver™ that demonstrates how to design a platform that shows how to connect and synchronize (at the RF side) multiple AD9361s for SIMO/MISO/SU-MIMO/MU-MIMO applications. For many broadband wireless access (BWA) systems, multi-input/multi-output (SIMO/MISO/SU-MIMO/MU-MIMO) operation and RF beamforming are proven techniques for maximizing throughput and efficient spectrum utilization.—<https://wiki.analog.com/resources/eval/user-guides/ad-fmcomms5-ebz>

Technical Articles/Application Notes

- ▶ **Technical Article:** High Performance Integrated 24 GHz FMCW Radar Transceiver Chipset for Auto and Industrial Sensor Applications—www.analog.com/en/High-Performance-Integrated-24-GHz-FMCW-Radar-Transceiver-Chipset.pdf

- ▶ **Video—Vibration Immunity in Analog Devices MEMS Gyroscopes:** This video shows a side-by-side demo of the Analog Devices MEMS gyroscope and a competitive gyro, comparing their responses when erroneous input stimuli are applied. Our new gyros exhibit high immunity to shock, vibration, and linear acceleration.—www.analog.com/en/education/education-library/videos/1711072635001

If You Need More ADI Civilian UAV Applications and Products Information, Please Visit:

www.analog.com/en/landing-pages/001/adev-pavillion/unmanned-systems-solution.html

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