CHALK 2, INC
19055 Pimlico Rd. Apple Valley, CA 92308
ph: 760-963-2762 Chalk2.com

Providing safe, reliable support to the UAS industry.

CHALK 2 STANDARD OPERATING PROCEDURES

The contents of this SOP are confidential and only meant for use by the recipient.

CHALK 2, INC
19055 Pimlico Rd. Apple Valley, CA 92308
ph: 760-963-2762 Chalk2.com

Providing safe, reliable support to the UAS industry.

TABLE OF CONTENTS

Part A. General

Photography/Videography

18. Hangar Procedure

Part B. Flight Operations

1. Training
2. Use of Checklists
3. Crew Resource Management (CRM)
4. Arrival at Airport
5. Preflight Action
6. Fueling
7. Start/Taxi
8. Departure
9. Enroute
10. Chase Operations
11. Chase Communications
12. Basic Formation
13. Advanced Formation
14. Descent
15. Landing

16. Post Flight Action
17. Night Flight
18. Range Operations
19. Flights Requiring Oxygen
20. Fuel Relief
21. Emergencies

Appendices

1. Appendix A – Company Organization Chart
2. Appendix B – Job Descriptions
3. Appendix C – Employee Timecard
4. Appendix D – Employee Warning Report
5. Appendix E – Incident Reporting Form
6. Appendix F – Engine Shock Cooling Document
7. Appendix G – Chalk 2 Memos
8. Appendix H – Excerpt from GA-ASI 08098, Rev B
9. Appendix I - Required employee documents

Part A. General

1. Introduction to Chase

The following points summarize the procedures and considerations for chase plane operations:

1. Chase plane support of Unmanned Aerial System (UAS) flight-testing has a single objective: THE SAFETY OF NON-PARTICIPATING AIRCRAFT FLYING IN THE OPERATIONS AREA.
2. The observing and reporting of the Unmanned Aerial Vehicle's (UAV) condition, reporting its position, taking photos and other incidental tasks may be performed only if there is no conflict with the primary objective of guaranteeing the safety of any non-participating aircraft. Photography will not be conducted by the chase pilot, observer or anyone else without proper written consent by customer and the Chalk 2 President/Owner.
3. UAV chase operations require special techniques unrelated to conventional flight and are only remotely related to the type of chase operations used to support manned aircraft flight tests.
4. All established safety precautions relating to conventional flight i.e., proper pre-flight, weather checks, pilot qualifications, observer qualifications, documentation, etc. must be adhered to.
5. The following terms are used throughout this document

- **CHASE:** **The chase plane and crew.**
- **GROUND:** **The UAS remote plane station and crew.**
- **UAS:** **The unmanned aerial system (includes ground control station, UAV, etc.).**
- **UAV:** **The unmanned aerial vehicle.**

2. Operational Control

As the certificate holder, Chalk 2 retains the right to operational control of all flights involved. This allows the exercise of authority to initiate, conduct and terminate a flight. Procedures and policies are in effect to give Chalk 2 operations management personnel and flight crews the necessary information to perform their duties and to ensure adequate information and facilities are available to conduct the planned operation.

Personnel authorized by Chalk 2 to exercise operational control will include the President, Operations Manager, Safety Officer, and designated Supervisor of Flying (SOF). A list of these employees can be found on company roster in Chalk 2 hangar office.

The Pilot-in Command always retains the final authority for the safe operation of the aircraft and for compliance with the Federal Aviation Regulations (FAR 91.3).

3. Crew Duties

Pilot In Command (PIC) Duties

Only approved, trained and certificated commercial pilots will act as PIC and exercise overall control of the chase aircraft at all times during Chalk 2 company operations.

The CHASE Pilot should maintain an appropriate chase position reference the UAV and observe the UAV during flight. Report any unusual configuration or event to the GROUND Crew. The CHASE Pilot is responsible for the following: completing preflight and post flight checks; checking that weather is above minimums for the duration of the flight; ensuring current aircraft documents and publications are on-board; maintaining proper radio communications; supervising the CHASE Observer.

The CHASE Pilot will monitor and report status of assigned UAV flights to SOF's. Delays, cancellations, need for fuel relief and any unusual schedule disruptions or conflicts should be reported as soon as possible. If communications with SOF's cannot be made via radio on company frequency, text messaging is authorized. Text messaging will be limited to company operational issues. If no radio or text contact is possible with the SOF's, CHASE Pilot will use good judgment and contact other chase crews for schedule assistance.

PIC duties will all be performed in accordance with the Chalk 2 Standard Operating Procedures. See Appendix B for additional information.

Observer Duties

The primary purpose of the Observer is the safety of all non-participating aircraft flying in the area. The Observer is to maintain Eyes Outside at all times. This serves a secondary purpose of maintaining situational awareness of the CHASE

Plane's position and altitude, as well as keeping track of other Company traffic working near the same area.

The observers' duties during flight are to assist the PIC in the operation of the flight. This will include the use of checklists (with the exception being during chase), performing see and avoid monitoring, and any other duties deemed necessary for the operation of the flight. The PIC may request that the Observer assist with radio communications but this must be specified by the PIC and should not be assumed by the Observer without clarification. Although the observer might be a pilot, if they are not checked out in Chalk 2 aircraft and/or have not been accepted by our insurance company, they are not allowed to perform any ground movement or flight operations. The Observer will possess a current FAA Second Class Flight Medical.

See Appendix B and J for further information.

Non-Flying Duties

Chalk 2 views the proper care of aircraft, equipment and facilities as an essential part of the operation. Therefore, non-flying duties will be assigned and are to be completed in a timely manner. These duties will consist of cleaning the aircraft, hangers, and equipment. Other duties may include completing or reviewing proper documentation, developing material for the company, ordering of supplies and other duties deemed necessary by management.

4. UAV Overview

Unmanned Aerial Systems (UAS) included the UAV (Unmanned Aerial Vehicle) as well as the Ground Control Station and all additional equipment required for the UAV to fly. Currently Chalk 2 supports four different UAV variants: the MQ1 Predator (piston/gas), MQ1C Warrior/Grey Eagle (piston/diesel), MQ9 Reaper (Turboprop) and the Predator C Avenger (Jet). Each of these platforms has different features that Chalk 2 employees should be aware of: (see next page)

CHALK 2, INC
19055 Pimlico Rd. Apple Valley, CA 92308
ph: 760-963-2762 Chalk2.com

Providing safe, reliable support to the UAS industry.

MQ1B Predator

Customer(s): USAF
Vmin: 45kts
Vmax: 125kts
VLE: 125kts
VLO: 100kts
VX: 65kts
VY: 70kts
Avg. Climb: 1500fpm
Avg. Descent: 1500fpm
Service Ceiling: 25,000ft
Max Endurance: 40hrs

MQ1C Warrior/Grey Eagle

Customer(s): U.S. Army
Vmin: 45kts
Vmax: 135kts
VLE: 135kts
VLO: 105kts
VX: 70kts
VY: 75kts
Avg. Climb: 1500fpm
Avg. Descent: 1500fpm
Service Ceiling: 25,000ft
Max Endurance : 40 hrs

MQ9 Reaper

Customer(s): USAF, U.S. Customs, NASA
Vmin: 61kts
Vmax: 230kts
VLE: 230kts
VLO: 125kts
VX: 105kts
VY: 110kts
Avg. Climb: 2,500fpm
Avg. Descent: 2,000fpm
Service Ceiling: 40,000ft
Max Endurance: 24hrs

P46 Avenger

Customer(s): USAF
Vmin: 75kts
Vmax: 250kts
VLE: 167kts
VLO: 135kts
VX: 140-150kts
VY: 150kts
Avg. Climb: 2,500fpm
Avg. Descent: 2,500fpm
Service Ceiling: 40,000fpm
Max Endurance: 20 hrs

5.Crew Rest

Due to the nature of the operation, Chalk 2 believes it necessary to limit flight time per fuel load to 4 hours. In between fuel loads, crews should be given a 1-hour break for physiological needs. Although some aircraft in the fleet may be capable of longer flight time, a break every 4 hours will help reduce fatigue and complacency by allowing the crews to use facilities as necessary, stretch, eat and rest. If it becomes necessary to exceed these limits, it is the responsibility of the PIC to inform the SOF's. At that point, the SOF's will make changes as necessary to get that crew relief as soon as possible.

6.Use of Oxygen

FAR Part 91.211 :

No person may operate a civil aircraft of U.S. registry (1) at cabin pressure altitudes above 12,500 feet (MSL) up to and including 14,000 feet (MSL) unless the required minimum flight crew is provided with and uses supplemental oxygen for that part of the flight at those altitudes that is of more than 30 minutes duration (2) at cabin pressure altitudes above 14,000 feet (MSL) unless the required minimum flight crew is provided with and uses supplemental oxygen during the entire flight at those altitudes; and (3) at cabin pressure altitudes above 15,000 feet (MSL) unless each occupant of the aircraft is provided with supplemental oxygen.

Chalk 2 maintains a supply of oxygen and equipment necessary for those flights that will exceed the altitude or time limits in FAR part 91.211. If for some reason a flight will exceed these limits without prior notice, Chalk 2 requires the flight crew to comply with FAR part 91.211 and inform the operations manager immediately to arrange for oxygen equipment.

7. Uniform Policy / Dress Code

The Chalk 2 company uniform is as follows:

- Tan flight suit with Velcro name tag.
- Black or white "T" shirt. (No Logos) *
- Black or brown solid or two tone shoe or boot. (No Logos) **
- Black or brown solid color jacket. (No Logos) ***

- Ball cap with Chalk2 logo (not required to wear).

No alterations are permitted to the issued uniform without the expressed consent and authorization of the company President/Owner Julie Mangold.

Chalk 2 shall provide the following:

Full time employees (pilots/observers)

- (3) Flight suits with (1) Velcro name tag
- (1) Black winter jacket
- (1) Ball cap with Chalk2 logo, or beanie with Chalk2 logo

Part time (pilots/observers)

- (1) Flight suit with (1) Velcro name tag
- (1) Black winter jacket
- (1) Ball cap with Chalk2 logo, or beanie with Chalk2 logo

Employee is responsible to provide the following:
* His/her own “T” shirt in accordance with policy requirements.
** His/her own shoes/boots in accordance with policy requirements.
*** If so desired, the employee may provide him/herself with their own jacket provided the jacket is within policy requirements. Leather is approved.
**** If so desired, the employee may provide him/herself with their own cold weather head covering cap or wool beanie provided the article is solid black with no logo.

The company dress code is as follows:

The company uniform has been established to provide employee standardization, uniformity, and to present a positive, professional image of commitment to our customers.

The flight suit shall be worn in the manner it was intended to be worn at all times whenever,

- In flight
- You are away from home base Apple Valley
- While performing pre-flight operations/aircraft maintenance/hangar maintenance, the flight suit can be worn around the waist provided no part of the suit is dragging on the ground and provided these activities are limited to home base Apple Valley.

No visible piercings will be permitted. All personnel will be well groomed and maintain personal hygiene. Facial hair is approved but must be kept groomed.

8.Maintenance Reporting and Action

The following scheduled maintenance checks are completed to ensure Chalk 2 aircraft are ready and safe to fly: 50-hour oil changes; 100-hour inspections; annual inspections; required overhaul on timed components. The operations manager is responsible for recording aircraft and engine times and scheduling routine maintenance.

An aircraft defect may be discovered during pre-flight, in-flight, or post-flight that requires unscheduled maintenance. The defect may be deferrable or a cause for aircraft grounding.

The crew that discovers the defect must notify Chalk 2 Operations Manager and SOF's as soon as possible.

If maintenance to repair the defect can be deferred (meaning the aircraft is safe for flight and complies with the FAR's) then the PIC will notify the SOF's/Operations Manager of the current aircraft status and intent to continue chase support. The Operations Manager will coordinate with Chalk 2's maintenance provider to repair the defect as soon as possible.

If the defect prevents further flight and requires a landing as soon as possible, notify the SOF's/Operations Manager as soon as practical. The Operations Manager, in conjunction with the Maintenance Provider, will decide how to return the aircraft to flyable status. The aircraft might be flown to Apple Valley, or landed at another airport such as El Mirage or Grey Butte depending on the situation. At all times during this decision-making processes Chalk 2 will remain in compliance with the FAR's. If the aircraft is at Apple Valley when defect is identified, notify SOF's/Operations Manager, park aircraft in hangar and secure the "out of service" banner to the aircraft. After un-scheduled maintenance has been completed, and aircraft is flyable, the Operations Manager or maintenance technician will remove the "out of service" banner.

For in-flight maintenance issues (including gear malfunctions) the PIC should when safe and practicable speak directly to the mechanic to get assistance in troubleshooting.

9.Use of Radios/Communications

Commonly used frequencies:

Joshua Approach: 126.1; 124.55
Victorville Tower: 118.35
Victorville Ground: 124.45
Sport: 132.75
Sport (Alt): 133.65
Company Air to Air: 129.9
Chase to UAS Operations: 123.47/123.55
Big Bear: 123.475
Grizzly Operations: 122.65
Kingpin: 123.55

Terminology:

"Go Company": communicate with another chase aircraft on company frequency. Use radio that is monitoring Joshua Approach.
"Go Primary": Return to primary monitoring frequency, i.e. Joshua Approach.

When operating as a "flight", UAS will be responsible for all required radio calls to ATC. The exception will be when chasing ANG. When supporting ANG, Chase PIC will be responsible for all ATC calls, except calls in Class D airspace. Chase will monitor and comply with frequency changes. If necessary, Chase will relay any communications from ATC.

Radio Calls to be made when operating as Chase.

When airborne and in position for UAV take-off, call "In position overhead, Ready for pickup."
When joined with UAV and in "chase position: call "Joined Up."

When on range pick-up mission and UAV is in sight, call "Predator _____ Chase has you in sight, turn south"

Other calls to be made at the discretion of UAV PIC.

Two-way radio communications will be maintained between Chase and the UAS. A radio check will be accomplished every 15 minutes if no other communications have been made.

* More in-depth coverage of this topic can be found in the Flight Operations section of the SOP.

10.Incident Reporting

There are three types of incidents that occur with this type of operation: those which are defined by the Federal Aviation Regulations; those which cause damage to the aircraft but don't conform to the Federal Aviation Regulations; and those which involve the operation of the aircraft during actual chase operations.

Incidents, which conform to the Federal Aviation Regulations, will be handled per the requirements of those regulations. The President of Chalk 2 will also require immediate notification of the incident via phone.

Incidents/non-standard occurrences, which do not conform to the Federal Aviation Regulations, will be reported immediately to management. The crew will initially contact the assigned SOF. The SOF will then report to the Operations Manager, Safety Officer and President via phone. A group text may be used to make the initial report but should be followed up by a phone call. Additionally, the crew involved in the incident is required to complete an incident reporting form (Appendix E), which is available in the office, and turn it into the Operations Manager the same day that the incident occurred. An investigation will follow with the appropriate actions being taken. Examples include: wing tips run into hangers; gear doors departing the aircraft; aircraft doors blown off the hinges: propellers hitting hanger doors or tugs; any event that causes damage to Chalk 2 aircraft and/or other property, physical injury, and any other event that management believes should be investigated.

Incidents that do not meet the FAR definition (FAR 803.2) and involve damage to an aircraft and/or equipment will be cause for an immediate investigation with independent interviews of all employees involved and a final review from a panel.

Incidents, which involve the operation of the aircraft during chase operations, will be reported to management as soon as practical, but no later than the end of the work day during which the incident occurred. An incident report will be filled out and kept on file and then discussed with the flight crews. Additionally, incident reports are required to be completed by any Chalk 2 crews that observe a customer incident even if not directly involved.

Refer to Incident Reporting Memo in Appendix G.

11. Disciplinary Action

Compliance with Chalk 2 policy will be strictly adhered too. Any infraction by an employee may cause a write up to be placed in their permanent file (Appendix E). An employee may receive one verbal warning from management prior to a written warning, which will be documented in their employee file. When an employee receives three write-ups total or two within 90 days, a management review will occur. The management review panel will consist of the President, Operations Manager, and one SOF. The panel also reserves the right to call on other company officers to sit on the panel if necessary. The panel will review the employee's file and determine a disciplinary action.

12. Emergency Procedures

Other Than Flight Related Accidents:

Accidents that occur on the ground will be reported to the SOF's, Operations Manager, Safety Officer, and President.

If an injury or injuries are present medical attention should be sought immediately. There is a First Aid kit located in the office. If the injury/injuries are significant enough the employee(s) should seek medical assistance as soon as possible and 911 should be called if necessary.

In case of a fire, two fire bottles are located on the walls in the Chalk 2 hangar. Attempts to suppress then fire should only occur with no risk of injury or death to an employee. If the fire is out of control evacuate the area immediately and call 911.

Flight-Related Accidents:

In the event of an accident notify the SOF's immediately who will then contact the Operations Manager, Safety Officer and President.
No Chalk 2 employee other than the President or Operations Manager will speak with anyone (this includes customers, reporters, friends or family members) outside of the company regarding the incident/accident.

Only the President or a person designated by the President may contact next of kin or the listed emergency contact for any Chalk 2 employee that may be involved in an accident.

All Chalk 2 employees will work openly and honestly with local authorities, the FAA and the NTSB in the event of an incident/accident.

13.Weather

Chalk 2's company minimums for weather is 1000 FT AGL and 5 SM visibility. The flight crews will comply with FAR Part 91.155 Basic VFR weather minimums and cloud clearances at all times. When an airport is reporting a steady direct crosswind that exceeds 15 knots or exceeds the demonstrated crosswind component of the aircraft (not to exceed 15 knots) and no other runway is available, the pilot will fly to an alternate airport where the crosswind component does not exceed the crosswind limits. The alternate available will be Victorville, or if Victorville is not available, then any local airport that will allow the pilot to land with a crosswind component that does not exceed the limits. After landing the aircraft, the pilot will notify the SOF's to arrange for transportation. The SOF's will notify the Operations Manager for a landing at an alternate airport due to weather.

Chase crews may be asked to provide PIREPS for turbulence or actual cloud coverage in the Operating Area. Definitions of turbulence levels may be found in Aeronautical Information Manual (Chapter 7-1-44). Chase PIC should be proactive in alerting UAV Ground of possible adverse weather conditions. If encountering undesired level of turbulence, request that UAV adjust altitude during flight. Advise UAV Ground of required flight path to remain within cloud clearance requirements.

Chase PIC, SOF's, Safety Officer, and Operations Manager need to remain alert to developing adverse weather that might affect on-going and/or up-coming flights. Decision about continuing or aborting chase mission should be made with safety of the chase crews as the priority.

14. Instrument Flight Rules (IFR)

Instrument Flight Rules are not approved for any chase operations. For movement of aircraft for relocation purposes in IFR conditions, Chalk 2 requires that any pilot flying hold an instrument rating, be current, and adhere to all FAA IFR regulations.

15. Administrative Procedures

The PIC is required to maintain a record of total work time and flight time for each assigned UAV chase flight. If an employee is on company time, a record of total daily work time and flight time (if applicable) and assigned task will be maintained. Employees may use personal log for daily record keeping of work times and flights but will use company time sheet form for the weekly report. Time sheets using company format will be electronically submitted to Julie Mangold by Sunday evening for the previous week's (Sunday through Saturday) work. Refer to the Memorandum titled "Filling out time sheets" in Appendix H for detailed information on completing the required time sheets.

Aircraft flight logs will be completed at the end of each workday. Entries to be made include: Hobbs times, time flown, PIC's initials, and fuel purchased. At the end of every mission day the PIC will text "Down and Safe" to the assigned SOF to confirm the crew's safe return. The SOF will text Operations Manager "All crews down and safe" at the end of each mission day.

16. Use of Medication, Illegal Drugs and Alcohol

Chalk 2 employees and crewmembers will comply with FAR 91.17 at all times. If an employee is suspected to not be in compliance, the employee will be requested to conduct a drug and alcohol test. If the employee refuses to comply he/she will be suspended immediately and a review will occur to determine the employees' future with Chalk 2. We reserve the right to randomly drug and alcohol test employees at any time.

When an employee is taking medication not approved by the FAA for flight, it is the responsibility of the employee to inform management that they are not safe to fly.

17. Carriage of Passengers

The carriage of passengers will only be allowed with the expressed written consent of the President/Owner(s).

18. Photography/Videography

Photos and/or videos may not be taken by anyone, including crew, without expressed written consent of the President/Owner(s) of Chalk 2 as well as direct permission from the client.

19. Hangar Procedures

The Chalk 2 hangar is home base for the company. Because of this it is incredibly important to maintain the highest level of organization, care and cleanliness for the hangar and all of its contents.

Only Chalk 2 crewmembers may pull aircraft out of the hangar and push aircraft back into the hangar.

The office door should remain locked any time employees are not present – the door should not be unlocked when all employees are on chase missions.

The sliding hangar doors should be opened and closed with care. The doors should not be slammed into one another as it puts undue stress on bearings, sliders, etc. On days with high winds or during blowing rain the doors should remain closed to keep the inside of the hangar as clean as possible.

The assigned SOF is required to ensure that the hangar is closed and secured at the end of the mission day.

Maintenance delays and weather holds may be utilized for hangar cleaning, organization and/or additional company projects. The Facilities Manager in coordination with the President/Owner will notify employees of these projects and plans as appropriate.

Office and bathroom cleaning are shared responsibilities among all pilots and observers. The Facilities Manager will create and maintain a cleaning rotation

sheet providing cleaning assignments on a weekly, monthly, and quarterly schedule.

20.Time Off Request

Request for time off must be submitted to Operations Manager three days in advance. Request must be submitted electronically to the Operations manager. The Operations Manager will approve or deny the request via email. Company policy is to allow only two employees to be off on the same day but adjustments to this policy may be considered on an individual basis and will depend on current mission support tempo.

Part B: Flight Operations

1.Training

Training is conducted on the job. Crewmembers will receive training on company SOP's, chase observer and chase pilot duties and responsibilities inflight and while on the ground, aircraft specific procedures, local area orientation, ground operations at customer support sites and at Apple Valley airport. Chase observers must successfully complete an initial safety orientation and a SOP exam. Chase pilots must successfully complete an initial safety orientation, a SOP exam, aircraft specific written test, and a check-ride with designated company CFI or Operations Manager. Ground and flight training will be conducted by SOF's, Operations Manager, Safety Officer and designated company CFI. Company designed task tracking sheets and chase pilot checkout sheets are used to track training tasks and aircraft checkout required tasks. Pilots in training must carry their tracking sheets with them during their flights. These sheets are available for review in the hangar office.

The standard course is for training and tracking of proficiency in chase pilot tasks to be conducted by SOF's and company CFI. When the tracking sheet has been completed for an individual pilot, it will be forwarded to OM for review and recommendation for a check-ride. Check-rides will be conducted by OM and/or company CFI.

Special Operations Advanced Training for photo/video flights, advanced formation flight, night operations and other special projects will be conducted for selected pilots.

The Operations Manager will maintain a "Letter of X's" to identify pilots and the aircraft and missions they are qualified to fly.

Recurrent training will be provided annually for all Chalk 2 crewmembers. This will include a review of SOP's, FAR's, Chase/Basic formation flying, and any additional specialized training skills particular to specific pilots.

Quarterly safety/training meetings will be scheduled and are mandatory for all employees.

2.Use of Checklists

The use of a checklist is required for all pre-flight, in-flight and post-flight operations. A “challenge” and “response” method is to be used when using a checklist to ensure proper verification and crew coordination. The crewmember reading the checklist will advise, “_____Checklist complete.”

When one crewmember is using a checklist exclusively, such as during pre-flight of the aircraft, the crewmember is responsible for the successful completion of all items on the checklist.

The PIC may pre-complete the checklist items (flows) without call-outs. When the PIC calls for the appropriate checklist, the Observer will then announce the items and the PIC will respond with the published response.

When in-flight and either chasing or in formation (depending upon the operation) it is the observer’s job to run all checklists as the pilot should never look away from the lead aircraft.

The pilot flying will give a takeoff crew briefing at the end of the Before Takeoff Checklist. The minimum briefing will consist of what action will be taken in the event of an emergency before rotation speed is achieved and after rotation speed is achieved, which duties each pilot will perform in the event of an emergency, and altitude and direction of flight for departure.

When the aircraft taxis onto the runway for departure, the pilot flying will complete a verbal checklist. This will include confirming the proper runway, final and departure is clear, transponder is on if appropriate and required aircraft lights are on.

During chase operations, memorized checklists may be used and the observer shall monitor the Pilot in Command (PIC) to confirm that the checklist is being followed. If there is any doubt, the observer shall announce the missed checklist item(s) in question.

3.Crew Resource Management

Crew Resource Management (CRM) is essential to the smooth operation of all flights. In order to ensure this, flight crews will be trained in CRM. This training

will include how the crew should operate as a team, how to properly use approach control for chase operations, how to work with UAS crews, and any other personnel for normal and emergency operations.

4.Arrival at Airport

Chalk 2 scheduler will issue the next day's schedule via e-mail by 7 pm the night prior. Crews will arrive at the airport 1 hour prior to mission show time. Upon arrival, the PIC will contact UAV flight crew to get a phone briefing. During the phone brief the chase PIC should confirm mission take-off and landing times, verify type of flight (local or range), and ask about any special mission profiles. If range flight, confirm range time and ask if the UAV will be in range for duration of mission. If unable to establish direct contact with UAV flight crew, contact King Pin/ODO or Big Bear/Pred Ops and advise them that you are unable to contact UAV flight crew and you need to confirm mission information. On certain missions, the chase crew may be requested to attend an on-site briefing prior to flight.

The flight crew will check aircraft squawk sheet for any open maintenance squawks, pre-heat the aircraft engine compartment if necessary, open hanger door, complete the initial aircraft pre-flight (see #5 in this section) and then remove the aircraft from its hangar. After that, the hangar door will be closed, the aircraft will be stocked with water if needed and the Hobbs meter will be checked to confirm it matches the number written in the record log.

Contact Information:

El Mirage ODO: 760.388.8250
Pred Op's (USAF): 661.789.5545
Big Bear (Gray Butte Deconfliction): 661.789.5589
King Pin (El Mirage Deconfliction/Alt. ODO): 760.388.8368

5.Pre-Flight Action

The pre-flight inspection will be performed before the first flight of the day and anytime a flight crew change occurs. This action will be accomplished per the checklist. When done before the first flight of the day, the pre-flight may be

performed at the fuel ramp by one of the flight crew members while the other member is performing other tasks, such as fueling the aircraft.

Prior to departure the crew must make sure that they have a charged handheld VHF radio onboard the aircraft with them in case of a loss of communication during chase operations.

6.Fueling

All aircraft will be fueled at the end of the day to ensure mission ready status for the next day's flights.

When fuel is required, the aircraft should be taxied to fuel pumps and the crew will follow posted fueling procedures. If during truck operating hours, the fuel truck will be called via 122.8. Chalk the aircraft on the ramp in front of the Chalk 2 hangar. When using the fuel truck, fueling will be accomplished by Mag Aviation personnel. Chalk 2 flight crew will standby and provide assistance if required. After fueling is complete, (at the pumps or with the truck) log required information into the aircraft log and put the receipt in the provided sleeve. At least one Chalk 2 crewmember will remain with the aircraft until fueling is complete.

All fueling from GA will occur at El Mirage using the following procedures:

1. Land and taxi to the fuel pump and chock the aircraft and install the gust-lock.
2. PIC should go to Tool Crib and ask the person at the desk for the fuel chip for the specific tail number you are fueling.
3. Take the fuel chip to the pumps.
4. Ground the aircraft using both grounding wires.
5. Raise safety chains.
6. Swipe the fuel chip at the control panel.
7. Pump fuel.
8. Return fuel chip to the Tool Crib.
9. Take Safety chains down, remove both grounding wires and remove chocks and tow bar prior to start.

It is the flight crews' responsibility to ensure that the proper fuel type is put into the aircraft and the fuel load is correct. After fueling is complete, obtain the amount of fuel that was pumped and enter the information into the fuel log.

7. Start/Taxi

Prior to starting the aircraft, the crew should be sure that the chocks have been pulled, the tow bar/tug has been disconnected and returned to its appropriate place, and the area behind the aircraft is clear. Additionally, the crew should be aware of the wind direction and make sure the aircraft is placed into the wind prior to opening the doors as high winds have the ability to remove doors from their hinges when the aircraft is parked pointed down wind.

Prior to taxi, chase crew will determine that ramp area and taxiway are clear. Continue to clear entire area while taxiing. Chase may contact other chase crews in the area to get additional updates on airborne flights in the vicinity of airport.

Anytime the aircraft is being taxied, the PIC will remain eyes outside to guarantee safety of the aircraft. The observer may perform preflight duties at this time. When entering a taxiway both crewmembers will confirm that the taxiway is clear of other aircraft and it is the correct taxiway before entering. Ensure aircraft engine oil temperature is within green range and the CHT's are at least 200 degrees (bottom of the green) prior to take-off. This may require an extended idle period in the run-up area during the winter months.

8.Departure

After the before takeoff checklist is completed the aircraft will be taxied up to the hold short line and the takeoff checklist will be reviewed. Before entering a runway at an un-controlled airport, the PIC will announce over the radio which runway the aircraft will be departing from and the direction of flight. The aircraft will then be lined up with the runway centerline and departure will be performed as outlined in the takeoff checklist. The crew will comply with any published departure procedure for the intended runway or any local noise abatement procedures for that airport. If no procedures are published the crew will fly the runway heading until a minimum of 500' AGL before commencing any turns and will avoid over-flight of any buildings. Power changes will not be made below 1,000 feet AGL.

At airports with a control tower the crew will comply with the instructions from the tower unless safety of flight is an issue. If safety is an issue, the crew will announce the issue to the tower and request amended instructions. If no specific

departure procedure is given from tower, then the pilot will fly runway heading until a minimum of 500' AGL and then turn on course.

After the aircraft departs the surface the PIC will confirm and announce two positive rates (altimeter increasing and VSI showing a climb). At this time the landing gear shall be retracted (if applicable). The aircraft shall be reconfigured for cruise climb upon reaching 1000' AGL, unless there is a need to reconfigure at a different altitude. Then, the cruise climb checklist will be performed.

All departures from Apple Valley will use the Corwin pass route.

Formation take-off's are not approved for any reason.

9.En-route

PIC's will initiate a level off 100 feet below en-route altitude. If the aircraft has cowl flaps, they will be put in the proper position. Time of year and anticipated flight condition will determine cowl flap position. After the aircraft is leveled off and cruise speed stabilized, the PIC will request the en-route checklist be reviewed by the Observer. If at 5000' MSL or above, it is recommended to lean the mixture to find the peak for the conditions of that day. The aircraft, at or above 5000' MSL, should be leaned to 100 degrees rich of peak EGT. Additionally, if at all possible cruise settings of 2300 RPM's and 20" MP are recommended unless higher power is required for the specific mission. These settings should happen prior to chase operations so the pilot is not eyes-inside leaning the mixture once joined-up.

Minimum en-route altitudes to and from Victorville airport will be 4500' MSL. Minimum en-route altitudes to Grey Butte and El Mirage will be 5000' MSL and returning to Apple Valley from these two airports will be 5500' MSL. This is to reduce the possibility of conflicts with opposing company traffic and to give the pilot adequate altitude encase of any emergency that may occur.

For all other airports, the pilot will comply with FAR's 91.119 and 91.159 with a minimum altitude of 2000' AGL, except when needed for descent to an airport.

En-route communications are recommended to include the use of flight following to the maximum extent possible.

Formation flight with company aircraft (other than as necessary for fuel relief purposes or training) are not approved.

10.Chase Operations

Chase operations will be flown in accordance with all current COA's. Please refer to these documents, which are located on the office desktop computer.

Chase operations are the operations necessary to provide see-and-avoid support to UAS's. This is not considered formation flying due to the distance that the chase plane should be flying from the UAV and the operations that are required. In standard chase operations the chase aircraft should never come closer than 100 yards to the UAV. This does not mean that chase flying should be taken lightly as it is a very serious type of flying requiring focus, skill, planning, and situational awareness by all involved.

OPERATION DESCRIPTION. The following chase plane/ground operation procedures must be observed (per GA-ASI's ASI-03938 Rev C):

1. **The UAS Eyes** – The eyes of the chase crew are in effect the eyes of the UAS. It is essential that the chase crew provide uninterrupted visual scanning of the flight path in front of and on all sides of the UAV.

2. **Crew Size** – An Observer is required on all flights. Maintaining the optimum chase position that yields the greatest safety (as described in number 5 of this section) requires constant vigilance on the part of the pilot and so to an extent compromises his effectiveness in searching for traffic. The CHASE Pilot's primary purpose is to keep a constant eye on the UAS for anything unusual or out of the ordinary and to relay such instances to the GROUND Crew. CHASE will most likely be the first to notice anything physically outside of the norm with the UAV and should report it without delay. The CHASE Pilot is constantly evaluating the condition of the UAV and in some instances many go the entire flight without taking both eyes off of the UAV. During such times it is not uncommon for the Chase Pilot to lose track of his/her location, hence the Observer. The primary purpose of the Observer is the safety of all non-participating aircraft flying in the area. The Observer is to maintain Eyes Outside at all times. This serves a secondary purpose of maintaining

situational awareness of the CHASE Plane's position and altitude, as well as keeping track of other Company traffic working near the same area.

3. **Weather** – VMC must be maintained at all times. It is CHASE's responsibility to advise GROUND if the flight path indicates a possible conflict with weather, and CHASE shall advise GROUND of possible options to remain with VFR minimums. Chase should never follow the UAV into IMC.

4. **CHASE/UAS Visibility to Other Aircraft** – All means should be used to enhance the CHASE UAV formation's visibility to other aircraft. The chase plane should have all beacon lights and running lights on at all times, even daylight. The UAV strobe lights and beacon should be on at all times. The UAV's transponder should be on and squawking the assigned code. CHASE's transponder should have the assigned code dialed in and it should be on STANDBY. This is so that if the UAV transponder fails the chase plane is ready to squawk.

5. **CHASE Plane's Position in the Formation (IAW AFI 11-2FTV3, para A27.3.12.5)** – A formation with approximately 100 yards between the aircraft is the safest. Other aircraft are more likely to see at least one of the two aircraft, which in turn provides an "umbrella" for the other. Conditions or anticipated maneuvers may dictate that a looser formation is flown as defined in the paragraph below.

   The chase plane should maintain a position that has 10 wingspans of separation from the UAV, slightly higher or lower and 20-45 degrees left or right of center. If the chase plane is too far to the left or right or too close to the UAV it jeopardizes the safety of CHASE and the UAV. The UAV could make an unexpected turn, pitch or airspeed change that may converge with CHASE's flight path.

6. **Initial Pick-Up on Take-Off** – This is the preferred method of joining up. The initial pick-up on take-off is best performed by having the chase aircraft in the air first. When CHASE is airborne and in position for UAV take-off, call "In position overhead, Ready for pick-up." When joined with UAV and in 'chase position', call "Joined up."

7. **Initial Pick-Up in Flight** – At times, such as during a company demonstration, it is advantageous to join up at altitude. In this case,

CHASE will take-off and loiter south of the field. Ground will inform CHASE when they are going to take-off. CHASE will keep the UAV in sight and climb along with it, but remain south of the field until either GROUND says to join up or the UAS is at 2,000 feet AGL. Upon reaching 2,000 feet AGL, or when directed by GROUND, CHASE will head north and join up with the UAV in the appropriate chase position. In a situation where the UAV is airborne upon CHASE's arrival, CHASE will remain south of the field until the UAV is in sight. GROUND can assist by giving CHASE the UAV's location and altitude. With the UAV in sight, CHASE can proceed north to join up.

8. **UAV Handover at Landing** – When it is desired to recover the UAV, the normal procedure is to bring the UAV into visual range of the ground crew. Chase will continue to maintain visual contact with the UAV on the landing roll (remaining above 500 ft AGL) until the UAV makes a full stop landing and taxis onto the ramp. This is to ensure that if GROUND decides to do a touch and go or go-around, CHASE is prepared to continue with the UAV on the upwind leg. When a full stop landing is completed, and GROUND calls "chase cleared to break", CHASE will either RTB, land at EL Mirage or Grey Butte, or as directed by SOF.

9. **Call-OFF** - There are innumerable conditions that might cause a mission to be aborted, e.g., deteriorating weather, system failures, chase plane problems, etc. But, these can be handled quite routinely as long as two-way radio contact is maintained. However, <u>IF TWO-WAY RADIO CONTACT IS LOST, SAFETY IS SERIOUSLY JEOPARDIZED.</u>

   The following call-off procedures are essential:

   - If CHASE detects a communication failure with GROUND, CHASE should immediately make blind calls to GROUND, attempt to contact the ODO, Pred Ops, Kingpin, or Big Bear by radio and issue a request to retrieve the UAV.

   - If, for some reason, the vehicle is not retrieved as requested, CHASE is obligated to continue the chase operation to provide a safety umbrella for the UAV until retrieval is successfully concluded. The only exception is in the case of a life-threatening situation e.g., collision threat, low fuel, unable to maintain VMC conditions, etc.

- If GROUND detects a communication failure with CHASE, GROUND is obligated to initiate immediate retrieval of the UAS. GROUND shall make blind calls to CHASE informing them of the situation. GROUND should also contact the ODO and ask the ODO to attempt contact with CHASE via radio. GROUND rocks UAS wings for 30 seconds to signal loss of communications. As above, it is CHASE's obligation to continue operation until the UAS has been successfully retrieved even though radio contact has been lost with the exception of a life-threatening situation.

  * The cause of a communication failure may not be immediately evident to either CHASE or GROUND. Safety precautions dictate that retrieval must be started immediately upon detection, and only then followed by any attempt to re-establish communications.

11. Chase Communications

The importance of reliable two-way radio communications between CHASE and GROUND is self-evident and cannot be over-emphasized. Without it, CHASE cannot advise GROUND of actions to avoid flight conflicts. In order to be sure that radio contact has not been lost, at least one radio transmission should be made every 15 minutes. If fifteen minutes has passed without a radio call, either GROUND or CHASE shall request a radio check. Each radio check and transmission shall include the aircraft call sign. The chase aircraft shall use FAA registration (tail number) and the UAS shall use the tail number. Prior to leaving APV, chase crew will take a hand-held radio that may be used in the event all other on-board radios fail.

Radios/Communication – Radio communication between the GROUND Crew and CHASE is of utmost importance. Every radio communication must have a verbal acknowledgement, every time. This verifies that radios are working and reasserts the quality of the transmissions. Double clicking the mic is NOT an acceptable way to acknowledge a communication from CHASE. Unsafe or unreliable radio communication compromises the entire UAS Operation as well as the safety and lives of the Chase Crew and non-participants in the area.

REQUIRED COMMUNICATION IN DAILY OPERATIONS:

CHASE aircraft are equipped with two radios. One radio will be set to the designated frequency between CHASE and GROUND (CTAF). The second radio will be used to monitor approach control (Joshua Approach) so that CHASE can maintain the highest level of situational awareness as well as provide communication assistance to GROUND if necessary. Refer to Communications Memo in Appendix G for more information.

From **GROUND** to **CHASE**:

- Call all changes in ALTITUDE.
- Call all changes in AIRSPEED.
- In close formations or during night operations, call all TURNS.
- Call the VFR descent to the field.

From **CHASE** to **GROUND**:

- Call prior to entering operations area.
- Before landing call positions in the pattern.
- Report local altimeter setting.
- Call when in position.
- Call gear down position on final.

Actions/Communications to Avoid Flight Conflicts:

If CHASE sees a possible flight conflict, CHASE shall contact GROUND with a clear order to make an immediate maneuver for the conflict avoidance. GROUND must understand that an **immediate** maneuver is of utmost importance. The convergence rate may be high or a potential conflict might be caused by a faster aircraft overtaking and closely passing CHASE.

CHASE should repeat if an immediate maneuver is not observed.

When traffic is no longer a factor, CHASE will notify GROUND that it is safe to resume normal flight operations

*Although the GROUND is the controlling authority during a UAS test, when CHASE makes the Immediate Conflict Avoidance Order, it is to be accepted as a direct order and not to be debated or delayed. The UAV PIC must take immediate manual control of the UAS and follow the

direction of CHASE over any other direction or instruction going on in the Ground Control Station until the threat has been nullified. This includes Examiner Instruction during check-rides as well as training being presented by an instructor.

Extensive UAV chase experience has shown that a CHASE order to maneuver may be a rare occurrence. Sometimes several tests will be conducted without a single CHASE maneuver order being necessary. Therefore, GROUND must guard against complacency. GROUND must be continuously alert for a maneuver order.

12. Basic Formation

Chalk 2 considers basic formation to be the flying required during chase during *fuel relief or during emergency equipment checks* requested by the UAV pilot. During this type of flying pilots should be no closer than 50 yards (roughly 5 wingspans) of the UAV.

If, for any reason, a Chalk 2 employee feels that the basic formation flying is unsafe or if the pilot has not been properly trained for a specific request (i.e. positioning, maneuvering, etc.) the pilot should respond "**unable**".

13. Advanced Formation

Advanced Formation is flying that is required for unique flights including, but not limited to, photo flights, video flights and certain test flights. Advanced formation requires additional training to prepare crew for closer flying, to prepare/consider/review emergency procedures specific to different formation configurations and emergency situations, etc. Advanced Formation Pilots must be approved by the President/Owner(s) and then trained and checked-out by the Safety Officer and/or Operations Manager. Training will be specific to the requirements of certain flights and each pilot's training and approved types of formation will be recorded in their employee records.

14. Descent

When a descent with the intention for return to airport is required, the PIC shall reconfigure the aircraft, if necessary, and then request the specific checklist to be reviewed by the Observer.

When a descent is required during chase, the PIC shall attempt to configure the aircraft so as to keep the power setting within the normal operating range (green arc on RPM or Manifold Pressure) to avoid shock cooling the engine (high rate of cooling air that could damage the engine) if at all possible. Shallow S-turns, slips, (if approved by airplane POH) and turns in the opposite direction while maintaining visual contact at all times with the UAV can be used to help with the descent. If these maneuvers become excessive, then a further reduction in power may be required.

15. Landing

Upon entering the traffic pattern, the PIC will request checklists from the Observer and perform any actions required. One callout in the pattern will be made after the landing gear is down and locked “Gear Down” with the normal call outs, confirming gear position. The radio call on final should include “gear down and locked”. All landings will be performed per POH recommendations with the wheels touching down at or before the 1000' runway markers, if markers are present, or within the first 1/3rd of the runway. If these requirements cannot be met, then a go-around will be initiated and another approach and landing will commence. The wind requirements for landing are outlined in the Weather Chapter of the Operations Manual.

Landings will be performed with full flaps. The only exception is to accommodate adverse wind or weather conditions.

Runway choice should be made based on acquiring the most favorable wind conditions for landing (i.e. minimizing cross-winds).

All arrivals to Apple Valley will utilize Bell Mountain route.

16. Post Flight Action

Upon return to the home base airport, the aircraft should be taxied back to hangar and parked in such a way that will allow the opening of the aircraft doors without the wind damaging the hinges. The aircraft should be chocked and gust-lock installed any time it is parked outside the hangar. The hanger door will be opened and the aircraft will be repositioned in the hanger once it has been refueled. Only Chalk 2 crewmember may push an aircraft into the hangar. The seat belts should be clipped together over each of the two front seats. The aircraft windows and leading edge surfaces will be checked and cleaned as necessary. A post flight walk around will be performed to check for any discrepancies with the aircraft. If a discrepancy is found, then the pilot will write it up and inform the required personnel. The flight time log will be filled out. Any trash will be removed from the aircraft and the hanger will be closed. Every Friday, the flight crew will clean the belly of the aircraft they were assigned, sweep out the hanger and empty the trash, unless instructed not to by management. When all actions are complete, the PIC will contact the SOF thru text or phone call to let him/her know that the aircraft and crew are safe on the ground and are departing the airport.

17. Night Flight

Two rated pilots are required during night operations. One of the pilots may be a private pilot only. The chase pilots should have a brief individual's piloting duties prior to takeoff. During chase operations at night, the person on the controls should have their eyes on the UAV at all times. The second pilot will fulfill observer duties except during critical phases of flight created by the night flight mission. Advanced training for night chase operations is required to be successfully completed by any pilots used for night chase operations.

18. Range Operations

Range Drop-Off

1. Normal range used is R-2515
2. Once the UAV enters the range they will radio to CHASE "clear to break".
3. CHASE should ask GROUND what time they would like pick-up.

4. Once CHASE breaks from the UAV they are to contact “Sport” on 132.75 and state aircraft call sign, what UAV they were chasing and that they are heading south squawking VFR.
5. When clear of the range, CHASE will proceed as assigned by SOF’s; either return to Grey Butte or El Mirage and maintain radio and phone standby or act as fuel relief for another chase aircraft, time permitting.

Range Pick-Up

1. CHASE should depart Gray Butte/El Mirage and fly direct to Sun Hill Ranch.
2. CHASE will climb to an altitude of 500 feet below the UAV’s pick-up altitude.
3. CHASE contacts GROUND and asks if they are ready for pick-up.
4. If not ready for pick-up CHASE continues to hold over Sun Hill.
5. If ready for pick-up CHASE is to contact “Sport” on 132.75 stating aircraft call sign and what UAV they are to pick up.
6. Once CHASE is cleared into the range by “Sport” they are to proceed into the range and will receive radar vectors from “Sport” to the UAV.
7. CHASE will notify “Sport” when they have the UAV in sight and that CHASE will squawk standby upon joining up.
8. Once CHASE has joined up with the UAV CHASE will tell GROUND “Joined up, proceed south”.

19. Flights Requiring Oxygen

Two pilots are required during operations that require oxygen. This is necessary due to the additional duties that go on along with oxygen flights, such as setting and maintaining oxygen levels, changing the oxygen bottles; and transference of the controls while the pilot places, adjusts and removes the mask. The second pilot will fulfill observer duties except during critical phases of flight created by the oxygen-required flight mission. Oxygen use is recommended for night flights above 5000 MSL.

20. Fuel Relief

When fuel relief is necessary, the flight crew assigned the relief will be notified of required join up time and when, if any, the next aircraft will be back up and joined. UAS will be advised that a change in chase aircraft is taking place for fuel relief and chase will request that UAV maintain heading, altitude, and airspeed.

Fuel relief aircraft will use Joshua Approach to coordinate join up with UAV/chase combo for fuel relief. If Joshua is too busy (during the day) to provide join up vectors, the inbound aircraft may use company frequency for join up assistance. If using Joshua Approach for join-up vectors, utilize the following radio procedures:

"Joshua Approach, this is 12M, fuel relief for UAV 11, location, altitude, requesting vectors."

Proceed on assigned vector and when UAV/chase combo is in sight:

"Joshua Approach, UAV 11 in sight, request frequency change."

On CTAF, request chase aircraft to "Go company" and proceed with chase relief. Relief aircraft should approach UAV on opposite side of existing chase aircraft and stack slightly high. When the relief aircraft is in position, they will call "in position, cleared to break". The relieved chase aircraft will clear the area and break away from chase. Once clear, they will reduce power if necessary and start a 500 fpm descent towards fueling site. The relief chase aircraft will check in with the UAS when joined. Communications between chase aircraft will be made on company frequency.

21. Emergencies

Ground Emergencies:

CODE YELLOW (Potential Emergency):

The chase crew dedicated to the UAV experiencing the CODE YELLOW should return to their aircraft and wait for further instructions.

CODE RED (Emergency in Progress):

Human safety is the number one concern for Chalk 2. If a CODE RED is declared while on the ground at El Mirage or Gray Butte crews should

become aware of the situation and location of the emergency prior to returning to their aircraft. If the emergency has occurred off-airport or in-flight the chase crew dedicated to the UAV declaring the CODE RED should start up, confirm with King Pin/Big Bear that the area is clear for take-off and depart to join up with the UAV.

If the Emergency is occurring in the pattern or on the airport, Chalk 2 employees should remain well clear of the ramp and not return to their aircraft until the area has been deemed safe.

Fire in hangar:

In case of a fire there are fire extinguishers located on both sides of the Chalk 2 hangar.

If the fire is out of control all employees should evacuate the premises immediately and call 911 as well as notify the airport manager.

Chemical Spills:

Chemical spills include but are not limited to fuel, hydraulic fluid, break fluid, break cleaner, engine cleaner, and any other hazardous materials. The fluid should be covered with cat litter and the Operations Manger should be notified immediately. For large spills the Airport Manager and head of airport maintenance should be contacted immediately.

Bodily Injury:

A first aid kit is located in the Chalk 2 office. If the injury is serious enough to require medical assistance seek this assistance immediately. If the injury is serious enough to require emergency response 911 should be called.

In Flight Emergencies:

All aircrew should review the Emergency Procedures section of the aircraft's POH prior to departure. In the event of an actual emergency, the PIC shall remain at the controls and communicate as necessary. The Observer will perform any operations necessary to remedy the problem and perform any checklists. If the emergency occurs during chase operations, the PIC will inform

the UAS immediately of the emergency and what is required of the UAS. If possible, chase will remain with the UAV until either relief chase is in position or the UAV is within its' COA/LOA, **but only if safety of flight is not in question.**

LOSS OF VISUAL CONTACT WITH THE UAV

If CHASE loses contact with the UAS **the crew should immediately inform GROUND** and separate themselves from the UAV by 500 feet of altitude. The preferred action is to initiate a climb but a descent may be necessary in certain situations. CHASE should notify GROUND of their action and altitude they are currently at and climbing to. If contact is lost for greater than a 30-second period CHASE should establish a heading of south and loiter south of the field until visual contact is reestablished. While CHASE is looking for the UAV, GROUND should be making position reports and calling turns to assist CHASE. If the UAV contact is lost by the ground grew the UAV should be turned toward “home” while the outside crew is vigilantly looking for other traffic in the area.

LOST COMMUNICATIONS

- If CHASE detects a communication failure with GROUND, CHASE should immediately make blind calls to GROUND, attempt to contact the ODO, Pred Ops, Kingpin, or Big Bear by radio and issue an order to retrieve the UAV.
- If, for some reason, the vehicle is not retrieved as ordered, CHASE is obligated to continue the chase operation to provide a safety umbrella for the UAV until retrieval is successfully concluded. The only exception is in the case of a life-threatening situation e.g., collision threat, low fuel, unable to maintain VMC conditions, etc.
- If GROUND detects a communication failure with CHASE, GROUND is obligated to initiate immediate retrieval of the UAV. GROUND shall make blind calls to CHASE informing them of the situation. GROUND should also contact the ODO and ask the ODO to attempt contact with CHASE via radio. GROUND rocks UAS wings for 30 seconds to signal loss of communications. As above, it is CHASE’s obligation to continue operation until the UAV has been successfully retrieved even though radio contact has been lost with the exception of a life-threatening situation.

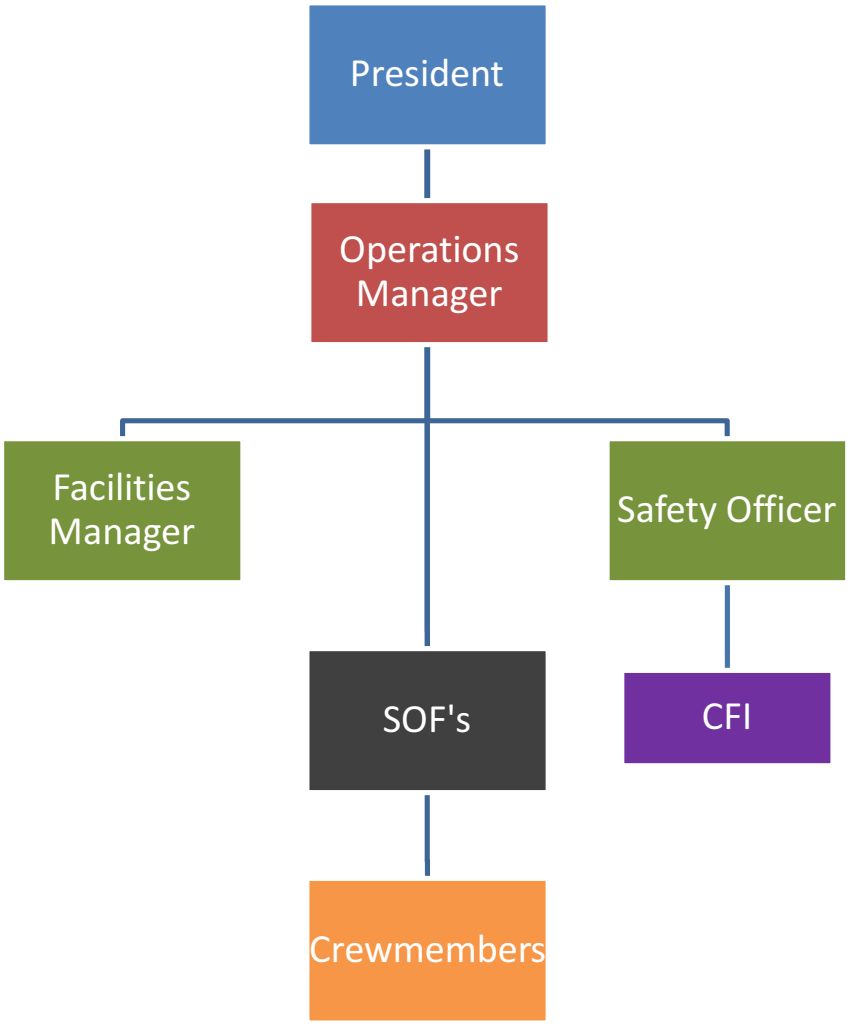
* The cause of a communication failure may not be immediately evident to either CHASE or GROUND. Safety precautions dictate that retrieval must be started immediately upon detection, and only then followed by any attempt to re-establish communications.

LOST LINK

If lost link occurs, it is CHASE's obligation to continue operation until the UAV has been successfully retrieved even though radio contact has been lost. The only reason to break chase is if a life-threatening situation develops. In an un-commanded lost-link situation the Chase PIC should contact GROUND and request the expected duration of the situation. If beyond the fuel capacity of the chase aircraft, communication should occur between the Chase PIC, GROUND and ODO, Pred Ops, Kingpin, or Big Bear to arrange for fuel relief.

APPENDIX A

Company Organizational Chart



APPENDIX B

Job Descriptions

President

The President of Chalk 2 is responsible for all aspects of the company including strategy development, performance management, bid proposals, payroll, and public relations. The President maintains all employee files. The President is also in charge of all performance evaluations (working in tandem with the Operations Manager, Safety Officer and designated CFI's), written warnings and hiring and termination.

Contact Information: Julie Mangold
Phone: 760.963.2761
Email: chalk2llc@yahoo.com

Operations Manager (OM)

The OM is responsible for the overall operations of Chalk 2 including acting as a liaison between Chalk 2 and its customers. The OM works directly under the President/Owner of Chalk 2. Responsibilities of the OM include supervision of daily scheduling of aircraft and pilots/observers, scheduling and tracking of aircraft maintenance, overall management of office/hangar/aircraft, along with any additional tasks assigned by the President/Owner. The OM works with the Safety Officer and designated company CFI's as needed. The OM is in charge of employee management, keeps employee roster up to date, has final approval for aircraft and PIC checkouts and maintains the Letter of X's. The OM has the authority to provide verbal and written warning that may be placed in employees' file.

Safety Officer (SAO)

The SAO will oversee and implement initial, recurrent and remedial safety training for pilots, observers and administrative staff. This includes but is not limited to initial safety orientation for new pilot and observers, flight safety, chase and formation operations, ground safety, hangar safety, and emergency preparation, procedures and response. In case of accidents or incidents the SAO in conjunction with Operations Manager and President/Owner should be

notified immediately and will work together to handle any and all public relations, customer relations, etc. The SAO is also responsible for conducting monthly safety meetings and acts as a liaison at any safety meetings held by Chalk 2's customers. The SAO will work directly with the President/Owner and the OM with regard to any safety concerns, infractions, incidents or accidents as well as maintaining and/or modifying the SOP.

Supervisor of Flying (SOF)

The Supervisor of Flights, here after referred to as SOF, are supervisory positions within the Chalk 2 management organization. SOF's will be supervised by, and will report directly to the Operations Manager. SOF's are leaders, mentors, and trainers. SOF's will be held to a high level of professionalism, confidentiality, and accountability.
It will be the policy of Chalk 2 under routine operations to maintain two SOF's on duty per day.
If unforeseen complications arise, then Chalk 2 management can modify the SOF schedule with one SOF filling the all-day supervisor role. The Chalk 2 owner/president, may elect as many employees to the SOF position as is deemed necessary, but is under no obligation to rotate any one individual to the active duty assignment at any time. Rotation to active SOF will be determined solely by the owner/president of Chalk 2. The SOF duty will be assigned weekly, rotating from AM SOF to PM SOF.

Duties:

- AM SOF:
  Regardless of his/her scheduled flight time, will be responsible for operations from the time the first crew is scheduled for flight. AM SOF duty hours will end at 1300.
  The AM SOF will be the morning point of contact for ODO/King Pin/Pred Ops/Big Bear and all Chalk 2 crews. The AM SOF may on occasion have to receive phone calls from GA at times earlier than the scheduled first crew. This is rare, but may occur.
- PM SOF:
  Regardless of scheduled flight time, will be responsible for operations from 1300 to end of flight schedule. PM SOF will be the afternoon point of contact for ODO/King Pin/Pred Ops/Big Bear and all afternoon Chalk 2 crews. PM SOF will stay in touch with the crews and ensure the last crew is "Safe on deck".

PM SOF will forward to Operations Manager, last crew "Safe on deck".

- SOF's will check in with ODO/King Pin/Pred ops/Big Bear. Identify yourself, give each of them your company phone number, and the aircraft "N" number you are assigned to.
- SOF's will stay updated via company phone emails for flight updates, i.e. weather holds/ maintenance holds/ cancellations/ any other changes to the published flight schedule, and advise crews as needed.
- SOF's will check in with the crews that are on the schedule.
- SOF's will make sure that crews returning to base check in with you. If a crew has a flight cancel, the SOF may re-assign that crew as needed. i.e.: another flight, or hangar maintenance.
- SOF's will coordinate for any unscheduled fuel relief needs, pop up flights, flight delays that may conflict with other scheduled flights.
- Crews are to check in with the SOF's upon completion of their flight. SOF's may release the crew, or re-assign as needed.
- SOF's are tasked with administering chase training. New pilots will have a chase training tracking form issued to them by Operations Manager. They must carry the form with them each day. The SOF's are to administer the proper training and once the new pilot demonstrates proficiency in each area the SOF's are to initial the box. Once the form is complete, the SOF's will then forward the training form to the Operations Manager.

Facilities Manager

The Facilities Manager is responsible for overall condition of hangar, office, classroom, storeroom, bathrooms, and aircraft cleanliness. He will supervise necessary repairs to areas inside the hangar and will coordinate with airport maintenance department for required repairs to hangar structure. He will coordinate with Operations Manager for any work that will take place inside the hangar and will schedule required cleaning of work spaces and aircraft. He will order required supplies for facilities and crews. He will assist the President in collecting required documents from crewmembers. List of required documents is located in Appendix I. He will coordinate with Chalk 2 customers for required badging of Chalk 2 crewmembers.

Pilot

Qualifications:

Chase pilots must have a minimum of an FAA commercial pilot's certificate. Prior to flying as chase PIC, pilot will complete required training and aircraft checkout.

Duties:

The CHASE Pilot's primary purpose is to keep a constant eye on the UAS for anything unusual or out of the ordinary and to relay such instances to the GROUND Crew. CHASE will most likely be the first to notice anything physically outside of the norm with the UAS and should report it without delay. The CHASE Pilot is constantly evaluating the condition of the UAS and in some instances many go the entire flight without taking both eyes off of the UAS.

It is the responsibility of the pilot to provide safe operation of the aircraft including proper preflight, weather checks, documentation, flying duties and radio communications.

Duties will also include monitoring and reporting to the SOF of all UAS flights, on the ground waiting for departure or currently in the air. Only approved and certificated commercial pilots will act as PIC and maintain overall control of the aircraft at all times during Chalk 2 company operations.

This will all be performed in accordance with the Chalk 2 Standard Operating Procedures.

Non-Flying Duties:

Chalk 2 views the proper care of aircraft, equipment and facilities as an essential part of the operation. Therefore, non-flying duties will be assigned and are to be completed in a timely manner. These duties will consist of cleaning the aircraft, hangers, and equipment. Other duties may include completing or reviewing proper documentation, developing material for the company, ordering of supplies and other duties deemed necessary by management.

Observer

Qualifications:

Observers must have an FAA 2nd Class Medical Certificate (per the LOA) and have received the appropriate training. Prior to acting as an observer on chase missions they will be appropriately trained in the Standard Operating Procedures and be approved by the Chalk 2 Owner/President and OM.

Duties:

The observers' duties during flight are to assist the PIC in the operation of the flight. This will include the use of checklists (with the exception being during chase), performing see and avoid monitoring, and any other duties deemed necessary for the operation of the flight. The PIC may request that the Observer assist with radio communications but this must be specified by the PIC and should not be assumed by the Observer without clarification. Although the observer might be a pilot, if they are not checked out in Chalk 2 aircraft they are not allowed to perform any ground movement or flight operations.

Non-Flying Duties:

Chalk 2 views the proper care of aircraft, equipment and facilities as an essential part of the operation. Therefore, non-flying duties will be assigned and are to be completed in a timely manner. These duties will consist of cleaning the aircraft, hangers, and equipment. Other duties may include completing or reviewing proper documentation, developing material for the company, ordering of supplies and other duties deemed necessary by management.

CHALK 2, INC
19055 Pimlico Rd. Apple Valley, CA 92308
ph: 760-963-2762 Chalk2.com

Providing safe, reliable support to the UAS industry.

APPENDIX C

EMPLOYEE TIMECARD

NAME: _____

WEEK ENDING: _____

DAY OF WEEK	DATE	N NUMBER	UAV #	OBSERVER NAME	FLIGHT TIME	WORK TIME	OVER- TIME	CHARGE NUMBER
				Totals:	0.00	0.00	0.00	

EMPLOYEE SIGNATURE: _____

APPROVAL SIGNATURE: _____

APPENDIX D

EMPLOYEE WARNING REPORT

Employee's Name Date of Warning:

TYPE OF VIOLATION

☐ Attendance
☐ Tardiness or Leaving Early
☐ Substandard Work
☐ Other:

☐ Insubordination
☐ Willful damage to property
☐ Rude to Customers / Co-Workers

☐ Uncooperative
☐ Violation of Company Policy/Procedure
☐ Conduct

Date of Violation:
Time of Violation:
Place of Violation:

☐ 1st Written Warning
☐ 2nd Written Warning
☐ **FINAL WRITTEN WARNING**

COMPANY REMARKS

State the inappropriate behavior as discussed with employee. List any witnesses to the incident.

Click here to enter company remarks

Has employee been warned previously about similar conduct? ☐ Yes ☐ No If yes, when and by whom?

Form of Warning	1st Warning	2nd Warning	3rd Warning
Oral			
Written			

Name of any other person present:

CORRECTIVE ACTION TO BE TAKEN

State desired behavior and the timeframe employee has to accomplish the correction.

Click here to enter corrective action to be taken

EMPLOYEE RESPONSE

The absence of any statement on the part of the Employee indicates his/her agreement with the report as stated.

I have entered my version of the matter above. _____ _____
Employee's Signature Date

I have read this Warning Report and understand it. I also understand that further misconduct may result in additional discipline, up to and including termination of my employment.

_____ _____
Employee's Signature Date

Click here to enter name of person
Name of person who presented Report to employee.

_____ _____
Signature Date

_____ _____
General Manager Signature Date

CHALK 2, INC
19055 Pimlico Rd. Apple Valley, CA 92308
ph: 760-963-2762 Chalk2.com

Providing safe, reliable support to the UAS industry.

APPENDIX E

Chalk 2 Incident Reporting Form

Date of Occurance	Location of Occurance

Aircraft (Type/N#)	UAV Type/Call Sign

Chase PIC	Chase Observer

PIC Total Hours	Observer Hours

Phase of Flight

Aircraft Standing	
Taxiing	
Take-off	
En Route	
Chase	
Manuevering	
Approach	
Landing	

Weather Conditions

Wind	
Ceiling	
Visibility	
Precipitation	

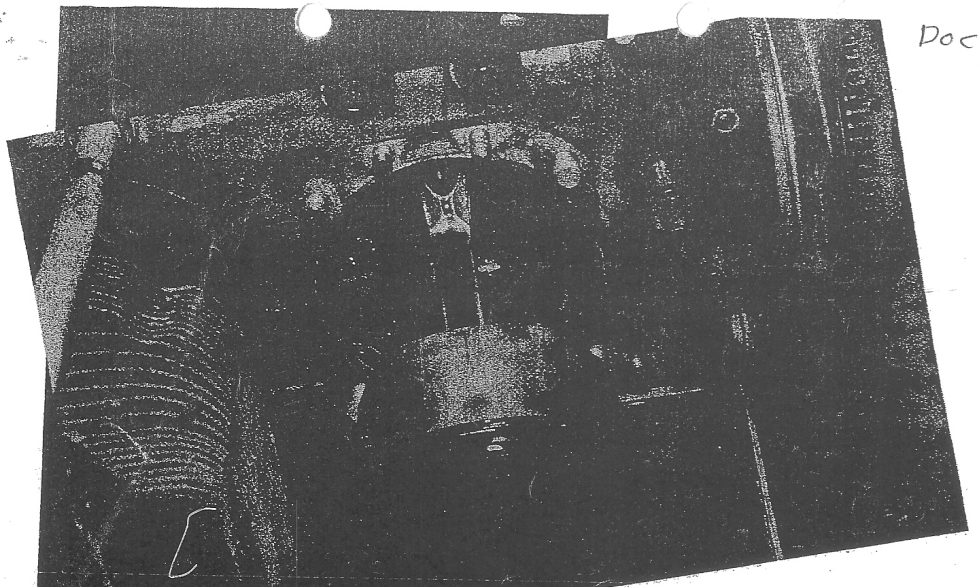
Altutude of Incident

MSL	
AGL	

Please fully describe the occurrence (include your suggestions to prevent further occurrences). Use additional pages if necessary.

APPENDIX F

Doc 4



ENGINE SHOCK

Chopping throttle at altitude is only one way to punish your engine. Would you believe normal starting is another? Here's the inside scoop on giving your powerplant a long and happy life.

By Bud Corban

It's a familiar scenario, one repeated almost daily at airports across the country. The pilot is in a rush. He needs to get somewhere fast and is behind schedule. The airplane is in good shape, the winds are favorable, it's a warm July day and the pilot hurries through the preflight, being careful to cover all the items, but as quickly as possible.

Preflight complete, he climbs aboard, starts the engine and adds just enough breakaway thrust to get the plane rolling and let the engine warm up during taxi. On the way to the run-up area, the pilot speeds through the before-takeoff checklist, touching every base but spending minimum time getting the aircraft ready to fly. The run-up goes smoothly, and he's soon number one for takeoff.

Fortunately, the tower and traffic are on the pilot's side. He's cleared for takeoff almost immediately, the engine responds smoothly as the throttle is eased full forward and he's soon folding the wheels into the wells and climbing to altitude. As he clears the summer haze layer, the airplane is running perfectly, weather is excellent all the way to his destination and the pilot feels he has nothing to worry about.

Don't bet on it.

"We see it all too often," says John Pava, executive vice president and director of technical services at Victor Sloan's Victor Aviation Services in Palo Alto, Calif. "A normally well-organized and conscientious pilot will jump into a big single or corporate twin, fire it up and be off the ground in less than three minutes. In fact, the pilot may be subjecting his or her engines to serious abuse, even in warm weather when he or she assumes they'll come up to tem-

SHOCK

perature quickly. Though it's important to avoid too much warmup time, many pilots don't allow nearly enough, especially with large piston engines. It may be two to three minutes before you can add taxi power, and it may take a good eight or 10 minutes to bring those engines up to proper operating temperature for full takeoff power."

Pava knows whereof he speaks. In building up hundreds of engines over the last 17 years, the experts at Victor Aviation have learned what makes them hum. They've also learned what can destroy them. Pava and Sloan recently talked to *PLANE & PILOT* about their pet peeve in engine management, thermal shock.

"Heat or the lack of it is the nemesis of all engines, large or small," says Sloan. "Even if you treat your engine with exceptional care, the worst abuse comes during the starting process when the engine is cold. In a perfect world, every engine would be preheated to at least 50 degrees C before engaging the starter and would be allowed to warm up to full operating temperature before takeoff." He continues, "In the real world of normal 10- to 30-degree C outside air temperatures, engine preheat isn't realistic or practical but, below 10 degrees C, it should be mandatory if you expect your engine to deliver reliable power to TBO."

Pava adds, "Cold starts are killers for any engine. Any time you engage the starter, you should have some lubrication on the cylinder walls and enough heat inside the engine to normalize the mating of different metals.

"There are several dozen metals employed in an aircraft engine, everything from copper and tin to aluminum and steel," he continues. "They all have slightly different coefficients of expansion and don't grow or shrink at the same rate. That's one reason operating tolerances are built into an engine—to allow for expansion and contraction of dissimilar components. All the engine's parts need to be at a reasonably consistent operating temperature before the throttle goes forward."

Despite many pilots' belief that abusing the throttle generates nearly all shock cooling, Pava and Sloan suggest there are four controls that govern cooling in the engine: throttle, prop control, mixture and cowl flaps. "It's true that rapid movements of the throttle induce large, abrupt changes in manifold pressure and produce the worst shock cooling, but proper management of the other two power controls and cowl flaps are equally important in regulating engine temperatures," Sloan explains. "Technically, shock cooling occurs when the pilot either reduces the heat within the engine abruptly, increases the cooling air dramatically or mismanages both simultaneously. We normally regard shock cooling as any cooldown rate in excess of about 40 degrees C per minute."

Pava enjoins, "We know engine failures happen most often during power adjustments, most specifically the first power reduction after takeoff. That's why takeoffs should be made at full power to at least 2000 feet before making *any* change to manifold pressure, rpm or mixture.

"On the majority of normally aspirated engines, it's best to climb all the way to cruise altitude without a manifold pressure reduction," he explains. "In a typical high-performance retractable that climbs at 800 fpm or more, you'll reach 4000 feet from sea level in the first five minutes, so

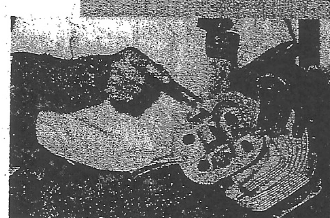
TBO TECHNOLOGY

ECI's newly developed nickel-alloy cylinder bore-coating process, CermiNil, is taking a step into the "green zone"

By Steven Higginson

Growing clamor from government environmental agencies and activists has brought widespread affirmative action toward global cleanup of pollutants and industrial wastes. New and more stringent regulations are taking shape that govern how industry manages its manufacturing practices and how it conducts present and future business. These regulations have affected the aviation industry as well, and Engine Components Inc. (ECI) has reacted as an environmentally conscious company.

ECI has been a leading supplier of remanufactured aircraft engines and engine components since the 1980s. Back then, the company set a new industry standard for engine cylinder bore coatings it called Cermichrome. The process would bring timed-out cylinders back to life by electroplating the cylinder bore with chromium and boring it to a new standard size. Silicon carbide particles were then impregnated into the surface to obtain the new ring finish. By introducing silicon carbide to the cylinder bore, ECI successfully increased cylinder durability by improving oil wettability and decreasing surface friction over porous chrome coating.



Once ECI had a better product, environmental issues that affected the chromium plating process and the disposal of its waste products prompted a search for a practical and "green" solution to the cylinder plate-coating problem. Thus, ECI introduced CermiNil as a state-of-the-art, nickel-alloy cylinder bore coating that offers superb oil wetting capability throughout the entire cylinder wear cycle.

With the exception of the CermiNil process, all currently approved cylinder bore surface treatments have one thing in common—they exhibit increasing wear rates as the bore enlarges due to the effects of friction. As the new cylinder bore surface wears, the cross-sectional thickness and lubrication is reduced during periods of high cylinder temperatures and power settings. Once the lubrication between piston rings and cylinder bore deteriorates, friction begins to remove metal from the bore and wear rates climb, resulting in an extreme ring step.

The biggest advantage of the CermiNil process is that it has a uniform porous composition throughout its cross section. This means oil wettability stays constant during the life of the cylinder; any short-term increase in wear rate due to reduced lubrication (such as initial startup when oil pressure is at a minimum) is temporary and wear rate will decrease when lubrication normalizes. Once the machined ring finish on a porous-chrome cylinder bore coating wears away, oil retention of the cylinder wall diminishes and bore deterioration accelerates.

The CermiNil process has been certified (STC SE8776SW) for use on any aircraft piston engine. ECI also performs a wide array of plane engine rebuild and part services. For more information, contact: Engine Components Inc., 9503 Middlex, San Antonio, TX 78217, (800) ECI-2FLY or (210) 828-3131.

the engine will be down to the normal 25-inch manifold pressure limit almost automatically on engines that demand maximum except takeoff (METO) power reductions after five minutes."

On many engines, the best operational advice is to put the throttle to the stop and leave it there until it's time to descend for landing. "Reducing power during climb is like trying to struggle up a hill in fourth gear. Most of the time, it just doesn't make sense," says Sloan.

According to the engine rebuilders, the same advice applies to coming back downhill, within reasonable limits. If you're cruising at 6500 feet in a Centurion, Cardinal RG or Bonanza, for example, one method that works well is to never let the manifold pressure increase past 25 inches or decrease below 23 inches until you're ready to enter the pattern. By definition, that means the maximum power adjustment will be two inches at a time. In aerodynamically clean airplanes, it may be impractical to leave the power full forward because of speed buildup, but you should minimize reductions to keep the cylinder heads warm during descent.

Pava suggests the prop control is perhaps the least understood device for regulating engine temperatures. "It's always frustrating when a controller issues one of those slam-dunk 'go down, slow down' directives, but the prop control can help you descend and decelerate at the same time without shock cooling the engine. If you reduce manifold pressure *and* rpm, the engine continues to drive the prop rather than the prop driving the engine."

He continues, "You want to maintain brake mean effective pressure as high and as long as possible so the engine is still producing some power and heat during descent. It's true that lower rpm extends the glide slightly and isn't as efficient as reducing power at bleeding off altitude but, in combination with other techniques, reducing rpm can improve descent without shock cooling the engine."

Most pilots are aware that mixture control is as important as regulating fuel flow in controlling cooling. Yet, some don't use intelligent mixture management techniques during descent. "Too often, pilots don't enrichen the mixture gradually during descent. Instead, they push the control full forward past a predetermined altitude or ignore it during descent, then advance it to the wall upon entering the pattern, not realizing that this causes major shock cooling to the engine because of the cooling effect of excessive fuel," Sloan explains. "The better procedure is to enrichen gradually, just as you decrease power an inch or two at a time during descent. On injected engines, pushing the mixture full forward can increase fuel flow so dramatically that you'll sometimes crack injectors."

As the only control device specifically earmarked for cooling, the cowl flaps' function is often misunderstood. "Virtually everyone knows to leave the cowl flaps open during climb, but some pilots misinterpret when to close them," Sloan comments. "Many aircraft checklists only contribute to the confusion by listing cowl flap adjustment as the last item on the cruise checklist, when it should be first." Close the cowl flaps just *before* level-off while the plane is still at a relatively slow climb speed to minimize the ram effect. If you wait until you've accelerated to full cruise, the change in airflow is much more dramatic and shock cooling is worse.

The condition of engine baffle seals can have a major impact on cooling rate, and that's most noticeable at the higher speeds associated with cruise and descent. Worn or missing baffling can contribute to uneven cooling and creates hot spots at various stations on individual cylinders, causing cracking and premature failure.

"Some people routinely ignore descent checklists, and that can be bad news for the engine, especially if a pilot forgets to close the cowl flaps for cruise after the climb," says Sloan. "If open cowl flaps aren't necessarily a cardinal sin at cruise, they're almost unforgivable during descent. Worse still, some pilots actually pop open the cowl flaps deliberately to increase drag during the letdown. You may already be cycling more ram air through the engine because of the descent, and opening the cowl flaps can make the situation worse."

He adds, "Contrary to popular belief, it's often better to leave the cowl flaps closed until you're at your tiedown spot and ready to shut down rather than blindly opening them immediately after the rollout. During landing, you're subjecting your engine to probably the quickest cylinder head temperature reduction it will experience during the flight. There's no sense in making things worse by opening the cowl flaps when you clear the active. Most of the time, you can leave them closed until engine shutdown."

If you can use aerodynamic braking to slow the airplane for landing, so much the better. On a few planes such as the Bonanza, the high landing-gear limit speed makes the gear a good aerodynamic speed brake, but the best brake is a real one. Speed brakes offer pilots an excellent hedge against shock cooling because they allow an aircraft to decelerate and descend without a power reduction. It may not seem terribly fuel-efficient to buy a fast plane and then mount speed brakes to slow it down, but engine life can be extended if you leave

(to page 76)

BEAUTY

(from page 31)

G's—significantly higher than Normal category certification under FAR 23. Despite the aircraft's pristine condition, however, time takes an often insidious toll on airframes, and I'd be reluctant to subject this one to potentially high G-loads.

Still, it was a joy to roll the 140 left and right to 60 degrees of bank. The plane loves to maneuver and makes its pilot feel right at home, much more so than the later 150. There's little question Cessna made substantive improvements to the 150's airframe and powerplant, but control response didn't improve with other upgrades.

Slow flight is *slow*. Pull in full flaps, add power to hold altitude at the absolute minimum airspeed and you'll be plugging along at less than 35 knots. Even power-off stall is 39 knots.

With such a low stall speed, you can feel right at home flying final at 55 knots. Unlike most other Cessnas, the 140's wing flaps seem to have little effect on glide characteristics, but that doesn't really matter since the plane can plant and stop in 300 feet or less. Like most other late-'40s two-seaters, the 140 is happier at the bottom of its speed envelope than at the top.

Truly fanatical 140 owners sometimes indulge themselves with elaborate mods. The 100 hp O-200 Continental engine will practically bolt right into the C85's engine mounts, and many owners make the upgrade at overhaul time. Some have even stepped up to the O-235 Lycoming, which isn't a bolt-on conversion. Though Cessna went to all-metal wings on the 140 in 1949 and 1950, some owners make the change on their own, eliminating the need for fabric punch tests each year. Individually adjustable Cessna 150 bucket seats are retrofittable to the 140 in place of the standard bench style. Wheel extensions improve gear geometry, and most 140s have transitioned from the old Goodyear brakes to the heavier-duty and less touchy Cleveland wheels and brakes.

Good Cessna 140s are worth exactly what you can get for them, and standard *Aircraft Bluebook* price quotes don't mean much to prospective buyers. *Trade-A-Plane* is perhaps a better pricing source. A recent issue listed 19 airplanes for sale at prices between $13,000 for a runout 120 and $23,000 for an allegedly perfect 1950 model 140A with GPS and all the mods.

For the record, Rudrud's own 1947 Cessna 140 isn't for sale, though he's always eager to show it off to anyone with a sincere love for the type. Just don't ask him to spin it. P&P

SHOCK

(from page 67)

the power up during letdowns and let the speed brakes control descent rate.

Touch-and-go landings probably abuse engines worse than any other flight mode. They exact a tremendous toll on the mill because of the rapid changes from full power to idle and back. Pava says, "Perhaps the only saving grace for engines subjected to that kind of treatment is that they're normally flown often. It's a definite tribute to Lycoming and Continental that their small-bore O-235s and O-200s sometimes endure for 2000 hours despite such harsh use."

One practice both Pava and Sloan recommend for all engines, not just turbocharged powerplants, is a three-minute cooldown. Most pilots who fly behind turbos are taught that a three- to five-minute cooldown is mandatory, since the turbo takes its oil supply from the engine and spins at 40,000 rpm or more at cruise. Unblown mills can benefit from the same cooldown practice because of the different contraction rates of various metals in the engine.

Sloan claims some pilots may unknowingly do slight damage to the engine even after shutdown by indexing the prop to a favorite position—horizontal on a two-blade or one blade vertical on a three-blade. "Many pilots don't understand that the crankshaft and the crankcase that surrounds it are made of different metals and cool at slightly different rates," he says. "Typically, the case will cool and shrink at a faster rate, putting a slight binding force on the crankshaft. If a pilot moves the prop immediately after shutdown, he or she will sometimes hear a squeak and feel a slight binding because the shrinking case is squeezing the shaft. An hour later, when both components are sufficiently cooled, it's okay to move the prop."

Though Pava and Sloan make their livelihood overhauling aircraft engines, they'd both be happier if the only reason for overhauls was expired TBOs. Instead, they suggest that easily half the powerplants submitted to Victor Aviation for overhaul have failed well short of TBO because of poor pilot technique.

"There's no question that shock cooling is one of the major causes of engine failure and, even when it isn't directly responsible, it's often a major contributing factor," Sloan concludes. "If pilots were in a little less of a hurry and used more reasonable engine management techniques, they could lengthen the overhaul interval and save themselves thousands of dollars in engine overhaul expense." P&P

APPENDIX G

Company Memos

1. SUBJECT: Timesheets

The timesheet you complete and send to me weekly is a very important document that is utilized in several ways.

The timesheet serves as a pay report, listing total times for day flight time, night flight time, total daily work time, and overtime. Pilots documenting work time for observers that don't send me time sheets need to ensure the times listed are accurate. I encourage observers and chase pilots in training to send me timesheets to ensure I pay you correctly for time worked; and the additional information from your timesheets allows me to cross check. I would like to clarify reporting of night time and day time for the same UAV flight. Crews often start at night and then continue the chase into daylight hours or vice versa. Please break up the day and night time (as defined by FAR 1.1) on your time sheets. Many of you already do this but I wanted to clarify the policy.

The timesheet serves as an invoicing tool, because I use the information on your time sheets to develop a master time sheet and invoice to send to our customers bi-monthly. The master time sheet is sent to my Flight Operations liaison for audit and approval. Sometimes, the information I submit is challenged so I need to have accurate timesheets from you to back up my invoicing.

It is crucial that the accounting of your workday as you support UAV flights be as accurate as possible. Mark Kirk sent an emailing explaining how to document your mission support, especially when you are assigned multiple UAV flights or as relief. I will restate his main points. Your mission support time begins one hour prior to UAV's scheduled take off time and ends one hour after the UAV has landed. If you are scheduled to support a second UAV flight immediately following your first mission, then you can close out the work time against the first UAV when it lands, and start your work time for the second UAV immediately. When the second UAV lands, then your work time will end one hour after its landing time. Any time worked after the one-hour window should be charged to company time and a note added to your time sheet indicating your duties – maintenance, hangar, and paper work.

If you are scheduled for multiple UAV flights with extended ground time (more than 2 hours) in between, then the ground time that is more than one hour after the first mission and one hour before the second mission should be listed as company time. I hope this was worded without causing confusion.

If you support multiple UAV flights consecutively, as on relief, you need to make note of the total time and flight time spent on relief for each UAV and be as accurate as possible.

Delays and cancellations present more challenges accounting for your workday. For delayed missions, I cannot cover every scenario. If a flight has an extended ground delay, you can add a note on the timesheet indicating that the extra ground time charged was due to maintenance or weather. Sometimes a delayed flight will overlap with a second UAV flight that you were scheduled to support. Use your best judgment when charging ground time between the two flights.

Cancellations may occur in two ways. If a mission is cancelled the night before through an email from customer (by 2300), the assigned crew should be notified and the schedule should be adjusted with no charge to our customer. For cancellations the day of, the crew should list the UAV flight on the timesheet with 4 hours of ground time and 0 flight time. Reason for cancellation should be noted, if able. If a crew is notified of cancellation prior to their airport arrival, we expect the crew to report for duty and find out if they are needed to cover other flights, or perform work as directed by Flight Operations manager or SOF. Charging 4 hours ground time and not working is prohibited.

2. SUBJECT: Chase Communications

CHASE aircraft are equipped with two radios.
During chase operations, (when “JOINED UP” with the RPA),
One radio shall be set to the designated CHASE TO GROUND frequency (CTAF). The second radio shall be set to monitor Joshua Approach or other ATC controlling agency.
This method will provide the highest possible level of situational awareness as well as provide immediate traffic confliction notifications.
CHASE aircraft may coordinate positions with each other via company frequency 129.9, but keep communication short and return to monitoring ATC.

CHASE aircraft transioning from APV to ElMirage / Gray Butte.
While transioning to ElMirage / Gray Butte, through VCV class Delta, CHASE aircraft will have one radio set to VCV TWR. The second radio shall be set to company frequency 129.9.
Once clear of the class Delta, transioning crews shall set one radio to designated CHASE TO GROUND frequency (CTAF). The second radio shall be set to company frequency 129.9. Transioning crews shall “call out” on CTAF frequency, “CHASE GO COMPANY”. Any CHASE aircraft hearing this will come up on company frequency and state N#, position, altitude.
If a CHASE aircraft is “JOINED UP” with an RPA, that CHASE aircraft has priority and will advise the incoming CHASE aircraft of where to hold in order to remain clear.
CHASE aircraft enroute ElMirage shall remain South of the extended center line, Low level (4000msl) unless otherwise coordinated and instructed by on site CHASE aircraft.
CHASE aircraft enroute Gray Butte shall remain South of the extended center line, Low level (4000msl) unless otherwise coordinated and instructed by onsite CHASE aircraft.

CHASE aircraft transioning from ElMirage / Gray Butte to APV.
While transioning from ElMirage / Gray Butte to APV, (outside VCV class Delta), CHASE shall have one radio set to designated CHASE TO GROUND frequency (CTAF). The other radio shall be set to company frequency 129.9. If departing through VCV class Delta, one radio shall de set to VCV TWR, the second radio shall be set to company frequency.
Departing CHASE aircraft shall remain South of the extended center lines at all times, unless coordinated and instructed by on site CHASE aircraft.
Once clear of the UAV operating areas, radios shall be set as desired by PIC.

Appendix H
Excerpt from GA-ASI 08098 Rev B
01 July 15

CHASE PLANE OPERATIONS

1. INTRODUCTION. The following points summarize the procedures and considerations for chase plane operations:

Chase plane support of Remotely Piloted Aircraft (UAV) flight-testing has a single objective: THE SAFETY OF NON-PARTICIPATING AIRCRAFT FLYING IN THE OPERATIONS AREA.

The observing and reporting of the UAV's condition, reporting its position, taking photos and other incidental tasks may be performed only if there is no conflict with the primary objective of guaranteeing the safety of the aircraft. Photography will not be conducted by the chase pilot or observer.

UAV chase operations require special techniques unrelated to conventional flight and are only remotely related to the type of chase operations used to support manned aircraft flight tests.

All of the established safety precautions relating to conventional flight i.e., proper preflight, weather checks, pilot qualifications, observer qualifications, documentation, etc., must be adhered to.

The PIC of the chase aircraft shall either attend the flight brief or if unable to attend, shall contact the UAV PIC by phone.

The following terms are used in the description:

o CHASE: The chase plane and crew.
o GCS: The UAV remote plane station and crew.
o UAV: The remotely piloted aircraft.

2. REFERENCES.

Federal Aviation Administration (FAA):

o Certificate of Authorization of Waiver and Experimental Ops Limits (COA)
o Memorandum of Understanding/Agreement
o Experimental certification restrictions

Federal Communication Commission (FCC): VHF radio communication

3. OPERATION DESCRIPTION. The following chase plane/ground operation procedures must be observed:

The UAV Eyes – The eyes of the chase observer are in effect the eyes of the

UAV. It is essential that the chase crew provide uninterrupted visual scanning of the flight path in front of and on all sides of the UAV.

Radios - Radio communication between Ground Crew and Chase is of utmost importance. Every radio communication must have a verbal acknowledgement, every time. This verifies that radios are working and reasserts the quality of the transmissions. Double clicking the mic is NOT an acceptable way to acknowledge a communication from CHASE. Unsafe or unreliable radio communication compromises the entire UAV Operation as well as the safety and lives of the Chase Crew and non-participants in the area. (See also Call-Off Procedures.)

Actions to Avoid Flight Conflicts – If CHASE sees a possible flight conflict, CHASE shall contact GCS with a clear order to make an immediate maneuver for the conflict avoidance. GCS must understand that an immediate maneuver is of utmost importance. The convergence rate may be high or a potential conflict might be induced by a faster aircraft overtaking and closely passing CHASE.

Repeat if an immediate maneuver is not observed.

When traffic is no longer a factor, CHASE will notify GCS that it is safe to resume normal flight operations.

Although GCS is the controlling authority during a UAV test, when CHASE makes the immediate conflict avoidance order, it is to be accepted as a direct Order and not to be debated or delayed. The UAV PIC must take immediate manual control of the UAV and follow the direction of CHASE over any other direction or instruction going on in the GCS until the threat has been nullified. This includes Examiner Instruction during check-rides as well as training being presented by an Instructor.

Extensive UAV chase experience has shown that a CHASE order to maneuver is a rare occurrence. Sometimes several tests will be conducted without a single CHASE maneuver order being necessary. Therefore, GCS must guard against complacency. GCS must be continuously alert for a maneuver order.

Crew Size – An Observer is required on all flights. Maintaining the optimum chase position that yields the greatest safety (as described later) requires constant vigilance on the part of the pilot and so to an extent compromises his effectiveness in searching for traffic. The CHASE pilot's primary purpose is to keep a constant eye on the UAV for anything unusual or out of the ordinary and to relay such instances to the GCS crew. CHASE will most likely be the first to notice anything physically outside of the norm with the UAV and should report it without delay. The CHASE pilot is constantly evaluating the condition of the UAV and in some instances may go up to a full hour without taking both eyes off of the UAV. During such times it is not uncommon for the CHASE pilot to

lose track of his location, hence the Observer. The primary purpose of the observer is the safety of all non-participating aircraft flying in the operations area. The observer is to maintain eyes outside at all times. This serves a secondary purpose of maintaining situational awareness of the CHASE plane's position and altitude, as well as keeping track of other company traffic working near the same area.

Two pilots are required:

o During night operations. The chase pilots will attend the pre-flight brief and know each individual's piloting duties prior to takeoff. During chase operations at night, the person on the controls should have their eyes on the UAV at all times. Chase pilots and UAS ground and airborne observer(s) must be in place 30 minutes prior to night operations to ensure dark adaptation.

o On flights requiring oxygen. This is necessary due to the additional duties that go along with oxygen flights, such as setting and maintaining oxygen levels; changing oxygen bottles; and transference of the controls while the pilot places, adjusts, and removes the mask.

Visual Meteorological Conditions (VMC) - VMC, as established by the Federal Aviation Regulation's (FAR 91.155) must be maintained at all times. GA-ASI basic VMC is defined as:

o 3 SM visibility
o 500 feet below clouds
o 1,000 feet above clouds
o 2,000 feet horizontally from clouds

It is CHASE's responsibility to advise GCS if the flight path indicates a possible conflict with weather, and CHASE shall advise GCS of possible options to remain inviolate of the minimums.

CHASE/UAV Visibility to Other Aircraft – All means should be used to enhance the CHASE UAV formation's visibility to other aircraft. The chase plane should have all beacon lights and running lights on at all times, even daylight. The UAV strobe lights should be on at all times, and the UAV beacon should be used during all night operations. The UAV's transponder should be on and squawking the assigned code. CHASE's transponder should have the assigned code dialed in and it should be on STANDBY. This is so that if the UAV transponder fails the chase plane is ready to squawk.

Chase Plane's Position in the Formation (IAW AFI 11-2FTV3, para A27.3.12.5.)– A formation with approximately 100 yards between the aircraft is the safest. Other aircraft are more likely to see at least one of the two aircraft which in turn provides an "umbrella" for the other. Conditions or anticipated maneuvers may dictate that a looser formation is flown as defined in the

paragraph below.
The chase plane should maintain a position that has three planes of separation, behind the UAV, slightly higher or lower and 20 to 45 degrees left or right of center. If the chase plane is too far to the left or right it jeopardizes the safety of CHASE and the UAV. The UAV could make an unexpected turn into CHASE's flight path. During night operations, the chase plane and the UAS shall use the same altimeter setting. Additionally, the chase plane and the UAS shall never operate at the same altitude. All provisions of the night operations COA will be briefed at each night operations pre-flight briefing. Any provisions in the COA that are more restrictive take precedence over this document.

Call-Off - There are innumerable conditions that might cause a mission to be aborted, e.g., deteriorating weather, system failures, chase plane problems, but these can be handled quite routinely as long as two-way radio contact is maintained. However, IF TWO-WAY RADIO CONTACT IS LOST, SAFETY IS SERIOUSLY JEOPARDIZED.
The following call-off procedures are essential:
o If CHASE detects a communication failure with GCS, CHASE should immediately make blind calls to GCS, attempt to contact the ODO by radio and issue an order to retrieve the UAV.
o If for some reason the vehicle is not retrieved as ordered CHASE is obligated to continue the chase operation to provide a safety umbrella for the UAV until retrieval is successfully concluded. The only exception is in the case of a life threatening situation e.g., collision threat, low fuel, unable to maintain VMC conditions, etc.
o If GCS detects a communication failure with CHASE, GCS is obligated to initiate immediate retrieval of the UAV. GCS shall make blind calls to CHASE informing him of the situation. Ground should also contact the ODO and ask the ODO to attempt contact with CHASE via radio. GCS rocks UAV wings for 30 seconds to signal loss of communications. As above, it is CHASE's obligation to continue operation until the UAV has been successfully retrieved even though radio contact has been lost.
o The cause of a communication failure may not be immediately evident to either CHASE or GCS. Safety precautions dictate that retrieval must be started immediately upon detection, and only then followed by any attempt to re-establish communications.

Communications – The importance of clear reliable two-way radio communications between CHASE and GCS is self-evident and cannot be overemphasized.
Without it, CHASE cannot advise GCS of actions to avoid flight conflicts. In order to be sure that radio contact has not been lost, at least one

radio transmission should be made every 15 minutes. If fifteen minutes has passed without a radio call, either GCS or CHASE shall request a radio check. Each radio check and transmission shall include the aircraft call sign. The chase aircraft shall use FAA registration (tail number) and the UAV shall use the tail number.

REQUIRED CALLS IN DAILY OPERATIONS:

From GCS to CHASE:

Call all changes in ALTITUDE.
Call all changes in AIRSPEED.
In close formations or during night operations, call all turns.
Call the VFR descent to the field.

From CHASE to GCS:

Call prior to entering operations area.
Before landing call positions in the pattern.
Report local altimeter setting.
Call when in position.
After talking to approach, tell GCS the altitude they are clear to climb.
Call all gear up and down positions.

Initial Pick-up on Take-off – This is the preferred method of joining up. The initial pick-up on take-off is best performed by having the chase aircraft in the air first. When CHASE is in its appropriate CHASE position, the CHASE pilot will make a call saying, “In position”.

Initial Pick-up in Flight – At times, such as during a company demonstration, it is advantageous to join up at altitude. In this case CHASE will take-off and loiter south of the field. GCS will inform CHASE when they are going to take-off. CHASE will keep the UAV in sight and climb along with it, but remain south of the field, until either GCS says to join up or the UAV is at 2,000 feet AGL. Upon reaching 2,000 feet AGL, or when directed by GCS, CHASE will head north and join up with the UAV, in the appropriate CHASE position. In a situation where the UAV is airborne upon CHASE’s arrival, CHASE will remain south of the field until the UAV is in sight. GCS can assist by giving CHASE the UAV’s location and altitude. With the UAV in sight, CHASE can proceed north to join up.

UAV Handover at Landing – When it is desired to recover the UAV, the normal procedure is to bring the UAV into visual range of the ground crew and break the chase off for landing. While the UAV is landing, CHASE will either leave the area of operations or orbit south of the field and land after the runway is clear. There are no chase operations below 500 feet AGL. When the UAV and CHASE are within 500 feet of the ground, CHASE will leave the formation by heading south and remaining south at the airfield until the UAV is down and clear of the runway.

Loss of Visual Contact with the UAV – If the CHASE loses contact with the UAV he should inform GCS and immediately separate itself from the UAV by 500 feet of altitude. This can be a climb or descent, whichever is best for the situation at hand. If contact is lost for greater than a 30-second period, CHASE should establish a heading of south, and loiter south of the field until visual contact is reestablished. While CHASE is looking for the UAV, GCS should be making position reports and calling turns to assist CHASE. If the UAV contact is lost by the ground crew, the UAV should be turned toward “home” while the outside crew is vigilantly looking for other traffic in the area.

Appendix I

Required Employee Documents

1. Pilot Certificates
2. FAA Medical – 2nd or 1st Class
3. Current Flight Review endorsement
4. High Performance Aircraft Endorsement
5. Driver's License
6. Completed I-9
7. W-9 or W-4 as required
8. Emergency Contact Form
9. Pilot Experience Form
10. Direct Deposit Form if required
11. Training Tracking Sheets for pilots