“...Would a means to fly in and extract isolated personnel without putting additional personnel in harm’s way be of value? The answer to that question is an obvious - Yes!”

CWO4 Michael Durrant, USA (Ret), Pilot SUPER SIX FOUR, 160th SOAR, Battle of Mogadishu, OPERATION GOTHIC SERPENT, 1993

Unmanned Aerial Vehicles For Casualty Evacuation: The SOF Medical Future

Colonel Paul Parker
Senior Lecturer in SOF Medicine
SOMSA 9 May 2019

“...No amount of bravery at a personal level can overcome the lack of a robust plan”

Content
• History
• The Status Quo
• Why Unmanned Aerial Vehicles (UAVs)?
• The Concept
  – Benefits
  – Disadvantages
• Future Development
First Ever Drone Strike?

September 27th 1944

Interstate TDR-1  WW2
Sweden – Drone Defibrillators

Malawi - Sample Retrieval

China - Disaster Assessment
Rwanda launches drones to deliver medical supplies

Rwanda’s government has launched a drone network capable of delivering vital blood supplies to far-flung areas. It is hoped the speedy delivery service will help save lives in hard-to-reach parts of the country.

Post Partum Haemorrhage - Africa?

WhatsApp/Text request for Blood

Zipline

Zipline Technologies
The Challenge

• Still an expectation of rapid evacuation with a high “Western Medicine” level of care
  • As was the case in Afghanistan (with Air Superiority)

• Multiple small Training or SOF teams working in austere, remote and isolated areas
  • Elongated timelines
  • No UKUSA Air Assets or close-by R2/3 medical assets

• The need to develop new capabilities to prepare for future conflicts/tasks
  • The dynamics and constraints of future conflict are often unknown (£/€/$)

The Current Contingency Reality
Current Doctrinal Status
The 10 – 1 – 2 Timeline
The Operational Patient Care Pathway

New Concept?

Current UAVs

Figure 6: Unmanned Little Bird at Marine Corps Mountain Warfare Training Centre
Figure 6: Kaman/Loxheed Martin K-X was UAV in Afghanistan
Aldous Huxley

- “That men do not learn very much from the lessons of history is the most important of all the lessons that History has to teach”

Intuitive Surgical 1995

DARPA Trauma Pod 1/2 2005
DARPA Trauma POD 2

Automated En Route Care
Lost Opportunity: DARPA Trauma POD 2
Continuation of DARPA Trauma POD 1 program by Dr. Satava
Demonstrate resuscitation and damage control surgery
on live animal:
• Robot establishes airway and starts ventilation
• Robot places an IV and delivers resuscitation
  fluids/drugs
• Robot diagnoses and treats tension pneumothorax
• Robot diagnoses and controls non-compressible
  internal bleeding
Funded at $49M in 2007, Cancelled due to USAMRMC
  "not wanting" it

Unmanned Aerial Vehicles

• Automated and remote controlled
  — Load and Go, Commercial Development
• Becoming increasingly affordable, reliable and
  sophisticated
• Already used for medical purposes
  — Blood/Drug/AED delivery
• The Geneva Convention already provides
  guidance for Medical UAVs
  "Any medical transport by air is protected"

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  sophisticated
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• The Geneva Convention already provides
  guidance for Medical UAVs
  "Any medical transport by air is protected"
• “The use of UAS for CASEVAC is ethically, legally, clinically, and operationally permissible, so long as the relative risk to the casualty is not increased.
• The employment of VTOL UAS for casualty evacuation will soon be a reality and eventually commonplace in the battle-space. By conducting the research proposed in this paper, NATO members will be ready...”

Safe Ride Standards for Casualty Evacuation Using Unmanned Aerial Vehicles
(Normes de transport sans danger pour l’évacuation des blessés par véhicules aériens sans pilote)

“The use of UAVs for casevac will take place as soon as cargo UAVs or optionally-piloted conventional aircraft are available on the battlefield, it is up to NATO and the nations to be ready”
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Future Doctrine

Levels of Care

- Level Zero - Lone Patient
- Level One – En-Route TCCC Provider
- Level Two – En-Route Interventional Care
- Level Three – En-Route Surgical Care

NL – Level Zero

Demo Cargo Drone
11-07-2018
NLR / Boessenkool
Ministerie van Defensie
Level Zero - DP14 Hawk

Patient Sized Load Bay

430 Lb Payload

Autonomous Operation
VTOL Self-launch/Recover
5 min 'hot-on-pad' launch
105 KT Speed (Cruise 72KT)
NOE Flight Capable
Non Line of Sight if no GPS
All terrain landing (15°)
2.4 Hour Endurance
4.5Kw on-board Generator
Level One - Cormorant UAV

Casualty Loading

Cormorant Casualty Flight
And away....

En-Route Capabilities
As this develops they may increase ability for unescorted transit or automated in transit care

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<thead>
<tr>
<th></th>
<th>Current</th>
<th>Near Future</th>
<th>Possible Future</th>
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<tbody>
<tr>
<td>REBOA</td>
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<td>Remote ventilator &amp; drug syringes</td>
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<td>Intra-abdominal foam</td>
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<td>Pre-hospital traumatic arrest cooling</td>
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<td>Blood forward (stored vs EDP)</td>
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<td>Junctional tourniquets</td>
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<td>Remote monitoring</td>
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Bell V280 - Valor
Enroute Level 2 Care

Watch the G’s

En-Route Therapies

Cells and Plasma 24/10/18
UK Level Two En-Route Care

CH-47/MV-22 Lessons

In-Flight Resuscitative Thoracotomy
Larger Drones

Level 3 - Transformer Vehicles
UAV Advantages

- Cost
- Expendability
  - Shifts when casualty on board
- Reliability and removal of human error
- Hover time or ability to place forward
  - Rapid extraction, decreasing effect on the teams ability to complete mission/task – QR Codes
- Can sit on roof of Patrol House Landing ability
- Direct to Role 2/3

Disadvantages

- Battle space management
- Cyber attack and security
  - However if purely medical use are protected by Geneva convention
- Level of care delivered 0/1/2/3?
- User acceptability
- Skynet....

Continuously evolving technology

![Life-saving kidney delivered by drone](https://news.bbc.co.uk)
TCCC Space Trauma Guidelines

TCCC Drone Guidelines

- Level Zero - Lone Patient
- Level One – En-Route TCCC Provider
- Level Two – En-Route Interventional Care
- Level Three – En-Route Surgical Care
TCCC Drone Guidelines?

- Level Zero - Lone Patient
  - Tourniquets & Pain Control
  - Oxygen & Pelvic Binders
  - Active Warming
  - TXA & Antibiotic Injection
- Level One – En-Route TCCC Provider
  - Blood Transfusion & Active Wound Mx
  - Airway (Saline cuffed tubes/I-Gel?)
  - Peripheral Nerve Catheters
  - Abdominal Foams

In Summary

- The use of UAVs in the extraction of casualties will become common place in future conflicts
- As with all new capabilities there will be challenges and opportunities
- We must remain innovative and work directly with the end users and commanders

We must now develop UAV Medical Care Protocols

PMID: 29523753

Questions?
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Kyle Reese

- Listen, and understand. That *terminator* drone is out there. It can’t be bargained with. It can’t be reasoned with. It doesn’t feel pity, or remorse, or fear. And it absolutely will not stop, ever, until you are dead rescued!

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**Capability Development**

- We must always keep the end user in mind
- We are currently operating regularly in small teams in remote austere locations
  - Environment demands inventive/innovative soldiers/commanders who often have interest in cutting edge techniques (SPIB)
  - Pilot groups
- Two way conversation
- Involve both Primary and Secondary care clinicians in collaborative research
- Responsible and appropriate use of private developers