

Attachment C:  
Soyuz TM (Soyuz TMA) Crew Extraction and  
Medical Support at a Contingency Landing Site

A. General Information:

MEDICAL INFORMATION FOR THE AFRCC IN THE EVENT OF A CONTINGENCY  
SOYUZ LANDING

Three returning Soyuz crewmembers have been on board the International Space Station (ISS) for \_\_\_\_\_ (days/months) and could experience any or all of the following patho-physiologic systems decrements upon landing: 1) Musculoskeletal, 2) Neurovestibular, 3) Cardiovascular, 4) Decompression Sickness, and 5) Other medical conditions.

The Soyuz has additional medical kits onboard that may be used by the rescue forces. The crewmembers can advise on the storage location of the kits, method of extraction and use of the Russian medical kits.

1. Musculoskeletal: Expect no crewmember assistance in their extrication from a Soyuz vehicle due to total body musculo-skeletal strength decrements of 20% to 40%, weight-bearing bone mass decrements of 3% to 18%, and risks of spinal column injury (eg. herniated discs).

Actions: All crewmembers should be treated as unconscious unwitnessed trauma patients. Therefore all crewmembers should have spinal stabilization with full body restraints.

2. Neurovestibular: Any head movements could cause dizziness, nausea and vomiting, and possibly incapacitation due to inadequate neuro-vestibular re-adaptation to earth's gravitational forces.

Actions: Head and body translational forces must be kept to a minimum, therefore any stretcher or wheelchair movements must be as slow as possible. IM (25 to 50 mg) or IV (12.5 to 25 mg) phenergan may need to be administered for vertigo, dizziness, nausea, and vomiting.

3. Cardiovascular: A crewmember's physiologic compromise will be caused by the following: an intra-vascular volume loss of 6 to 12%; baro-receptor /autonomic nervous system dysfunction, and decreased cardiac muscle and filling capabilities.

Actions: All crewmembers must be recumbent or at a head down tilt configuration. If oral fluids are not tolerated then an IV of Normal Saline or lactated Ringers with a 1000 cc bolus with 200cc/hr maintenance dosage should be administered. Autonomic dysfunction may necessitate ACLS protocol drug administration at higher than normal dosages.

4. Decompression Sickness (DCS): This could be a consequence of an emergent Soyuz re-entry scenario.

Actions: In the initial treatment and evacuation of crewmembers to a definitive care medical facility 100% oxygen should be administered and any aero-medical transport should be kept to a minimal altitude (< 1000 feet AGL).

5. Other medical conditions/contingencies: Medical histories, Allergies, In-flight medical conditions (eg. kidney stone, DCS, etc.) are described below.

For this contingency landing the crew is being returned for \_\_\_\_\_. This situation could result in a medical condition for one or more of the crewmembers as above. Further details include the following:

Crewmember (1)

Blood Type

Height, Weight and shoe size (for clothing selection)

In-flight medical history

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Crewmember (2)

Blood Type

Height, Weight and shoe size (for clothing selection)

In-flight medical history

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Crewmember (3)

Blood Type

Height, Weight and shoe size (for clothing selection)

In-flight medical history

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OR

A crewmember is being returned for \_\_\_\_\_. Additional information for the ill/injured crewmember is as follows.

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For additional information, contact:

ISS Crew Surgeon Phone [DELETED]

ISS BME Console Phone [DELETED]

This instruction contains medical aspects of Soyuz. However, various situations can occur at the landing site. Therefore, personnel participating in contingency operations at the Soyuz landing site must be ready to work under difficult conditions, while showing initiative and professionalism.

Medical personnel may be requested to assist directly in the opening of the hatch. (See AFRCC/DDMS procedures on wrench locations and hatch opening.)

Expect the crewmembers to be able to talk with you and assist with assessment and extraction procedures. Regardless of the subjective evaluation by the crewmembers of their own health status, the physician/medical provider must take into consideration the adverse effect of space flight on their bodies. (See above information.)

Crewmembers may lift the visors of their helmets and signal their condition and readiness for extraction through the window.

On the land, the Soyuz may come to rest on its side or upright. Extraction procedures/steps are detailed below for each situation.

#### B. Initial Assessment:

1. After opening the hatch cover medical personnel will determine the crewmembers health status based on external appearance and the results of questioning. If necessary, one person may render first aid immediately in descent module. (See medical information above.)

Caution: Perform resuscitation, if necessary, only after evacuating crewmembers from the Soyuz descent module.

2. The crewmembers will be in spacesuits and if their helmet visors are not open, open and raise the visors of the helmets and then remove the gloves to take their pulse. (Insert a picture of this, we need to be able to explain how to do this or show how do do this if they are not able to talk.) See medical information above.

3. After checking the crewmember's health status, the evacuation method has to be determined, and the procedure for preparing for it. Go to Soyuz descent module on side or vertical procedures indicated in the instructions below.

Note: BP may vary throughout the extraction and transport to medical facilities.

#### C. a. Soyuz Descent Module on the Side - Extraction Procedures:

Notes: a. Evacuation of the crewmembers from the Soyuz descent module lying on its side is possible with the crewmembers in any position relative to the horizon. However, to create favorable conditions during evacuation, the descent module should be rolled so that the crewmembers are in a "head up" position, if possible.

b. When performing these operations listen to the crewmembers, who will instruct personnel on how to perform the various operations.

c. The crewmember located in the center seat is evacuated first, followed by the crewmember in the worst state of health.

d. Extraction in seat liner requires removal of the hatch.

1. Clear away the soft portable emergency spares kits from the passageway to the hatch and, if possible, remove the spacecraft controls on the seats. (Insert a picture.)

2. Disconnect the electrical connectors of cable communications and medical harness and the connectors of the ventilation and gas mixture supply hoses of the spacesuits.

Note: These are bayonett type connectors and are disconnected by twisting and then pulling apart.

3. Disconnect restraint system and footrests.

Warning: If the Soyuz descent module is in a attitude that has the crewmembers on their side or up in the vehicle, ensure they are restrained before removing the restraints and footrest so they will not fall.

4. After advising the crewmember that the extraction is beginning, give the command to the assisting rescue personnel to extract the crewmember from the Soyuz descent module.

Warning: During the extraction process, avoid entangling the crewmembers with the Soyuz structural elements and guide the crewmember through the hatch and ensure the visor of the helmet is lowered (leave open enough to breath, but still provide protection for the eyes).

5. As the crewmember's head approaches the hatch opening, the assisting rescue personnel take the crewmember by the arms and together with the physician/medical

attendant remove him/her from the Soyuz and place him/her on a stretcher.

Note: After extraction of the crewmembers, ensure comfortable conditions for them. Do not allow abrupt changes in the cosmonauts' body position. Perform movements smoothly, with pauses. Do not subject them to physical loads and compression of the ribcage. Avoid collision with structural elements, hypothermia, overheating, and exposure to precipitation and do not position them where they are looking into the sun.

6. Move other crewmembers to the center seat and remove using the same process.

#### C. b. Soyuz in the Upright Position - Extraction Procedures:

Notes: a. When the descent module is upright, to the extent possible, a servicing platform or ladder(s) is used on the Soyuz. This will enhance the safety of operations during the process of crewmember evacuation. However, rescue personnel can climb up on the vehicle without a ladder. If a ladder is used, it may be placed over the opening where the parachutes were located.

b. When performing these operations listen to the crewmembers, who will instruct personnel on how to perform the various operations.

c. The crewmember located in the center seat is evacuated first, followed by the crewmember in the worst state of health.

1. Clear away the soft portable emergency spares kits from the passageway to the hatch and, if possible, remove the spacecraft controls on the seats. (Insert a picture.).

2. Disconnect the electrical connectors of the communications and medical harness cables, and the the connectors of the ventilation and gas mixture supply hoses of the spacesuit.

Note: These are bayonett type connectors and are disconnected by twisting and then pulling apart.

3. Disconnect seat restraint system and remove footrests.

4. Run the straps through loops in the clavicle area and fasten snap hooks of the rescue straps to the heavy-duty cables of the spacesuit in the hip area. Pass straps to assisting rescue personnel. (Insert a picture.)

Note: If the search and rescue team has no straps, they can be replaced with other lengths of rope each 4 m (approximately 13 feet) long and strong enough to lift a load weighing from 80 to 100 kg (approximately 180 to 220 lbs).

5. Pull down each strap and fasten their snap hooks to the soft loops on the spacesuit (,on the outside of the upper third of thigh). (Insert a picture.)

6. Verify the crewmember's readiness for evacuation and give the command to the two assisting rescuers to lift him/her to the top of the vehicle.

Warning: During the extraction process, avoid entangling the crewmembers with the Soyuz structural elements and guide the crewmember through the hatch.

7. After lifting the crewmember out of the Soyuz, set him/her down on the hatch frame with his/her legs inside the module. Next, holding one of the rescue straps (each rescuer has his own), the assisting rescuers place their other arm under the cosmonaut's knee and lifting him/her slightly they turn him/her 180° and set him/her down on the hatch frame with his/her legs hanging down outside the module. Have the crewmember fold their arms before they are lowered down the side of the vehicle.

Note: The vehicle will have soot/residue on the outside and rescuers may want to put something over the outside of the vehicle where they plan to slide the crewmember down to the ground.

8. Rescue personnel on the ground prepare to receive crewmember and when they are ready, the assisting rescuers lower the crewmember to the ground using the straps.

9. The rescue/medical personnel take the crewmember and place him/her on a stretcher and disconnects the rescue straps. Additional physicians/medical personnel should be assigned to monitor the crewmember.

10. Other crewmembers should be extracted using the same process. Each is moved to the center seat for removal.

Note: After extraction of the crewmembers, ensure comfortable conditions for them. Do not allow abrupt changes in the cosmonauts' body position. Perform movements smoothly, with pauses. Do not subject them to physical loads and compression of the ribcage. Avoid collision with structural elements, hypothermia, overheating, and exposure to precipitation and do not position them where they are looking into the sun.

#### D. Second Assessment

Wet the lips, but don't give water until the suit is removed. Use a cool cloth to remove moisture and to wipe face, etc.

#### E. Spacesuit Removal

1. Unfasten snap hook of vertical strap on upper chest. (Insert picture of suit with labels of each part)
2. Open Velcro zipper of lower opening, which provides access to lower tightening strap. Unfasten strap snap hook. This is a cross strap, much like a belt.
3. Open zipper of spacesuit shell, which provides access to the rubber tie on the sealing element of the inner suit at the chest area. (This is where the opening is gathered)

together in a bunch/twist, tied with a cord that has a knob on the end that is run through a loop to hold it in place.) Add a picture here.

4. Loosen rubber tie/cord and open the rubber suit in the chest area.
5. Remove spacesuit gloves (if they were not removed before crewmember evacuation from Soyuz). The skull cap/communication cap should be removed to make it easier to remove the suit. The spacesuit is now ready for removal.
6. Lower crewmember's head through lower frame of the spacesuit's pressure helmet. Fold back pressure helmet behind crewmember's back.
7. Pull crewmembers arms out of spacesuit sleeves one at a time.
8. Lower spacesuit over crewmember's body to the feet and remove it completely.
9. To facilitate the performance of the spacesuit removal operations, the crewmember should sit on a stool or some other suitable object (case, suitcase, etc.,)

Warning: If a crewmember has been injured, his movements must be minimized. The cosmonaut's spacesuit is removed piece by piece using a knife (or surgical scissors). When cutting the spacesuit shell, be careful not to injure the cosmonaut. Wire cutters will be required to cut the heavy duty cables mention in step 4.

Notes: a. Crewmembers may request a bathroom break and should not be left alone at this time.

b. Crewmembers should be given clothing and shoes to wear at this time.

#### F. Third Assessment

Have water available, if possible. (Plastic drink bottles will help.) Limit intake of water or the crewmember may become sick.

#### G. Medical Evacuation of the Crewmembers

1. The crewmembers should be moved by helicopter or ambulance to the nearest medical facility for treatment and/or observation.
2. Continue to monitor the crewmembers and take BP and pulse.

Warning: Be sure to observe the information about deconditioned crewmembers above.